World Potato Congress 2022

Dublin, Ireland

Presentation Summaries and Speaker Biographies

PL-01

Ireland, Canada and the potato: a historical perspective

Robert G. Kearns[1], Laura Smith[2]

[1]Canada Ireland Foundation, Toronto, Canada. [2]Canada Ireland Foundation, Burlington, Canada

Overview

Since Spanish Conquistadors transported it from North America across the Atlantic in the 16th century, the potato has been at the forefront of major global social movements. In Europe the widespread adoption of the potato radically altered European society. It laid the foundations of modern agriculture, provided food security and nutrition for millions, and fuelled the global dominance of Europe well into the 20th century.

In Ireland, the adoption of the potato was significant. Ideally suited to Ireland's climate, the potato offered the Irish peasantry an efficient, productive, and nutritious crop with which to strengthen its dairy-based diet and the country's population grew quickly as a result. This population boom was also the catalyst for wide-spread emigration from Ireland to the United States and throughout the British Empire, including to the Canadian colonies. By 1845 nearly 500,000 Irish, many lured by the promise of agricultural land, had settled in what is now Canada.

While the potato fuelled these radical changes, the failure of Ireland's potato crop in 1846 and 1847 was cataclysmic. Brought about by a blight originating in the Americas and spread from Europe, the resulting famine of unprecedented proportions radically altered Irish society, led to the deaths of millions and the emigration of at least a million more, including nearly 100,000 Irish who went to Canada.

Robert G. Kearns, Chairman of the Canada Ireland Foundation, will tell the remarkable story of this remarkable root vegetable, with particular attention paid to its significance to the history of Canada and Ireland in the 19th century.

Invited speaker photograph

Invited speaker biography

Born in Dublin, Robert G. Kearns graduated with a degree in Archaeology and Greek and Roman Civilizations from University College Dublin. He immigrated to Canada in 1979, where he built a successful career in the life insurance industry and established Kearns Insurance Corporation.

Robert has been deeply involved in a number of organizations within the Irish-Canadian community. Among other leadership roles, he is the Founder and Chair of the Canada Ireland Foundation. For his many years of dedication and service, Robert was recognized with the 2021 Lieutenant Governor's Ontario Heritage Award for Lifetime Achievement.

PL-02

The potato in a changing world

HE Qu Dongyu

DG FAO, United Nations, Italy

Overview

HE Qu Dongyu, DG FAO, United Nations will deliver a paper on the potato in a changing world.

Invited speaker photograph

Invited speaker biography

Qu Dongyu, who took office on 1 August 2019 as Director-General of the Food and Agriculture Organization of the United Nations, has spent his life working on how to make sure the world is fed.

Born in 1963 to a rice-growing family in China's Hunan Province, Qu studied horticultural science at Hunan Agricultural University and then plant breeding and genetics at the Chinese Academy of Agricultural Sciences. He later added environmental science to his knowledge portfolio while earning a PhD at Wageningen University, in the Netherlands.

He then progressed through a range of national and international activities, engaged simultaneously in science and management, all during a time when China's reform and opening-up process led the country to dramatically reduce poverty and hunger in a country with 20 percent of the global population, 9 percent of the world's cultivated land, and where over 90 percent of the rural population is engaged in small holder farm operations working less than 3 hectares.

His vision is founded on the belief that freedom from hunger is a basic human right, and that in the 21st century we have the capability to eradicate chronic food insecurity. While challenges loom, Qu's cardinal principle is that "problems can also be the source of progress".

Before coming to FAO, Qu served as China's Vice Minister of Agriculture and Rural Affairs, where one of his achievements was to promote inclusive and innovative development and make sure information and communication technologies (ICT) were available in rural areas so that more than 400 million farmers could use their smartphones as a new farming tool.

That vision has been consistent across a professional career that includes periods in central and local government, in and leading research institutes, and as a human resources leader at the China Three Gorges Project Development Corporation, a $40 billion investment project.

Among his national initiatives has been to improve reporting of wholesale prices for agricultural products in China and foster the establishment of more than 100 specialty production areas geared to making local comparative advantages work to the benefit of local farmers. As Vice Governor of Ningxia Hui Autonomous Region, one of China's landlocked and poorest areas, Qu formulated action plans aimed at poverty reduction, disaster reduction and prevention, women empowerment, agritourism and mutual learning platforms designed to boost trust between ethnic groups.

Qu says he represents the combination of an "Asian soul" and a "global mind". Recognized for scientific innovation as a young scholar, Qu has for 30 years been involved in international exchanges and orchestrated major events including the World Potato Congress, the International Rice Congress and the International Conference on Plant Protection, and participated in multilateral initiatives such as the World Trade Organization and the G20 as well as numerous bilateral initiatives involving Asia, Africa and Latin America. He has also directly helped design flagship South-South Cooperation projects with FAO and the World Bank.

His motto is "Simple life, but not simple work".

He is married, and has one daughter.

PL-03

Ireland - the Green Island

Tara McCarthy

Bord Bia - Irish Food Board, Dublin, Ireland

Overview

Ireland is renowned for its music, literature, culture, beautiful landscapes and as the land of a thousand welcomes. In recent decades and years, Ireland has developed a growing reputation for the production of great tasting food, drink and horticulture produce which is savoured by the many visitors who come to Ireland and indeed around the world where we annually export €13bn worth of food and drink.

This reputation is built on our family farm (and grass fed) tradition where the passion and love for the land and agriculture is passed down from generation to generation and underpins our modern food industry. Our farmers and growers are unique and innovative in how they produce quality ingredients for menus globally.

Our insight research tells us that consumers want nutritious food that is not just produced sustainably but has developed measurable proof points that underpin these sustainability credentials. In response Bord Bia developed the Origin Green Programme a decade ago, which encompasses all parts of the supply chain from the producer to the manufacturer to the market channel.

Origin Green is the world's only national food and drink sustainability programme, enabling Ireland's food industry to set and achieve measurable sustainability targets that respect the environment and serve local communities more effectively. Currently membership of the programme includes 55,000 farms, over 300 food manufacturers and 9 retail and food service companies. Over 90% of our food and drink exports come from Origin Green member companies.

The overall ambition of the Origin Green programme is that Irish food, drink and horticulture is the first choice globally because it is trusted as sustainably produced by people who care.

Origin Green has a crucial role to play under the Government's 10-year strategy for Ireland's food and drink sector, which envisions Ireland becoming a world leader in sustainable food systems over the next decade. Such a food system is profitable throughout, has broad-based benefits for society and has a positive, or neutral impact, on the natural environment.

Invited speaker photograph

Invited speaker biography

Tara McCarthy is the Chief Executive of Bord Bia, the Irish Food Board since 2017 and brings with her over 25 years' experience in the wider food industry. She was previously Chief Executive for Bord Iascaigh Mhara (BIM), Ireland's seafood development agency and has lived and operated in overseas markets such as Germany, France and Belgium for over 10 years.

• Tara's hallmarks are her unwavering belief in people and her passion for the opportunities to be found within sustainably produced food. She has led capability initiatives for students, early career executives and entrepreneurs within the food industry for over a decade with successful partnerships formed both nationally and internationally. In 2019 she co-founded Agdif an industry initiative championing diversity in the Irish food industry. She has represented Ireland's food industry globally speaking of Origin Green, Ireland's unique national sustainability programme and in 2021 led the establishment of the Origin Green Global Council.

• Tara holds a Bachelor of Commerce degree from UCG with an MBS in Marketing from Smurfit Business School and is an affiliate of IMD Business School, Switzerland. Tara has been recognised with a number of awards including UCG Alumna of the Year for Business and Commerce in 2017, Fellowship of the Marketing Institute of Ireland and Top 25 Irelands Most Powerful Women – Public Sector Leaders Award in 2018, and the 2019 UCD Smurfit School 'Alumna of the Year'

PL-04

Poland as a coordinator in the reconstruction of the Ukrainian potato industry.

Tomasz Bienkowski

Polish Potato Federation, Warsaw, Poland

Overview

According to geopolitical situation and war in Ukraine there is a lot of needs of support. One of way of this support is helping in rebuilding Potato market in Ukraine after the war and help now by sending aid in different forms like ware Potato or Products Made from potatoes. Also, it is very important to send seed materials for restarting production in Ukraine. Poland is very close to Ukraine and wants to be an aid Hub for this mission. Presentation of our capabilities should be useful for coordinating aid and its logistics for Ukraine.

Invited speaker photograph

Invited speaker biography

Tomasz Bieńkowski PhD, specialist in the field of plant production, in particular breeding and seed production of cereals and potatoes. Since 2000, the president and owner of CN Nidzica - one of the largest seed and breeding enterprises in Poland. At the same time, as a farmer, he runs a specialized commercial seed farm. In the years 2007-2013 an expert under the 7th EU framework program - AGREE. Co-founder and President of the Polish Potato Federation. Active member of Europatat including the seed committee and RUCIP. Founder of the first RUCIP representative office in Poland. For several years, the co-organizer and commissioner of the international POTATO POLAND fair - one of the most important events in the international potato industry. Co-organiser of the Polish Potato Congress. Currently, the deputy chairman of the Fruit and Vegetable Promotion Fund in National Agriculture Support Center and a member of the Program Council of the Polish Plant Health Inspection. One of the co-creators of Polish potato program 2020-2025. Initiator of the establishment of the Polish Parliamentary Team for the Development of the Potato Industry. Promotor of Polish and European agri-food products, especially Polish potato, not only on the domestic but also on the international markets.

PL-05

If I can…

Chris Koch

Alberta, Canada

Overview

The limitations we face in life are often the ones we place on ourselves. Chris Koch's inspirational "If I Can" presentation is about making the most out of life, with a focus on appreciating what we have instead of worrying about what we don't.

Despite being born without arms and legs, Koch didn't let limitations and obstacles stand in the way of achieving his goals and dreams. He still grew up working on his family farm, and has spent his adult life snowboarding, running marathons, and travelling independently.

If a guy without arms and legs can do all this, he says, we are all capable of some pretty amazing things. Sharing experiences and funny anecdotes from his life, Koch leaves his audiences motivated and empowered to build the life they dream of.

Invited speaker photograph

Invited speaker biography

Chris Koch doesn't let limitations or obstacles stand in his way. Despite being born without arms and legs, Koch grew up like any other small-town kid — playing road hockey, causing mischief at school, and helping out on his family farm. Neither he or his family treated his disability like a tragedy, and instead used it to fuel his dreams. Today, Koch is a motivational speaker who inspires his audiences to continually challenge themselves and build the life they dream of.

PL-06

The global food market of the near future

Damien McLoughlin

UCD Smurfit School, Dublin, Ireland

Overview

The global food environment is changing rapidly, significantly but also consistently. This paper will identify five areas of consistent change, development and progress and explore their dynamics over the coming near years. These five areas are: Digitisation, Sustainability, Consumer Behaviour, Capital and Supply Chain. A framework for managers to think through these changes and interpret them for their own business will be outlined.

Invited speaker photograph

Invited speaker biography

Damien McLoughlin is Anthony C. Cunningham Professor of Marketing at UCD Michael Smurfit Graduate Business School in Ireland. Damien has been a visiting professor at some of the world's preeminent business schools including the S.C. Johnson Graduate School of Management at Cornell University, the Indian School of Business, ESMT (Berlin) and IMD. Damien has also contributed to senior executive programs in Agribusiness at both Harvard Business School and Purdue University. Since 2014 he has been a visiting professor at the Stern School of Business at New York University and in 2021 was a visiting professor at the Tuck School at Dartmouth College. Damien has published more than seventy papers and two books on strategy and marketing issues as well as twenty-five case studies relating to leadership and strategy issues in global food and agribusiness, covering all geographies and major sectors. Recent cases have included Tyson Foods, Bayer Crop Science, Ocado and Kerry Group, Zoetis and Danish Crown. Damien is a member of the external advisory network of Bain & Co Consulting. As a director Damien has served several public sector organisations including the Medical Council of Ireland (2008-2013), where he chaired the Audit Committee for five years, HIQA (2010-2012) and Bord Iascaigh Mhara (2015-2020). Damien was recently appointed as non-executive director of Kepak, one of Europe's

leading food firms. Damien holds a Bachelor of Business Studies degree from Dublin City University, a Master of Business Studies degree from University College Dublin and PhD in Marketing from Lancaster University (UK).

PL-07

The dynamic global potato market

Cedric Porter

World Potato Markets, Tunbridge Wells, United Kingdom

Overview

The presentation will demonstrate how potato production, processing and trade is evolving as large trading regions such as North America come under production pressure and competition from other regions. The talk will be illustrated with unique information and data from World Potato Markets showing how the crop has evolved during the 21st Century and what potential it has for the future. The impact of the Covid pandemic will be discussed, along with other major global trends such as rising costs of production and tackling climate change.

The presentation will focus on the marketing opportunities for one of the world's most important crops and how that could benefit potato growers, packers, processors and consumers. It will include references to the cultural as well as agricultural contribution of potatoes in the past and future.

Invited speaker photograph

Invited speaker biography

Cedric Porter is the Editor of the weekly global briefing World Potato Markets which the covers trade, production and pricing of potatoes and potato products. He is UK-based and also publishes regular briefings on Brexit and the food industry. He is Vice Chair of the Linking Environment and Farming charity, a director of a large UK potato and arable farm and a member of the UK's Trade & Agriculture Commission which analyses UK trade deals.

PL-08

Global consumer trends in fresh produce

Lauren M Scott

International Fresh Produce Association, Newark, DE, USA

Overview

Consumers are the ultimate buyer for any product, including potatoes. This presentation will review world events and changing landscape that drive consumer behaviours. We will discuss the latest trends that will impact the produce industry. The presentation will explore the role of food, retail and commerce, attitudes towards sustainability and how produce is linked to the health and well-being of people around the world. More than a food source, produce is emerging as the answer to change the trajectory of lives all around the world with the potato at the heart of this movement.

Invited speaker photograph

Invited speaker biography

Lauren M. Scott is the Chief Strategy Officer of the International Fresh Produce Association, the largest and most diverse organization serving the entire fresh produce and floral supply chain. Prior to joining an association in 2016, Lauren garnered over 20-years' experience in the consumer products industry at PepsiCo, Diageo and Colgate-Palmolive. A believer in continuous education and development, Lauren earned her undergraduate degree in Marketing from Rutgers University, an MBA from University of Maryland and a Master of Science in Strategic Communication from Columbia University. Lauren's civic passions include combating food insecurities and perpetuating arts and culture.

PL-09

Fuelling performance with potatoes

Katherine A. Beals

Department of Nutrition and Integrative Physiology, University of Utah, Salt Lake City, UT 84112, USA

Overview

Rich in quality carbohydrates, vitamins and minerals potatoes are an ideal whole food to meet the nutritional needs of athletes. Specifically, potatoes provide the carbohydrate athletes need to fuel muscle and brain function, B vitamins to assist in metabolic processes, potassium to aid in fluid balance, nerve impulse conduction and muscle contraction, vitamin C to support collagen synthesis and immune function and protein to promote muscle tissue synthesis. This presentation will provide an overview of potato nutrition as it relates to athletic performance and will highlight recently published research demonstrating the benefits of consuming potatoes before, during and after exercise.

Invited speaker photograph

Invited speaker biography

Katherine Beals, PhD, RD, FACSM, CSSD is an Associate Professor (clinical) in the Department of Nutrition and Integrative Physiology at the University of Utah where she teaches graduate courses in research methods, macro and micronutrient metabolism and sports nutrition. In addition, Dr. Beals has provided nutritional and scientific counsel to a number of US commodity boards, including Potatoes USA, developing and directing their nutrition research programs and assisting with their nutrition communications and public relations.

Dr. Beals holds a PhD in Exercise Science and Physical Education from Arizona State University, is a Registered Dietitian, a fellow of the American College of Sports Medicine and a Certified Specialist in Sports Dietetics. She has published numerous articles in peer-reviewed journals and is a frequent speaker on a variety of nutrition topics at both national and international nutrition conferences.

PL-10

No risk no reward. Marketing potatoes in a world turned upside down

Jason Davenport

Allied Potato, Inc., Bakersfield, USA

Overview

We all come from diverse backgrounds and upbringings. My own upbringing gave me valuable challenges unique to me that allowed me to think about potatoes from a different point of view. I started my company at the age of 29, utilizing my unique life lessons to pave the way for how I would come to accept risk in a very difficult potato industry. From exporting potatoes, creating new markets, and looking for unique branding opportunities; we have grown as a company much the same as we all hope to grow from our various lessons that life finds a way to offer us each day. For me I have come to embrace mistakes and then cherish the process of learning from experience. Because I started making mistakes in life very early on. The curve for gaining experience and handling pressure changed for me at a fairly rapid pace. After all of this, I now choose to direct my business knowing that mistakes are possible and around every corner mostly due to my own possible errors or lack of "shooting down our own ship" mentality. Because if I cannot find a way to plug the holes of my own making, our ships will never sail.

Invited speaker photograph

Invited speaker biography

Jason Davenport is the President and CEO of the Allied Potato group of companies headquartered in Bakersfield California with farming operations in California, Washington, Oregon, and Colorado. Jason was raised on a farm near Boise Idaho and is a 5th Generation farmer and 1st generation college graduate from the University of Idaho with a Bachelor of Science in Plant Science. Currently Jason is serving as the Chairman of the Executive Board for Potatoes USA as well as serving on other boards and committees. Jason has been married to Nichole Davenport for 26 years and has 4 amazing children.

PL-11

CGIAR - food systems and the potato

Prof. Dr. Martin Kropff

CGIAR Global Director of the Resilient Agri-food Systems Science Area (RAFS), Montpellier, France.
Wageningen University, Wageningen, Netherlands

Overview

The potato has been a staple for centuries. Its continued place in our diets depends on the sustainability of the entire food system: how we produce, gather, transport, process, trade and consume potatoes. But food systems burden the climate and environment with unsustainable costs. For the world to continue to feed itself and offer employment in sustainable agriculture, our food systems – and the way we manage land and water systems – need urgent and profound reform.

By integrating science, technology, and holistic agricultural innovations with food systems stakeholders, One CGIAR and its partners help deliver the tools, knowledge and support to improve global food and nutrition security.

As pests and diseases continue to threaten the potato – just as the late blight devastated the Irish potato harvest in 1845 – scientists across CGIAR and partners are preparing innovative solutions (Global Research Initiatives) to ensure food security and livelihoods for the world's poorest.

An example of one of these Initiatives as part of the Resilient Agri-Food Systems science area is the Plant Health Initiative (PHI). PHI aims to protect key crops – cereals, food legumes, roots, tubers, bananas, and vegetables – from devastating pests and diseases and mycotoxin contamination. Similarly, the Excellence in Agronomy Initiative will contribute to reducing the potato yield gap in low and middle-income countries in Africa, Asia and Latin America through improved crop management.

In addition, building on decades of expertise, there are Global Research Initiatives dealing with better conservation and utilization of genetic resources through the CGIAR gene banks, where genetic diversity of potatoes continues to be conserved, studied and used for future generations. This genetic diversity will be used in breeding and seed delivery related initiatives to make sure that suitable potato varieties that respond to farmer, consumer and market demands in Africa, Asia and Latin America.

Invited speaker photograph

Invited speaker biography

Dr. Martin Kropff, Global Director, Resilient Agri-Food Systems, CGIAR

Martin Kropff is the Global Director of CGIAR's new Resilient Agro-Food Systems science area. In this role, he is building the world's largest scientific group on resilient agri-food systems and uniting scientists across 6 regions in Asia, Africa and Latin America and through 15 Research Initiatives in themes such as farming, cropping and livestock/aquatic food systems.

From 2015 and up until the middle of 2021, he was Director General of the International Maize and Wheat Improvement Center (CIMMYT). At CIMMYT, he led the development and implementation of a new Strategic Plan for science with impact at scale. He also helped frame the One CIMMYT philosophy, which encourages a shared mission and vision through scientific excellence, impact through partnerships and capacity development.

Before joining CIMMYT, Kropff was rector magnificus of Wageningen University and vice chair of the executive board of Wageningen University and Research. During his 10 years' tenure, it developed into the highest-rated agricultural university in the world. He was also a member of the Top Team developing the Agri & Food Top Sector in the Netherlands.

Kropff has had a critical role in the development of One CGIAR, leading the 2016 reform, serving on the first System Management Board, and contributing to the CGIAR 2030 Research and Innovation Strategy as co-chair of the advisory group.

Kropff earned a graduate degree in biology at Utrecht University and a Ph.D. at Wageningen University, both cum laude. He holds honorary doctorates from the National University of Life and Environmental Sciences, Ukraine and the Czech University of Life Sciences. He concurrently holds a professor position with Wageningen University.

His scientific background is in systems agronomy, agroecology, crop modelling and climate smart agriculture. He has supervised more than 30 Ph.D. students, many of them working in developing countries.

PL-12

The future of potato research and its contribution to food security and sustainability

Paul Struik

Wageningen University and Research, Wageningen, Netherlands

Overview

Potato plays an important role in the Zero Hunger Challenge, supported by international collaboration in research. Research is critical as current potato cultivation and processing leaves room for improvement in productivity, efficiency and sustainability, with serious problems persisting and new problems arising. Potato responds strongly to nutrient and water inputs, fluctuating weather and global change. Potato is affected by far more pests and diseases than cereals, has complex breeding and seed systems, and demonstrates strong genotype-by-environment interactions.

Research increasingly unlocks what potato offers to enhance food security and sustainability, by boosting its resilience and robustness, lowering its ecological footprint, and enhancing regenerative potato farming and potato processing. This talk highlights research and innovation options to produce healthy potatoes in diverse, sustainable, resource-efficient food systems, saving water, fertilizer, agro-chemicals, labour and land, while reducing undesired emissions.

Agronomic research should address yield gaps, especially in Africa; locally adapted seed systems; regeneration of diseased seed stocks; reduced and guided use of agro-chemicals while also protecting the arsenal of natural resistances; and use of biostimulants and biocontrol agents. Physiological research should study tuber size dynamics, develop omics-based assessment systems of tuber quality, and design guidance to adaptation to climate change through modelling. Research on storage and utilization should prioritize natural sprout suppressants, waste management and decarbonization. Pathology research should prioritize control of soil- and seed-borne bacteria, study biocontrol, and develop large-scale molecular diagnostics. Breeding research should aim for resilience and robustness through systems-based approaches, next-generation biotechnological tools, resistance genes, and healthy food, e.g., through biofortification.

Technological developments, including artificial intelligence, sensor technology, remote sensing, digital twins and data science, and biotechnology, will support these research efforts. Social sciences are equally essential in securing potato's role in food security and sustainability, support regulation and compliance with labels, and improve the image of potato.

Invited speaker photograph

Invited speaker biography

Paul Struik is Professor of Crop Physiology at Wageningen University, the Netherlands. He is involved in research projects on root and tuber crops in Africa, South America, Asia and Europe, with a focus on crop physiology, seed production technology, and seed systems. He is (co-)author of more than 500 papers in international scientific journals, many of them on potato. He has successfully completed the supervision of more than 115 PhD candidates and is currently supervising about 30 PhD students. He is Editor-in-Chief of Potato Research and Academic Editor of Annals of Applied Biology, Frontiers in Plant Science, and PLoS ONE.

PL-13

Planet of Plenty - making agriculture the solution to the problem

Robert Walker

Alltech, European Bioscience Centre, Dunboyne, Co. Meath, Ireland

Overview

The increasing importance of the Green economy represents a unique opportunity for Agriculture to reposition as a solutions provider. Agriculture has been portrayed in the media as the cause of issues ranging from climate change to environmental pollution to poor animal welfare to human health issues, and many more. However, agriculture has the unique ability to not only mitigate these issues but in fact to reverse them. Our agricultural industry is set to undergo rapid and significant change in the coming years with accelerated consolidation driven by the green economy, consumer trends, the rise of ag-tech and bio-tech, pandemics, and geopolitics. Convergence of agriculture with adjacent industries will result in opportunities in “agri-food”, “agri-health, “agri-estates”, “agri-finance”, “agri-energy”, and many others!

Alltech, a start-up in 1980, has grown to become a multi-billion-dollar company with over 5000 employees in over 120 countries. This phenomenal growth has been fuelled by the founder’s vision of providing agricultural nutrition solutions that benefit Agriculture, Consumer and Environment. Today, the company vision has been updated to reflect the interconnectedness of our complex supply chains, and Alltech is driven to work with partners to create a “Planet of Plenty”. Alltech has embraced the opportunities presented by the changes in our industry.

To find opportunity in the change; we need to be receptive to product and business model innovation and have a bias to action. Our teams should be driven by passion and purpose.

Invited speaker photograph

Invited speaker biography

As the European growth officer, Robert Walker serves as the CEO of KEENAN and head of key European markets for Alltech. He drives business growth via his work with ag-tech start-ups as manager of the Pearse Lyons Cultivator and via his responsibility for senior leadership talent development in the Alltech Mini-MBA program.

Walker joined Alltech in 2002 as a sales manager in Ireland. He later opened a regional sales office in Northern Ireland. In 2005, he transferred to Italy, where he served as country manager for Alltech before transitioning to the role of regional director of the eastern Mediterranean region. In 2011, Walker was appointed European director of Alltech Crop Science, based in Italy, and in 2013, he transferred to the U.S. to assume the position of global general manager for Alltech Crop Science. In 2016, Walker transferred to Ireland to assume his current position as CEO of KEENAN.

Walker received a bachelor's degree in agriculture from the University of Natal in South Africa in 1994. After graduating, he founded his own indoor farming enterprise in South Africa, through which he grew and packed flowers and tomatoes. Walker has also completed business courses at the University College Dublin Smurfit Graduate Business School and the Bocconi School of Management in Milan.

PL-14

Contribution of the potato to the SDG's and climate change

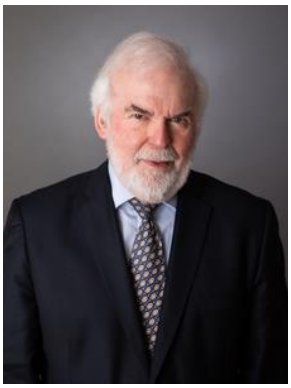
Tom Arnold

Irish Government's Special Envoy on Food Systems, Dublin, Ireland

Overview

The world is faced with two existential challenges by 2050: how to provide food and nutrition security for a population of close to 10 billion people while meeting the climate target of restricting the increase in global warming to 1.5 degrees above pre-industrial levels. This presentation will trace the growing importance of the potato in contributing to farming systems, to farm household income, and to nutrition. It looks forward to how this contribution can be further enhanced in the decades to 2050, identifying the policies, research priorities and development strategies to optimise the role of the potato in meeting the SDGs and the targets for climate action.

Invited speaker photograph



Invited speaker biography

Tom Arnold has served in various governmental and non-governmental roles at Irish, European and international level. His current and recent roles include: Chair, Irish 2030 Agri-Food Strategy Committee; Chair, EU Commission Task Force, Rural Africa; Coordinator, Scaling Up Nutrition (SUN) Movement); Director General, Irish Institute for International and European Affairs; Chair, Irish Constitutional Convention; Member, Global Panel on Agriculture and Food Systems for Nutrition; Board Member, Global Alliance for Improved Nutrition (GAIN). In his earlier career, he served as CEO, Concern Worldwide; Chief Economist and Assistant Secretary General, Irish Department of Agriculture and Food; Chair, OECD Committee of Agriculture; Administrator, EU Commission. He is a graduate in agricultural economics from University College Dublin (UCD) and has Masters degrees from the Catholic University of Leuven and Trinity College, Dublin.

C-01

The future is bright

Ross Keogh

Keoghs Farm, Dublin, Ireland

Overview

The humble potato is not so humble. It is our very own super food. I am going to present here why we are very fortunate to have such an amazing food source available to use and how its future is looking very bright. Be it from its environmental impact versus its competitors, to its excellent value to the consumer both from a financial and nutritional stand point. It is a fact that the world will need the amazing spud for a long while yet.

Invited speaker photograph

Invited speaker biography

Ross Keogh is one member of the Keogh farming family from North County Dublin. Keoghs grow and pack premium fresh potatoes and supply several retailers and wholesalers throughout Ireland. They also produce premium luxury hand cooked crisps and also supply retailer throughout Ireland as well as exporting to multiple countries throughout the world. Ross, along with his brother Tom and cousin Derek own the family businesses. Ross manages and directs all aspects of the running of the fresh potato business on a daily basis. knowing education is key to the continued success of any business, Ross has several qualifications to his name, most recently completing an MBA from Dublin City University.

C-02

The European perspective

Tigran Richter, Europatat President

Europatat, Rue de Trèves 49-51, bte 8 1040 Brussels, Belgium

Overview

High costs of potato production and transport, uncertainty over potato prices and high prices of alternative crops. All these factors, together with the post-pandemic market's readjustments, the increasingly unpredictable weather conditions and a high political pressure towards sustainability, are making the 2022 season one of the most challenging one ever.

From a business point of view, it is very difficult to predict where the European potato market will be in 5 years' time. However, thanks to the available information from the members of the European Potato Trade Association (Europatat), the new Associations' President (to be elected at the Europatat Congress on 30 May) will look at the main challenges for the potato sector in the future, but also at the opportunities that the changing world of potatoes might bring to the businesses around Europe.

C-03

Challenges and opportunities facing the global seed potato industry

Gerard Backx

HZPC, Joure, Netherlands

Overview

The Global Seed Potato Industry has two major challenges:

1. Currently only a small part of the world-wide potato growers are using higher quality seed potatoes. This does limit the potato production. So, a major question is how we could supply those potato farmers with technically and genetically high-quality seed potatoes!

2. The potato growers are growing relatively old varieties. The challenge of the potato breeders is to increase the genetic gain so the potato growers will have access to improved varieties.

Concerning the first item, we deal with transport-, political/legislative- and phytosanitary- barriers. Partly those hurdles can be lowered by more local production and likely true potato seeds. Further political solutions will be essential; More open borders and protection of plant breeders' rights. Farm saved seed is allowed within any plant variety legislation.

Concerning the second item, breeders currently are able to increase the genetic gain within the tetraploid varieties breeding based on the knowledge of the entire genome. Due to that, genetic markers are developed for different qualitative traits. This enables the breeders to execute more targeted breeding and to lift the bars for selection on those selected traits. Results will be visible in the products entering the markets in the coming years.

Next to that hybrid diploid breeding will increase the genetic gain over the coming decades considerably. It will take some time before this technique will be used for the advanced markets. However, also those markets will get a boost based on this breeding method.

New Breeding Technologies or Novel Genomic Technologies will be tools that might allow breeders to make big step forwards, especially to create high disease resistances. Acceptance of those technologies in the entire world and the potato value chains will be essential.

Invited speaker photograph

Invited speaker biography

Gerard Backx is CEO of HZPC Holding B.V., a leading seed potato company with headquarters in the Netherlands. Gerard started with HZPC in 2001 and in that period HZPC developed from a Dutch seed potato exporter to an international operating company with a large breeding program and affiliates in 14 different countries over 4 continents.

Gerard has a master degree in plant breeding and marketing from Wageningen University (1984) and worked, from 1984 till 2001, in different management positions with Advanta Seed company, dealing with several field crops.

C-04

What does good nutrition look like?

Orla Walsh

OWN, Dublin, Ireland

Overview

What does good nutrition look like?

Eating well to better nourish your body doesn't have to be complicated. In fact, it can be explained within a few short minutes. As most people don't realise how good they are designed to feel, making a couple of changes to mealtimes can be surprisingly beneficial.

So, where does the confusion come from? Nutrition is a science, not an opinion. There are different views but not many between those who have actually studied it. Education from those that are qualified is key to changing population nutrition habits and it has to be simplified to work for everyone.

After my presentation I feel confident that you'll know what to eat as well as how and when to eat it. The aim is to make nutrition digestible.

Invited speaker photograph

Invited speaker biography

Born in Dublin, Orla qualified as a Dietitian from Kings College London.

Orla also has an MA in Physiology from Trinity College Dublin, a Masters in Clinical Nutrition from Roehampton University, London and a postgraduate diploma in Sports and Exercise Nutrition at the University of Ulster.

C-05

Iron biofortified potatoes to contribute to reduce malnutrition

Gabriela Burgos, Elisa Salas, Thiago Mendes, Hareau Guy, Hannele Lindqvist-Kreuze

International Potato Center, Lima, Peru

Overview

The key findings from a recent study to evaluate iron bioavailability from potatoes in humans using stable isotopes indicate that iron from yellow-fleshed potatoes has remarkably high absorption (29%), much higher than that reported for other crops like pearl millet and beans. Consumption of 300-500g of high iron potato could cover between 30-50% of the daily need of women in reproductive age.

CIP has been working for over 15 years in the development of high iron biofortified potatoes to contribute to reduce malnutrition. Diploid Peruvian landrace potatoes were utilized in cross breeding to further increase iron concentration. Genotypes with high iron content selected among the diploid biofortified population were then crossed with elite tetraploid parental lines with high yield, resistance to most prevalent crop diseases such as late blight and tolerance to major abiotic stresses such as heat and drought. Micronutrient content in the new population was significantly higher than those of modern clones, indicating that the iron-content trait could be successfully improved by breeding. The currently available biofortified potatoes clones developed at CIP contain 40 to 70% more iron than regular commercial potato varieties.

A selected group of tetraploid biofortified clones has been tested by in Rwanda, Ethiopia and Peru. In Rwanda seven clones were selected with great potential to be released as the first biofortified potato. In Peru, 12 selected tetraploid biofortified clones were evaluated in multi-location yield trials and two promising iron biofortified clones have been selected for variety registration and release. In coordination with nutritional education campaigns, mothers of young children under the age of 5 in the Peruvian highlands received tuber seeds of the biofortified clones. Ninety percent of the families produced potato seed and showed interest in growing the high iron potatoes in the next potato season.

Invited speaker biography

Gabriela Burgos is a Peruvian scientist, doctor in Food Science, Master in Nutrition, Senior Research Associate and Head of Quality and Nutrition Laboratory at International Potato Center.

Since 2004, Gabriela has participated at or led CIP's projects focused on reduce malnutrition in Africa, Asia and Latin America through the improvement of the amount of micronutrients in potato and sweet potato. Currently, she is leading efforts to have evidence of the high contribution of potato to reduce malnutrition in target human populations.

She is author and co-author of more than 20 scientific papers in ISI journals.

C-06

Potatoes - The good carb

Georgia Thomas

Potato Growers Association of Western Australia, Perth, Australia. AUSVEG, Melbourne, Australia

Overview

Potatoes have been given a bad reputation over the years by many in the health and nutrition industry. New research dispels myths and shows that potatoes not only keep you fuller for longer than other carbohydrate sources, they are also low-fat and contain key nutrients. Research also shows that when cooked and cooled, potatoes have even more health benefits. In this presentation I will run through these findings and showcase how this information is being used to encourage potato consumption in Australia.

Invited speaker photograph

Invited speaker biography

Georgia Thomas has been working with the potato industry in Western Australia for over 10 years in various roles, including managing the industry's potato marketing program. Georgia has over 20 years' experience working in the agribusiness sector undertaking project management, digital marketing, PR communications, events, strategic planning and management roles. Georgia's career has allowed her to travel from Perth to Europe, America and South Korea. She loves talking about and eating spuds!

C-07

Breeding the varieties of tomorrow (faster!)

Dan Milbourne

Teagasc, Carlow, Ireland

Overview

Breeding better potato varieties is a key component in responding to a range of future challenges facing the potato industry across the value chain. Climate change, increased sophistication in end-user requirements, sustainability policies, emerging markets, food security and nutrition are among the complex problems in which new potato varieties with improved specific product profiles can contribute to solutions. However, potato breeding is both slow and imprecise. It takes over a decade to produce a new variety, so rapidly responding to emerging threats and opportunities is difficult. Additionally, the genetics and reproductive biology of potato mean that breeding varieties with specific combinations of target characteristics (the product profile) is more difficult than in many other crops.

However, potato breeding is in the midst of a sea-change that will transform the speed and precision with which new varieties will be developed. Genomic breeding technologies similar to those that have transformed cattle breeding are now also widely used by potato breeders. The regulation of novel breeding technologies such as gene-editing is becoming more sensible, making their use more practical. Scientists are even re-designing the reproductive biology of the crop in systems like hybrid breeding, for more speed and precision in breeding. In this presentation I'll give a whistle-stop tour of these approaches for non-specialists with the goal of giving you an appreciation of where the next generation of potato varieties are coming from.

Invited speaker photograph

Invited speaker biography

Dan is a research scientist at Teagasc, where he has over 20 years' experience developing and deploying genome-based technologies for potato variety improvement.

C-08

Intelligent technology solutions improve quality and yield along the value chain

Franz-Bernd Kruthaup

GRIMME Holding GmbH, Damme, Germany

Overview

Potato Growers around the world face major challenges in the coming years, like: - Climate changes with higher temperatures and lack of water supply, - Restrictions in the use of chemicals, fertilizer, etc., - Rising market demand for the quality of potatoes, - Decreasing availability of labour. An important role in overcoming many of the hurdles will be led by new Intelligent Technological Innovations. The session will present some mechanical as well as digital solutions in various areas of the potato production chain.

Invited speaker photograph

Invited speaker biography

After studying Agricultural Machinery technology and business administration, Franz-Bernd Kruthaup started his career at Grimme in the sales department in 1992. Besides the responsibility for various sales territories, he was also a driver in Product Management for the expansion of an innovative product portfolio. In 2012 he took over the position of Sales Director and further expanded the international sales network with a highly committed team. For the past few years, his core focus has been the market development of the two largest potato producing countries China and India.

C-09

Embracing agri-tech for step changing the potato supply chain

Vidyanath Gururajan

B-hive Innovations, Lincoln, United Kingdom. Branston, Lincoln, United Kingdom

Overview

There is a huge opportunity for technology to bring step change in the potato supply chain. There are lot of technology push but not enough pull from the supply chain. The presentation will cover the challenges and opportunities that Branston limited, one of the largest retail potato packers in the UK has identified and how B-hive Innovations Limited, SME Agri Tech business created by Branston is solving these challenges using innovative technologies.

Invited speaker photograph

Invited speaker biography

Vidyanath (Vee) is an innovator and co-inventor with over 16 years' experience in the fresh produce industry. He is Executive Board Director at Branston, with a varied portfolio covering R&D, potato variety development and IT. He is also Managing Director of our SME agri-tech businesses - B-hive Innovations ltd, HarvestEye ltd and RootExtracts ltd.

Details of interests

Speaker is the Managing Director of B-hive Innovations and Executive board director of Branston and the topic covered is industrial/commercial case study.

C-10

Food-nutrition security and sustainable intensification and diversification of agri-food systems: the role of potatoes

Hugo Campos, Oscar Ortiz

International Potato Center (CIP), Lima, Peru

Overview

Potato has played an essential role for food security and income in the Andean Region for thousands of years. Several centuries ago, it was introduced into farming and food systems in Europe and from there to Africa and Asia. Potatoes have been key to food security, nutrition, income, and population growth in many regions. More recently, potato has become important in China and India, but also in Africa, where cropping area and production has increased more than any other food crop. Potato is an extremely versatile crop, which produces more yields in a short period of time compared to other crops and provides food for the "hunger months" when cereals are not yet ready to harvest in several African countries. In Asia, millions of hectares of rice offer, during wintertime, a window of 2-3 months to add a potato crop in the farming systems. This contributes significantly to sustainable intensification and diversification of agri-food systems in resource constrained regions, improving livelihoods of millions of households with additional food, improve nutrition, and additional incomes, all in the same land. In the Andes, potato biodiversity still plays a key role in the high mountains agri-food systems and has the potential for intensification responding to emerging markets valuing biodiversity. In other parts of the world, however, the genetic variability of potato is relatively small and represents a risk due to the emergence of new pests and diseases. To continue contributing to sustainably intensify and diversify agri-food systems in Asia, Africa, and Latin America while increasing household resilience to climate change, the development of new varieties tolerant to biotic and abiotic stresses together with appropriate quality seed and crop management is required. CIP and several partners all over the world are working to develop the technological and agri-food system innovations to make this happen.

Invited speaker photograph

Invited speaker biography

Dr. Hugo Campos is the Deputy Director General for R&D (i.a.) at the International Potato Center. He has 25+ years of international experience in Sub Saharan Africa, Latin-America, US and the UK. His professional career has been devoted to increasing the impact of plant breeding programs, and to innovation and entrepreneurship. His book “The Potato Crop”, published with Oscar Ortiz, is a global best seller with over 250,000 copies sold/downloaded. He is a Chilean national, educated at the PhD and MBA levels (John Innes Centre, UK, Universidad del Desarrollo, Chile), and Executive Education level (Stanford University, USA).

C-11

Growing challenges: crop protection and sustainable farming

David Zaruk

Odisee University College, Brussels, Belgium

Overview

With public pressure and concern over the environmental effects of agriculture compounding, with harvest risks for farmers increasing and a growing population exacerbating food security levels and nutrition demands, there is a rising need for more research and technology to meet the growing challenges. At the same time, societal demands for natural, organic, traditional food and agricultural practises create regulatory obstacles for innovative solutions. In the field of potato research, genetic modification and new plant-breeding techniques have created enormous opportunities for higher quality and more sustainable intensification. But targeted campaigns by certain interest groups have created a public fear and reluctance to adopt the new technologies, with regulatory roadblocks and rejection down the food value chain. With clear health, nutrition, environmental and agricultural benefits from such innovations, what should the potato sector be doing to bring the activist groups, food manufacturers and regulators to the table? This presentation will look at how different interpretations of sustainable farming hampers effective dialogue and how policy actors have misused the precautionary principle to the detriment of farmers, researchers and consumers.

Invited speaker photograph

Invited speaker biography

David has been a Brussels-based environmental health risk policy analyst for over 20 years. Professor, science communicator, writer ... he is perhaps best known under his *nom de plume*, The Risk-Monger, where he often writes on agricultural policy issues in the EU.

C-12

Fertilisers, sustainability and the future

Michael McLaughlin

Fertiliser Technology Research Centre, The University of Adelaide, Adelaide, Australia

Overview

Nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) are key nutrients required for successful potato production yet these inputs are becoming increasingly expensive and under scrutiny for adverse environmental effects in their production and use. Nitrogen and S are prone to losses from soil into waterways and the atmosphere, and P can accumulate in soils and pose risks to pollution of waters from surface runoff. Phosphorus, K and S are also non-renewable global resources – fortunately, we are not going to "run out" of these nutrients in the near future, given world resources/reserves. However, poorer quality reserves and increasing costs to mine, manufacture and transport fertilisers, coupled with geopolitical tensions in exporting regions, means that costs of these essential nutrients are likely to increase and be volatile. Similarly, N and S fertiliser production, which are linked to fossil fuel production, are affected by volatility in raw material costs.

Is N use in agriculture inefficient? Yes, due to the mobility of N in soils and potential losses to the atmosphere, recovery of fertilizer N is generally poor". Hence, there is an opportunity for new fertiliser technologies to improve our use of this nutrient. Is P use in agriculture inefficient? No, not as inefficient as you might think. Efficiency of P use increases with continued use – here P is very different to N in that true losses of P from soils are usually quite small. However, there is poor re-use of P exported in produce from agricultural land so that from a circular economy viewpoint the use of P is indeed inefficient, but improving.

Looking to the future, projected declines in use of fossil fuels as renewable energy production increases, coupled to increasing environmental regulation, means there could be significant changes to how fertilisers are produced, distributed and used on farm.

Invited speaker photograph

Invited speaker biography

Mike McLaughlin is a Professor in the School of Agriculture Food and Wine and Director of the University of Adelaide Fertiliser Technology Research Centre. Mike gained his B.Sc. from the University of Ulster, a M. Agr.Sc from the University of Reading and his Ph.D. from the University of Adelaide in Australia. Mike's research interests are in soil/fertiliser chemistry and crop nutrition.

F1-01

2022: The new normal - Myths versa facts about potato consumers

Elizabeth O'vari

Europanel, London, United Kingdom

Overview

We are living through a period of unprecedented disruption. The pandemic and lockdowns have changed where and the way we purchase, when we snack, how often and what we buy. But how many of these new trends are here to stay?

Be prepared to confirm your hypotheses or to have them disproved while also learning what data we can provide you with to help you understand how potatoes are consumed in different countries today.

Invited speaker photograph

Invited speaker biography

Business Development Director of Europanel, the global strategic partnership of KANTAR and GfK.

With two MAs (International Relations/Russia, International Marketing Management/Budapest) and a Business Management postgrad from JICA/Japan, she has over 20 years of experience in market research, international project development, and IT system integration.

Languages: English, Polish, Russian, Hungarian.

F1-02

The commercialization of developing farmers in South Africa

Nomvula Xaba

Potatoes South Africa, Pretoria, South Africa

Overview

Approximately 13.8 million people in South Africa live below the food poverty line. The highest incident is among female-headed households in rural areas. Poverty eradication and wealth creation under an ideal free market system depend on the economic growth of sectors. This could be because the growth of one sector leads to the growth of another sector i.e. the growth of raw materials suppliers has been growing with the growth of those who process the raw material.

Consequently, South Africa, today has two very distinct economies in most sectors i.e. the developed economy also referred to as the first economy and the developing economy also referred to as the second economy. This dualism cuts across all agriculture sectors, sub-sectors and commodities including the potato sector.

The high barriers of entry (input cost, infrastructure, machinery and knowledge) prevent the entry of new participants from previously disadvantaged communities into the potato agricultural sector. Over the years the number of potato producers declined from 2031 in 1993 to 497 in 2020. The main reason for this is potatoes are a commodity with increasing input costs and the only way to remain competitive is to achieve economies of scale.

In the past, the Agricultural industry in South Africa was not entirely open to people from previously disadvantaged communities. Post democracy, the focus was on ensuring that that who were excluded by the system get all the support to participate in the Agricultural Sector. Potatoes South Africa embarked on the Enterprise Development Programme whose mandate is to ensure the commercialization of developing farmers. Through the grant that is funded through the levies, Potatoes South Africa commissioned support programmes that will ensure that the developing farmers that enter the potato industry get all the support and become sustainable commercial farmers.

Invited speaker photograph

Invited speaker biography

Ms Nomvula Xaba is currently the Transformation Manager for Potatoes SA where she is responsible for the development of New Era farmers. She has an Agricultural qualification from the University of Natal and a BCOM degree from UNISA. She obtained her Master's degree in Sustainable Agriculture from the University of the Free State. She also has a project management qualification under her belt through the University of Cape Town.

F1-03

The view from Germany

Thomas Herkenrath

Deutscher Kartoffelhandelsverband (DKHV) e. V., Berlin, Germany. Fritz Jungnickel GmbH & Co. KG, Neuss, Germany

Overview

The view from Germany

Germany has established itself as Europe's biggest potato producer, with excellent quality-standards, various accredited certifications, and thorough food safety regulations.

In recent years, the food sector and consequently the potato sector underwent significant change. We are faced with several new challenges, including climate change, increasing legislative requirements and private-sector demands by supermarkets and NGOs, as well as a shift in consumer sentiment towards regional, sustainable food.

Moreover, the food supply situation in Europe is facing rapid changes as a consequence of Russia's unprecedented military escalation in the east. Surging energy costs and supply disruptions impact production and logistics, forcing us to re-think the status quo of food supply in Europe. To adapt and mitigate the impact of geopolitical instability on our system, we must focus on developing self-sufficient structures, whilst bearing in mind our humanitarian duty to aid nations with existing or evolving hunger-crises.

Can we continue to afford the luxury of abandoning or re-purposing agricultural land, and imposing ever more stringent and restrictive agricultural quality and production standards?

How can we find a middle ground between sufficient yields and our renown quality standards, and motivate or incentivise farmers to cultivate potatoes for consumption in the future?

How can we innovate and combine solutions to manage these present and future challenges, in order to secure and reinforce our countries' collective food supplies?

Invited speaker photograph

Invited speaker biography

Thomas Herkenrath, born 1961 in Neuss, has been serving as President of the German Potato Trade Association (DKHV e.V.) since 2015. He holds a Master's degree in economic science, awarded for his thesis on „The Necessity and Risks of a German Commodities exchange for Potato Futures ". As the owner and managing director of Fritz Jungnickel GmbH & Co. KG, a family run potato trading company specialized in the worldwide potato trade for over 100 years, Thomas Herkenrath has accumulated more than 30 years of experience in the potato markets. From 2010 to 2016 Thomas Herkenrath served as the Vice-president of Europatat, and is currently appointed Chairman of the Europatat RUCIP Commission. Mr. Herkenrath is a well-known international arbitrator and an all-round expert in Potatoes.

F1-04

Our treasure in the Andes: Native potatoes in the Northern Highland of Peru

Jose Ronal Otiniano[1], Juan Miguel Perez[1], Jimena Sologuren[2,1], Stef De Haan[3], Hector Cabrera[4], Rosmery Pando[4]

[1]Pataz Association, Trujillo, Peru. [2]Poderosa Mining Company, Trujillo, Peru. [3]International Potato Centre, Lima, Peru. [4]National Institute for Agricultural Innovation, Cajamarca, Peru

Overview

Cultivated native potatoes date back to the first diploid native varieties, (of the Stenotomum group). The evidence places the first indications of potato cultivation around Lake Titicaca, more than 8,000 years ago (Spooner et al., 2005). Archaeological evidence suggests that the potato was domesticated by women while men hunted and fished. Also, today it is women who play a very important role in seed selection (Tapia and De La Torre, 1992). The Highland of La Libertad is home to many species of wild potatoes and it is not ruled out that the ancient settlers have also influenced the domestication and diversification of the potato. A recent publication even suggests that La Libertad is an important area for wild potato collections (Castañeda-Álvarez et al., 2015); area where single-use processes have originated, such as the preparation of chuño by anaerobic fermentation. The project is located above 3,200 meters above sea level, which allows it to have ideal edaphoclimatic conditions for the adaptability, stability and development of a large number of native potato varieties; whose objective is to value these varieties for the generation of economic income. And as a secondary objective is the publication of a bilingual catalogue, the registration of all the native varieties identified in the National Registry of the Native Potato of Peru, identification of the two best varieties with good market opportunities, and the formation of an association of potato seed producers for the production and commercialization of potato seed of high genetic and sanitary quality. This work includes the characterization: agronomic, morphological, molecular and nutritional; as well as the ploidy and genetic fingerprint of each of the 280 varieties of native potatoes.

Invited speaker photograph

Invited speaker biography

Agronomist graduated from the National University of Cajamarca (1995) in Peru, he obtained the degree of Master of Science in Plant Genetics from the Postgraduate College of Montecillos, Texcoco, State of Mexico (2002). He has strengthened his capacities in plant health issues, statistical analysis, Participatory Variety Selection (PVS) methodologies, among other issues at the International Potato Center (CIP); he received courses on Protection of new plant varieties, UPOV-INIA, Peru (2016). He worked since 1996 as an extensionist in the agricultural and forestry field, then he started teaching at the National University of Cajamarca in the departments of statistics, experimental designs, plant genetics and plant genetic improvement; He then worked at CARE PERU, and currently at the Pataz Association since 2008, in which he remains to this day, in the position of Agrarian Research Coordinator. He has participated in the release of the potato varieties: INIA 321 – Kawsay and INIA 325 – Poderosa, he is the author of the Catalogue of Native Potatoes of Chugay – La Libertad in Peru together with CIP and INIA. He has participated in several publications of national and international scientific articles together with INIA and CIP, he has participated in Latin American and world potato congresses. He has just received, jointly with CIP and INIA, the First Place in the CARAL 2020 Award in the Food and Nutrition Security category. He continues to improve his abilities thanks to a doctorate that he has been pursuing at the National University of Cajamarca.

F1-05

Emerging plant pathogens of potato

Amanda Gevens

University of Wisconsin Madison, Madison, USA

Overview

Despite the use of best and integrated management practices in potatoes, disease in the globally-important food crop persistently and negatively impacts yield and quality in the production field and post-harvest domains. At current, the predominantly non-true-seeded potato crop has many places within its life cycle for pathogen exposure and acquisition. Globally, the resulting disease can cause up to 20% crop losses annually at substantial economic, resource, and critical food losses. While the enhancement of disease and pest management over the past 50 years has helped double food production, it is becoming increasingly more important to further reduce crop production to best steward resources and sustain human and planetary health. We define emerging pathogens as those that have increased in incidence, geographical range, host range, have changed pathogenesis, have newly evolved, or have been newly discovered or described. Due to human factors and climate change, potato pathogens (including fungi, oomycetes, bacteria, viruses, nematodes, viroids, and plasmodiophorids) are continually undergoing changes as they respond to shifting environmental and system pressures. In this presentation, I will address critical emerging pathogens in potato from the perspective of pathogen ecological factors and regional and field-level management needs.

Invited speaker photograph

Invited speaker biography

Dr. Amanda Gevens is Chair, Professor, and Integrated Extension Specialist with the Department of Plant Pathology at the University of Wisconsin-Madison. Dr. Gevens' research and extension or outreach program focuses on advancing integrated disease management approaches in potato and vegetable crops across production strategy and scale of operation. In potato, Dr. Gevens has advanced novel detection, ecological characterization, and management strategies of several pathogens, but has

emphasized late blight, early blight, silver scurf and common scab in the production field. Her research also addresses disease management in storage through exploration of chemical alternative strategies. Dr. Gevens greatly enjoys engagement with growers and our agricultural industry, as well as mentoring the next generation of field scientists to support sustainable production.

F1-06

Changing arsenal of plant protection products

Max Newbert

Syngenta, Cambridge, United Kingdom

Overview

Societal concerns and global warming are putting greater demands on farmers as they try to produce the quality food that a growing world population needs. How is the crop protection industry responding to this? This presentation sets out the future challenges and demands facing crop protection companies and how Syngenta is meeting them. The use of science is key to delivering breakthrough technologies and solutions. This presentation uses three different examples to demonstrate the principles involved in building 'the changing arsenal of crop protection products' that will answer the agronomic and societal questions facing farmers in the future.

Invited speaker photograph

Invited speaker biography

Max Newbert is a Technical Manager for sustainability, insect control (all crops) and vegetable fungicides within the UK & Ireland. He joined Syngenta 6 years ago from Warwick University, where he was a Fellow within Warwick Crop Centre, specialising in viral genetics and plant resistance breeding after complete his PhD at the institute.

Max leads projects and trials investigating different integrated pest management (IPM) systems, as well as landscape management to enrich ecosystems that can also aid in IPM. This type of work requires a high level of cross functional work within the UK and EU organisation. To add scientific context and understanding into these new management systems, many projects are co-run with external independent research organisations adding valuable data behind the outcomes. The aim is to overcome grower issues, by using all available tools available to provide easy to implement and sustainable solutions.

F1-07

Economically important virus diseases of potato

Christophe Lacomme

SASA - The Scottish Government, Edinburgh, United Kingdom

Overview

Changes in the agricultural landscape, crop management, crop intensification, introduction of foreign plant material via increased trade and climate change favour the emergence of infectious diseases of plants. Diseases caused by plant viruses can have significant and devastating impacts on potato crops worldwide. The impact of disease caused by a virus depends on the virus species, strains, type of inoculum, host plant characteristics, vector pressure, climate, and agricultural practice. Viruses affect potato plants by causing a large variety of symptoms such as alteration of shape, pigmentation, necrosis on different part of the plant and affecting plant development. In most of the cases these lead to a decrease in crop yield and quality. There are numerous viruses that affects potato, amongst them aphid transmitted viruses such as Potato Virus Y (PVY) is considered to be one of the ten most important plant viruses of crops, because of its worldwide distribution and economic impact. PVY is transmitted non-persistently by non-colonising aphids, resulting in a rapid acquisition and transmission of the virus between plants. PVY exists as a complex of strains that can be distinguished according to their pathogenicity, serology, and genome analysis. Some PVY isolates can cause potato ringspot necrotic disease in infected tubers rendering them unmarketable. Understanding the genetic diversity and molecular biology of PVY is essential to understand its infectious cycle, epidemiology and developing efficient methods of control and management for the virus itself and its vector. Several major scientific challenges remain in understanding the molecular nature of the interaction between PVY, its hosts, aphid vector in different environments, its epidemiology and control when loss of actives substances is an important challenge to growers. I will present the context and current state of our knowledge in potato virus-host-vector interactions and management.

Invited speaker photograph

Invited speaker biography

Dr Christophe Lacomme is the Senior Virologist at SASA - The Scottish Government, (Edinburgh, UK) since 2009.

Christophe is the Virology team leader, which mission is to provide diagnostic and surveillance for regulated viruses of agricultural and horticultural crops in support to seed potato classification and the potato industry.

Christophe's role is to provide advice to stakeholders and Scottish's government policy makers.

Christophe has authored more than 60 peer-review articles, is an editor and reviewer for scientific journals and has numerous representative roles to National and European Plant Protection Organisation and Food Safety Authority.

F1-08

Emerging issues with pathogens and pests in China

Ruofang Zhang

Inner Mongolia University, Hohhot, China

Overview

There is an increase in the number of reports on potato disease in new geographical locations around the world. It can be positively accredited to the increase in scouting, advancement of scientific tools and facilities, an active scientific community, and improvement of the regional agricultural policies. Chronological reports on different potato diseases identified in Asian countries including China in the last decade will be presented with the current management policies at the regional level. There are emerging risks of bacterial diseases including Blackleg caused by *Pectobacterium* species and scabs by *Streptomyces* species in China. Challenges faced by small growers, potato seed producers, and breeders in managing different potato disease would be put forward. Finally, emphasis is made on the roles of growers, policymakers, and the scientific community for a combined effort to systematically identify, quarantine, or manage current potato diseases and prevent future outbreaks.

Invited speaker photograph

Invited speaker biography

Dr. Ruofang Zhang is a plant pathologist at Inner Mongolia University in Hohhot. She completed her undergraduate in biology from Inner Mongolia University. Then, she did her master's in plant genetics and breeding from Wageningen University in the Netherlands. She continued her career by getting her doctorate in plant pathology from Pennsylvania State University in the USA. After that, she joined Inner Mongolia University in 2004. With her initiative, the Potato Engineering & Technology Research Center of Inner Mongolia University was established in 2007. She is the executive director of the center.

F1-09

Statistical trends for trade of fresh and processed potatoes in and to Asia

Samarendu Mohanty

International Potato Center, New Delhi, India

Overview

Potato is the third most important food crop behind rice and wheat and a staple for 1.3 billion people, including millions of poor people in Asia. The importance of potato has been on the rise in Asia with its production rising from 23 million tons in 1961 to 189 million tons in 2018. Tracking production trend, per capita utilization of potato has on a steep rise since late 80s from 11 kilograms to close to 30 kilograms in recent years. This trend is expected to continue in the future due to a combined influence of rise in income and population growth. An extrapolation of total potato consumption in Asia by fitting a trendline indicate that the total consumption is likely to rise by another 50 million tons in the next decade.

Despite such meteoric rise in potato production and consumption, Asia is more or less self-sufficient in fresh potato. But the situation is much different in processed potatoes where Asia accounts for majority of growth in frozen potato imports in the past two decades. This presentation will discuss the recent trends in fresh and frozen potato trade in key Asian countries and projects the future trends with rise in income and population.

Invited speaker photograph

Invited speaker biography

Samarendu Mohanty (Sam) is Regional Director for International Potato Center. He provides programmatic oversight for research and development portfolio; provides leadership in regional operational systems; and plays representational role for CIP in Asia. Sam holds a Ph.D. in Agricultural Economics from University of Nebraska-Lincoln, a M.S. in Agricultural Economics from University of Nebraska-Lincoln and a B.Sc. from University of Agricultural Sciences in Bangalore, India. Sam joins CIP

after working as Principal Scientist at the International Rice Research Institute – IRRI in Philippines and previously as Head and Senior Economist for the Social Sciences Division in IRRI since 2008. Previously, he also worked as Associate Professor and Associate Director for Cotton Economics Research Institute at Texas Tech University and scientist/adjunct faculty at Food and Agricultural Policy Research Institute at Iowa State University

F1-10

Experience in developing domestic and export opportunities for potatoes in India

Jang Bahadur Singh Sangha

Sangha Group, Jalandhar, India

Overview

The Asian continent is the main center for potato cultivation with 51% approx. of the world potato production, followed by Europe (29% approx.), Americas (12% approx.), and Africa (7.2% approx.). China is the largest potato producer in the world while India holds the second position followed by Russia, Ukraine, and the US. North America leads in per hectare productivity followed by Europe, Asia, and Africa.

Out of India's 50 million metric tons annual potato production, only 5% is processed. The annual growth rate of potato production is more than 1%. Potato has the third position in per capita availability of food crops after rice and wheat. Total potato export is less than 1% of the production. The main barriers in export are non-tariff barriers including phytosanitary/quarantine and certification barriers. There is a huge potential for potato exports from India to Europe as the harvesting window is from January to March which is optimal to fulfil the fresh potato consumption requirements of Europe. In order to achieve this, India would require new varieties that meet the taste and texture requirements of the European countries.

Invited speaker photograph

Invited speaker biography

Jang Bahadur Singh Sangha, MS, Cornell University is the MD of Sangha Group, which is the leading producer of seed potatoes in India cultivating more than 5000 acres in the state of Punjab for the past 60 years. He represents various farmer organizations and advises state governments and federal departments on many issues related to agriculture. He has served on the Board of Punjab Agricultural

University. Presently, he serves on the Boards of the World Potato Congress and Australia India Institute, University of Melbourne.

F1-11

Experience in developing the domestic (China) and export processing markets in Asia

Martin van de Ven

MJ Consultancy, Netherlands

Overview

Snowvalley Agricultural Group is the largest comprehensive potato industry chain company in China. The company's business covers from potato seed cultivation, potato reproduction, professional potato planting mode promotion, potato storage to potato processing and processing products sales, and in every link of the industrial chain Snowvalley Agricultural Group has established professional, mechanized, information management processes and norms. In the speech, we will briefly describe the basic situation of Chinese potato industry and potato processing industry, and introduce the basic situation of Xuechuan Agricultural Group and the business model of the whole industry chain to the audience. In addition, we will talk about Snowvalley committed and effective efforts to achieve carbon neutrality and sustainable development. Finally, we will also present some potential cooperation and investment opportunities, hoping to contribute to the development and innovation of the world potato industry.

Invited speaker photograph

Invited speaker biography

Martin van de Ven, Netherlands

Graduated in Food Technology and Business Administration

Have about 30 years' experience in doing business in Asia.

1. 1990 – 2007 Board member of SVZ Industrial, CEO from 2000 – 2007 (fruit and vegetable sector)

2. 2000 – 2014 Member board of Directors Royal Cosun (agricultural cooperative)
3. 2008 - 2014 CEO of Aviko group (potato sector)
4. 2013 – 2021 board member of Snow Valley Food China (potato sector)
5. 2016 – now Chairman of supervisory board of Qlip (dairy sector)
6. 2018 – now Chairman of the board of Agristo (potato sector)

F1-12

Genome design of hybrid potato

Sanwen Huang

AGIS-CAAS, Shenzhen, China

Overview

Potato is the most important tuber crop, feeding over 1 billion people worldwide. Cultivated potato is autotetraploid, the genome of which is highly heterozygous. Due to the complexity of tetrasomic inheritance, the genetic gain in potato breeding is limited. Some century-old potato cultivars, such as Russet Burbank (released in 1902) and Bintje (bred in 1904), are still widely grown. Moreover, its clonal propagation bears a considerate carbon footprint. To overcome these drawbacks, we initiated the Upotato Plan, reinventing potato into an inbred line-based diploid crop propagated by seeds. However, self-incompatibility and severe inbreeding depression are two obstacles to hamper the development of inbred lines. We overcome the first obstacle by knockout of the S-RNase genes that control self-incompatibility, or application of natural self-compatibility genes. Then, we analyzed the genetic basis of inbreeding depression, and found that the mutation burden in potato is line-specific, suggesting crosses of different inbred lines will mask the effects of deleterious mutations and produce strong heterosis. Based on these, we developed the pipeline of genome design of hybrid potato. Using this strategy, we developed vigorous and fertile inbred lines (up to 99.94% homozygosity), derived from different lineages, and generated the first uniform F1 hybrid “Upotato1” by crossing two inbred lines with different lineages. Due to the genomic complementarity, the F1 hybrid showed strong heterosis in growth vigor and yield. To further accelerate hybrid potato breeding, we constructed the potato pan-genome map by integrating the genomes and variants of 44 diverse potato accessions, providing critical insights for improving inbred lines and precluding potential linkage drag.

This study enriches our understanding of the evolution and biology of potato, and transforms potato breeding from a slow, non-accumulative mode into a fast-iterative one, thereby potentiating a broad spectrum of benefits to farmers and consumers.

Invited speaker photograph

Invited speaker biography

Dr. Sanwen Huang studied in China Agricultural University and Wageningen University in the Netherlands. He is now a professor and Director General of Agricultural Genomics Institute at Shenzhen, Chinese Academy of Agricultural Sciences and Vice President of Chinese Academy of Agricultural Sciences. He serves as Vice President of Chinese Society for Plant Biology and Member of Academic Advisory Committee of Cell. He won the National Natural Science Award of China and Prize for Scientific and Technological Progress of the Ho Leung Ho Lee Foundation.

He works on the interdisciplinary field of genomics, molecular biology, and plant breeding, using potato and vegetable crops as research subjects. He illustrated the genomic history of the domestication of cucumber and tomato and dissected the genetic basis of cucumber bitterness and tomato flavor, which helps to develop vegetable cultivars with better flavor. Using genome design methodology, he is reinventing potato from a clonally propagated tetraploid crop into a seed-propagated diploid crop, which will transform potato breeding from a slow, non-accumulative mode to a fast-iterative one.

F1-13

Prepare to be surprised

Lorcan Bourke[1], Laure Payrastre[2], Katrien De Nul[3]

[1]Bord Bia, Dublin, Ireland. [2]CNIPT, Paris, France. [3]VLAM, Brussels, Belgium

Overview

Fresh potatoes remain Europe's most popular main meal carbohydrate and are deeply anchored in the food habits of the European Union. However nowadays they face two main obstacles: A long-term decrease in their consumption; and a stagnation of their image as a traditional food. This trend has led to a decrease of potato consumption among the different age groups, especially in people between 18- and 34-year-old living on their own, co-habiting or with young families.

To slow down this consumption trend, Bord Bia, CNIPT, Europatat and VLAM are running the inspiring campaign “Potatoes, prepare to be surprised – Europe’s favourite since 1536”. This joint initiative, which is co-financed by the European Commission under the EU Promotion policy, will run until December 2022 to encourage the consumption of fresh potatoes among millennials. The message of the campaign is clear: potatoes fit in a modern, healthy and sustainable lifestyle because they are a tasty, versatile and have good nutritional and health benefits!

Invited speaker photographs

Laure Payrastre

Katrien De Nul

Invited speakers’ biographies

Laure Payrastre

After obtaining an International Master's degree in Communication and Marketing, Mrs Laure Payrastre specialised in the food industry. After 8 years of experience with a leading French potato packer, she joined the CNIPT, the French interbranch of fresh potato in 2019. She is in charge of the communication strategy for the sector, in France and abroad, and manages communication projects co-financed by Europe.

Katrien De Nul

VLAM, Flanders' Agricultural Marketing Board, promotes the sale, the added value, the consumption and the images of products and services of the Flemish agriculture, horticulture, fishery and agro-alimentary sector. As promotion manager potatoes, Katrien De Nul, is in charge of campaigns for fresh, seed and processed potatoes both in Belgium and abroad. Some campaigns that are currently running are a European campaign for fresh potatoes in Flanders (in collaboration with Bord Bia, CNIPT and Europatat), a campaign highlighting the efforts in terms of sustainability in the potato sector, a campaign for processed potatoes in UK and a campaign promoting frozen fries in China, Japan, Singapore and South-Korea. Next to these campaigns, Katrien also coordinates the participation of companies at trade fairs like Fruit Logistica Berlin and Fruit Attraction Madrid.

F1-14

From couch potato to performance fuel - repositioning the potato

John Toaspern

Potatoes USA, Denver, USA

Overview

From Couch Potato to Performance Fuel – Repositioning the Potato

For most consumers, the nutritional benefits of the potato are at best not known and most often completely misunderstood. Few know that the potato is a nutritional powerhouse that provides the energy, potassium, and vitamin C needed to fuel them. Potatoes also have 3 grams of protein, 2 grams of fiber, and no fat, sodium, sugar, or gluten. But how to convey this to consumers when the prevailing notions are that potatoes are starchy fattening empty calories?

Rather than trying to counter the negatives, we at Potatoes USA are positioning the potato for what it truly is, a quality carbohydrate that will help everyone from athletes to busy parents to students perform at their very best. By starting with athletic performance, we have created a better understanding of and belief in potato nutrition. Along the way, we have been embraced by serious athletes and fitness fanatics that know and appreciate the benefits of potatoes. Team Potato is now leading the charge as we reach everyday people and most importantly generation Z as they develop their eating and health habits.

But with such prevalent and long-standing beliefs to overcome the industry must have the facts and science on its side which is why we are heavily investing in clinical and other nutrition research that proves the benefits of potatoes as a performance and health-boosting food.

Armed with this research and recognition by athletes Potatoes USA is taking the message; “Potatoes. Real Food. Real Performance.” to all levels of the nutrition hierarchy from scientists, to thought leaders, to practitioners, and ultimately to consumers. This session will cover the why, the what, and most importantly the how of this perception-changing campaign.

Invited speaker photograph

Invited speaker biography

John Toaspern is the Chief Marketing Officer at Potatoes USA; the marketing and promotion board for the U.S. potato industry. John joined Potatoes USA in 1999 as the VP for International Marketing and assumed the role of CMO in 2015. He has Bachelors and Masters degrees from Stanford University and previously worked as an Agricultural Attaché for the Foreign Agricultural Service of USDA.

F2-01

Micro-business seed potato production in Africa, South America and Asia

Monica Parker[1], Pieter Wauters[2,3], Samarendu Mohanty[4], Ravindranath Reddy[5], Willmer Perez[6], Jorge Andrade-Piedra[6]

[1]International Potato Center, Nairobi, Kenya. [2]International Potato Center, Kampala, Uganda. [3]Centre for International Migration and Development (CIM), Eschborn, Germany. [4]International Potato Center, New Delhi, India. [5]International Potato Center, Bangalore, India. [6]International Potato Center, Lima, Peru

Overview

Limited availability and access to seed is a major challenge faced by potato farmers throughout Africa, South America and Asia, and a main factor preventing potato from reaching its potential as a food and economic security crop for households to national levels. Several profiles of production systems characterize potato seed systems, with few countries having professional, medium- and large-scale farms and businesses producing seed under a national certification system or varying standards of quality assurance (QA). Selling seed from the farm gate dominates most production systems with few seed distributors due to perishability and planting volumes affecting access to seed, which is further exacerbated by the normally low number and sparse distribution of such seed producers. Micro-seed businesses (MSB) decentralize seed production, bringing seed closer to farmers. Producing on smaller plots of half to a few hectares scattered around potato production regions, MSB are critical to seed access. Normally MSB should obtain later generation certified seed to further multiply one or two seasons and follow other QA protocols. QA is less stringent at later generations, reducing production costs thereby further making MSB economical and seed affordable. QA in the presence of soilborne pathogens and nematodes and absence of certification systems is the principal risk of MSB. MSB also engage in early generation seed, bringing starter material closer to diverse seed multipliers. In South America, MSB are well-established as the driving force of seed systems, having traditionally produced seed for 1,000's of years in the Andes. In Asia, seed systems are also highly reliant on MSB to produce early generation and field multiplied seed. In Africa, several types of MSB operate from formal to informal. This presentation presents several profiles of MSB and production models to safeguard business development and QA.

Invited speaker photograph

Invited speaker biography

Dr. Monica Parker is a Senior Scientist with the International Potato Center based in Nairobi, Kenya providing program leadership for Potato for Africa program. With a career spanning 15 years in agriculture, primarily in Africa, Dr. Parker specialises in agricultural development through research and development, and delivering science. Bringing a multi-disciplinary approach, her work encompasses technical, project and program leadership, strengthening partnerships, and program growth. She originates from Canada, having completed her MSc (1999) from Simon Fraser University and her PhD (2012) from the University of Guelph, both in Plant Pathology.

F2-02

Hybrid potato breeding and the potential of true seed propagation

Edwin van der Vossen

Solynta, Wageningen, Netherlands

Overview

Compared to other major food crops, progress in potato yield has been slow. Genetic gains cannot be fixed due to obligatory out-breeding. Replacement of the traditional breeding method and clonal propagation by an F1 hybrid system with true seeds, is a journey that Solynta embarked on many years ago. Several hurdles have been overcome in this quest to revolutionize potato breeding, the major ones being self-incompatibility and severe inbreeding depression in diploid germplasm. Introduction of the Sli gene, which inhibits gametophytic self-incompatibility, enabled the development of self-compatible offspring from elite material, marking the start of our diploid hybrid breeding program. After many years of inbreeding and selection, vigorous inbred lines were developed and uniform hybrids have been tested across multiple field locations. We have since made significant progress and our hybrid breeding program is now ready to boost the development of new cultivars with new traits, such as tolerance and resilience to climate change, resistance to a wide array of pathogens and pests and high yields with high tuber quality traits.

This technological revolution not only accelerates the development of improved varieties but also greatly impacts the supply chain. The use of true seeds contributes to the reduction of disease transmission and makes the storage and transport of propagation material easier and more agile. However, for a widespread scaling of hybrid potato seed, several major regulatory hurdles still need to be addressed, including variety registration processes and phytosanitary regulations around import/export of true potato seeds. Also, the setting-up of the local intermediate infrastructure, i.e., the network of nurseries with the capacity to raise plantlets from seeds, and competent producers of first-generation tubers, requires immediate attention. Solving these issues will require a joint effort between leading industrial partners and designated authorities around the world.

Invited speaker photograph

Invited speaker biography

Edwin van der Vossen was born and brought up in Africa until the age of 15. Following his dream to contribute to food security, he obtained an MSc degree in Plant Breeding at Wageningen University, and a PhD in Plant Virology at Leiden University in 1996. For the next twelve years he pursued an academic career at Wageningen University and Research Centre, focusing on Molecular Resistance Breeding in potato. In 2008 he switched to industry and worked as VP Crop Innovation at the plant biotech company KeyGene until 2020. Since then, he is R&D Director at Solynta, the hybrid potato breeding company in Wageningen.

F2-03

Insights into the latest developments in hybrid potato breeding

Curtis Frederick

Aardevo B.V, Nagele, Netherlands

Overview

The hybrid breeding technology has made great progress in various arable crops (such as maize and sugar beet) and vegetable crops (such as tomato and onion). This has been discussed with potatoes for years, but no real breakthrough has yet been made. This presentation provides an insight into the latest developments of the hybrid potato, explaining the approach of Aardevo.

Invited speaker photograph

Invited speaker biography

Curtis Frederick is Senior Agronomist at Aardevo B.V., a hybrid potato breeding company that is a joint venture between KWS and J.R. Simplot. There he is responsible for the agronomic research program and the commercialization of hybrid potato varieties. Curtis hales from Pennsylvania, U.S.A. from a family-owned potato and grain farm. Interested in science and agricultural research from a young age, Curtis went to Penn State a B.Sc. in Horticulture and then worked in South Africa as a research manager on a project involving maize and dry bean root development. Following this, he attended at the University of Wisconsin-Madision where his thesis, advised by Paul Bethke and Shelly Jansky, focused on breeding for chip processing traits. He then worked in the tablestock potato sector and food service processing for Sterman Massers Inc., a member of the Fresh Solutions network in the US. There he worked on table variety development and research on processing fresh cut potatoes. This exposure to the tetraploid potato model and the issues involved with variety development instigated Curtis to take the opportunity to work on diploid hybrid potato breeding; a system that holds large promise for future growers and consumers of potato.

F2-04

Supporting the potato seed sector with a novel hand-held biosensor for in-field PVY detection

Fernando Diaz[1], Alan O'Riordan[1], Michele Della Bartola[2], Arabelle Cassidy[3], Huui Ma[3], Richard O'Kennedy[3], Ewen Mullins[2]

[1]Tyndall Institute, University College Cork, Cork, Ireland. [2]Crop Science Department, Teagasc, Oak Park, Carlow, Ireland. [3]School of Biochemistry, Dublin City University, Dublin, Ireland

Overview

The ending of potato seed imports from Great Britain, due to Brexit has further highlighted the need to revive the domestic seed potato sector in Ireland. A key challenge to producing high-grade potato seed however, is the continued prevalence of Potato Virus Y (PVY) and indeed recombinant PVY isolates across Ireland (Della Bartola et al, 2020). The issue is compounded by the absence of a field-based test that both detects and provides real-time information on the incidence of PVY within a potato crop. The implementation of an appropriate surveillance strategy to enable rapid and pre-symptomatic diagnosis in the field is an essential step for the protection and prevention of costly PVY outbreaks. By interconnecting crop pathology, immunochemistry and nanotechnology, the DAFM funded SCOPE project has been working on the development of a prototype microchip-based sensor and supporting electronics that can deliver a proactive diagnostic tool to aid the production of quality potato seed. The chips are made using advanced microelectronic fabrication processes, with each chip housed in a portable hand-held casing. Each chip has multiple sensors, and coating these sensors with disease-specific antibodies enables the quantitative detection of PVY in potato leaf serum. We have demonstrated in-field quantitative detection of PVY with a time-to result of ~30 minutes and the ability to detect PVY in asymptomatic tissues. The sensors have been benchmarked with and show comparable performance to standard laboratory methods including ELISA and PCR. Further field validations are planned for 2022 to support a route to mass development and commercialisation

Invited speaker photograph

Invited speaker biography

Dr Alan O'Riordan (Tyndall National Institute; Sensor-PI; male, h-index 26, FWCI 2.05) is a Senior Research Fellow at the Tyndall National Institute. He is an analytical chemist and leads a team of twenty researchers and support staff. His research is focused on developing solid-state sensitive and scalable smart sensors & systems. He is actively involved in National and International (EU, US-Ireland) projects, coordinating many of them, and has competitively won >€11M in research funding. He has graduated 11 PhD students, authored or co-authored >90 articles in various journals and conferences, has >2,100 Google Scholar citations and actively participates in various conferences and received a number of awards. He is an adjunct senior lecturer at Cork Institute of Technology, on the Steering Board Committee of Smart Systems Integration conference (European Platform of Smart Systems) and on the Editorial Board of the Journal "Biosensors" (IF 3.571). He is also a Principal Investigator in the SFI VistaMilk Research Centre. His group is active along the entire sensor development chain including: (i) Fundamental Science - theoretical simulations (analyte diffusion, electric fields), (ii) Nanofabrication – design and fabrication of reliable and robust nanostructured sensor devices, (III) Sensor modification - materials composition and surface chemical and biochemical modification and (iv) System integration - combining our advanced nanosensors with bespoke (or commercial) electronics and software.

F2-05

Storage - a North American perspective

Nora Olsen

University of Idaho, Kimberly, USA

Overview

The foundation of storage management is globally universal with overall goals to extend the duration in accessibility of the crop, minimize losses, and maintain quality in storage. The principles of storage management are physiologically based to maintain desired temperature and humidity and provide ventilation, but implementation and application of the basics vary worldwide. Location, climate, scale, and market criteria directly impact potato storage design and management decisions. In North America, storages have been designed based upon climate, market standards, and scale for bulk piling of potatoes. Development of resilient varieties and management adaptation have focused on quality retention with extensive harvest and handling mechanization and varying storage conditions and duration. Modernization of equipment and facilities, integration of sophisticated technology, application of basic and novel means for disease and sprout control, and incorporation of sustainable and energy saving management will continue to advance storage management approaches. Use of technology, aligned with fundamentals of storage management, is providing opportunities to minimize losses in storage and directly manage quality issues that may arise. Fluctuations in regional climate patterns have necessitated continued innovation and introduction of agronomic and storage strategies. Changes in resources, labor, and economics have prompted expanded efficiency and sustainability of production and storage practices. Storage design and practices in North America reflect application of basic storage principles specific to location, climate, and market.

Invited speaker photograph

Invited speaker biography

Nora Olsen is Professor and Potato Specialist for the University of Idaho in the United States. Her research and extension programs over the past 23 years have focused on potato field and storage

management, sprout and disease control, seed physiology and performance, harvest and handling management, and cultivar evaluations. Nora has given over 500 extension and scientific presentations and co-authored over 375 scientific and extension deliverables. Nora is past- President of the Potato Association of America and is currently a Director of the World Potato Congress.

F2-06

Storage post-CIPC: an overview of implications resulting from the recent loss of European regulatory approval for chlorpropham sprout suppressant

Adrian Cunnington

Potato Storage Insight Ltd, Spalding, United Kingdom

Overview

Chlorpropham (CIPC) was lost in 2020, following changes to the European approval protocols, after ~70 years' use as a sprout suppressant, treatment with CIPC allowed crops to be held in store at warm temperatures (>8C) to meet market needs, particularly for processing markets where light fry colours are important. Its loss meant industry needs a more integrated approach to storage, a journey we are just starting out on.

New chemistry is effective but it's expensive and not as long-lasting. Taking a wide, holistic view of the challenges steers us back to the potato gene pool and variety choice. Our industry of the future needs more dormant, cold tolerant and disease-resistant cultivars to deliver more predictable product from storage. We need better control of the store environment using efficient and targeted management interventions, thereby minimizing energy use, weight loss and wastage. Bacterial rotting in warm storage accounts for most pathological storage loss in potatoes.

And we need to use fewer chemical treatments to prevent sprouting. Since the demise of CIPC, industry has had to adopt a short-term strategy using costly, volatile chemicals for sprout control. These offer less efficacy and their lack of residual control has forced industry to rely on pre-treatment of crops in the field with maleic hydrazide. Once in store, options include ethylene, dimethylnaphthalene (DMN), spearmint oil and orange oil but approvals vary and, almost universally, they need to be used carefully. Ethylene needs slow introduction to the store whilst fog suppressant application is best with positive ventilation, especially as fans are key to attaining uniform distribution.

The option to forego chemical use altogether is there for those storing at lower temperatures, notably for fresh and, of course, seed markets. However, to be successful, temperature has to be uniform and control of the store regime closely regulated.

Invited speaker photograph

Invited speaker biography

Adrian is Director of Potato Storage Insight Ltd, a newly-established UK consultancy specializing in potato storage. Prior to setting up PSI, Adrian worked for over 30 years as Head of Site directing a research and knowledge transfer team at Sutton Bridge Crop Storage Research, before the site was closed in 2021 when AHDB's potato work ended. He has extensive experience of training and advising growers on potato store management practice. He has also led storage R&D for grower-funded trials and private contracts undertaken for many key organizations in the industry.

F2-07

The future of potato storage

Kürt Demeulemeester

Inagro, Rumbeke-Beitem, Belgium

Overview

The storage of potatoes has been receiving more and more attention in recent years and has, more than ever, become a fully-fledged specialisation alongside cultivation in the field. An increasingly professional storage requires more know-how and knowledge from the grower. There are various reasons for the current and future developments. We would like to explain a few trends from a largely European perspective.

A shift in cultivated varieties means that storage must also be increasingly geared to this. Thorough climate control and ventilation are necessary to be able to store these varieties optimally and according to requirements. The processing industry is increasingly demanding high-quality potatoes, also after long storage.

The disappearance of CIPC in Europe and the use of alternative germination inhibitors has clearly brought the issue of the ideal air distribution to the fore, including renewed attention to CO2 monitoring and control. Also, availability and knowledge regarding adapted equipment for germination inhibition is still in evolution, with sprout control being increasingly outsourced.

The investment costs in potato stores increased enormously, which raises questions about the profitability. Climate change, with milder winters and warmer springs, makes it difficult to maintain stable, low storage temperatures for long periods. Mechanical cooling, so far little used for bulk storage of industrial potatoes, can offer a solution here but also requires a great deal of (expensive) energy. Can our own renewable energy offer a solution here?

Finally, there are also opportunities for more thorough monitoring and control during storage. Can we get a better view on storability, dormancy the start of the storage period? Can we adequately measure more parameters during storage, such as weight loss, for example, and adjust our storage process accordingly?

Invited speaker photograph

Invited speaker biography

Kürt Demeulemeester graduated as MSc in 1996. In 1997, he started in applied potato research, and this from 2003 for Inagro. In 2011 he became responsible within Inagro for the arable crop department. Since 2015 intensive research was set up on sprout suppression in potatoes. In 2017, Kürt became vice president of EAPR.

F2-08

Potato storage in East Africa

Derek Roulston

IPC, Dublin, Ireland

Overview

The FAO estimates that each year, approximately one-third of all food produced for human consumption in the world is lost or wasted. This food wastage represents a missed opportunity to improve global food security, but it also has a negative environmental impact. Landfill dumping is increasing every year and as well as using up valuable land the decomposing of organic material results in methane gas being released into the atmosphere, these and other negative factors related to food waste need to be addressed. The focus on food storage solutions will be of the utmost importance if world food security is to be attained and malnutrition reduced or eliminated. In sub-Saharan Africa most farmers dispose of their produce quickly at harvest due to inadequate storage technology and facilities, and also on account of financial limitations. Other studies confirm that some of the constraints that hamper the proper functioning of markets include lack of information and inadequate storage and other physical infrastructures. To address these challenges farmer groups have been building potato stores using local materials and achieving storage periods of four and above months. Developing new potato storage solutions that are off grid and using appropriate technology are part of a project in Kenya funded by The Irish Government, Donegal Investment Group, and implemented by the IFDC. The talk will look at the problems faced by the farmers, it will show some of the current storage being used and will look to the future as new stores are being developed.

Invited speaker photograph

Invited speaker biography

Derek Roulston

Derek grew up with seed potatoes as both his father and grandfather grew certified potato seed, in time he became a grower after attending Gurteen agricultural college in 1984. In 1998 Derek and his family volunteered as a missionary and moved to Kenya where for 15 years worked in community and rural development. In 2010 Derek was involved in an advisory role in establishing a potato seed project with Kisima Farms in the Kenyan Highlands. After further study with the Agri-Food & Biosciences Institute in 2013, Derek now works as a consultant.

F2-09

Soil, water and topography maps as a management tool to improve profitability and sustainability within the potato industry

Evan MacDonald, Aitazaz Farooque

University of Prince Edward Island, Charlottetown, Canada

Overview

Potatoes are an expensive crop to grow, requiring many inputs such as fertilizers, fungicides, pesticides and more to be profitable. Site specific management, known as Precision Agriculture (PA), has the potential to ensure optimal distribution of inputs across the field by identifying variability and then managing it. To properly manage inputs on a site-specific basis, it is important to understand the soil characteristics that drive fertilizer uptake and yield potential. To do this, Soil, Water and Topography Maps (SWAT MAPS) use electrical conductivity (EC) information about the soil in addition to accurate topographic modelling of the landscape. Soil EC gives an indication of differences in soil texture, water holding capacity, soil organic matter and more. Topography determines where water sheds, where it collects, and where erosion has occurred. These layers of information are fundamental for successful site-specific management of the potato crop and can assist in making decisions for fertilizer applications, seeding, irrigation, herbicide applications and more.

This project focuses on using SWAT MAPS to influence variable rate (VR) seeding of the potato crop. Today's planting technology has the ability to automatically adjust seed and fertilizer rates according to management zones within the field. VR seeding has the potential to increase profitability for the farmer by managing risk and lowering cost of production in poorer performing areas of a field, while taking advantage of areas of the field with greater soil potential. VR seeding and fertilization can also help to mitigate the environmental impacts of over application of fertilizers in areas of the field they are not likely to be taken up by the crop. This can help farmers in reducing greenhouse gas emissions and leads to more sustainable potato production.

Invited speaker photograph

Invited speaker biography

Evan MacDonald is from Prince Edward Island, Canada, where he works as a Precision Agronomist and is pursuing his PhD in Environmental Science at the University of Prince Edward Island. His background and formal education are in mapping and GIS, and he has been combining this experience with agronomy since 2014 to help farmers optimize their inputs and improve sustainability.

F2-10

The potato on Mars

Jan Kreuze[1], David Ramirez[1], Walter Amoroz[1], Julio Valdivia-Silva[2,3], Sady Garcia[4], Elisa Salas[1], Wendy Yactayo[1]

[1]International Potato Center (CIP), Lima, Peru. [2]4Universidad de Ingenieria y Tecnologia, Lima, Peru. [3]NASA, Moffett Field, USA. [4]Universidad Nacional Agraria la Molina, Lima, Peru

Overview

Potato is an extremely versatile crop, able to grow from below sea level (in the Netherlands) to 4500 meters above sea level, from the equator to the polar circle, and from deserts to rain forests. CIP has exploited this versatility to develop varieties with tolerance to heat, salinity, frost, low inputs and improved nutritional content to contribute to healthy diets. On the other hand, climate change is predicted to lead to more extreme weather events and increasing temperatures, putting more pressure on land and water resources, possibly leading to their degradation. In this context, the adaptability of potato and its high water use efficiency compared to other major staple crops make it an ideal crop to face and mitigate these challenges, particularly if combined with other sustainable cultivation practices.

These same traits make potato a promising crop to produce beyond earth; in the movie “the Martian” a stranded astronaut survives by growing potatoes on the red planet until rescue arrives. Is that even possible? The Martian atmosphere is far less dense than Earth’s, consists of 96% CO2 and no oxygen. Whereas temperatures can reach 20 °C during the summer at the equator, there is little water, and the soils are generally extremely saline. In collaboration with NASA and the University of Technology (UTEC) in Peru, we embarked to test the limits of what is possible with potato; using ultra saline soils collected from the Southern Peruvian ‘la Joya’ desert, where it hasn’t rained in the last 2 million years at least and a prototype “Martian atmosphere simulator” we identified extreme levels of salt tolerance in a breeding population and demonstrated the ability of potatoes to germinate in “Martian atmosphere”. These results highlight the versatility of potatoes to mitigate climate-related challenges in agriculture on earth and beyond.

Invited speaker biography

Jan Kreuze leads the crop and system sciences division at the International Potato Center (CIP), based in Lima, Peru, overseeing crop management and cropping systems related research on potato and sweet potato at the global level. He received his MSc in plant breeding from Wageningen University and a PhD in virology from the Swedish University of Agricultural Sciences. Since joining CIP in 2003, he has managed a diverse set of research portfolios, including, basic plant pathology, development of transgenic plants, next generation disease diagnostics, risk modelling, biodiversity research and sustainable intensification of cropping systems.

F2-11

Precision crop spraying

Mark James

John Deere Limited, Nottingham, United Kingdom

Overview

A look at some of the latest technologies in crop spraying, how they can benefit growers and help with more sustainable, environmentally sound crop production.

Invited speaker photograph

Invited speaker biography

Mark has been involved with crop spraying equipment for over 30 years, with experience in sprayer operation, sales, product support and design engineering, with several sprayer manufacturers. In 2001 Mark joined John Deere, where he currently provides technical sales support to dealers throughout the UK and Ireland. Particular interests include droplet size controls for optimum coverage or drift reduction and zone or patch spraying to offer agronomic benefits and/or production cost controls.

Mark hails from Nottingham, UK, where he lives with his musician partner, Sarah.

Details of interests

Employed by John Deere Ltd.

F2-12

Every potato counts – the added value of optical sorting solutions

Marco Giovanni Colombo

Bergamo, Bergamo, Italy

Overview

Our mission at TOMRA is “making every resource count”. When we deploy it to our beloved Potato Category, one of the core segments where we want to increase our leadership in offering solutions to our customers, we are all inspired by the fact that Every Potato Counts.

And what does this mean for the farmers and growers that every day put passion and effort into cultivating and harvesting potatoes?

When we talk to them all over the world, we see critical challenges where we have focused our resources to support them:

- Keeping our food safe and sustainable
- Consistently guaranteeing quality according to agreed specifications
- Making the most of each and every potato they cultivate, pack, and process
- Decreasing the dependency on manual labor
- Offsetting the increase of operational costs.

The fundamental element is that we cannot just focus on a single challenge, whilst ignoring the others, as they are interconnected. The success of our customers, and, as a consequence, of TOMRA, depends on how we can support their business in Maximizing the Value of Each and Every Potato.

This means being able to consistently cultivate, pack and produce according to expected specifications, whilst making the most of every single potato we have available.

And this is where, at TOMRA, we have focused on developing connected solutions all over the potato value chain.

It all starts from sorting and measuring potatoes from the field and out of storage, with robust and efficient unwashed potato sorting. This prevents the vast majority of foreign material to reach the gates of any potato packhouse or process plant and guarantees the elimination of toxic defects, such as green potatoes.

Then we refine further the sorting when potatoes have been washed. That allows our customers to eliminate the remaining foreign material, and, based on advanced defect sorting, to direct different types of potatoes to different value streams, maximizing the benefit they can get out of each and every spud.

Finally, we understand how important it is for our customers to have interconnected machines throughout their operations, and we have developed TOMRA Insight, an advanced cloud solution that can provide tailored reports and insights on the quality and size of each batch of potatoes, and monitor the correct functioning of each of our machines.

This is how we leverage our unique value for potato growers and farmers, and for their customers, by making the best use of each and every potato we inspect.

Invited speaker photograph

Invited speaker biography

Since February 2020, Marco G. Colombo is the Global Potato Category Director at TOMRA Food, where he is responsible for TOMRA's global growth in the potato category.

Marco's key areas of activity are centered on generating added value solutions for TOMRA's potato customers, in all the related industries, with a clear focus on Potato Farmers and Fresh Packers.

Marco is also in charge of nurturing the relationship with TOMRA's potato Key Accounts, developing joint strategic plans, and making sure TOMRA's contribution to their success is continuously increasing.

Prior to joining TOMRA Food, Marco has developed his career in the Food and Beverage industries, where he has accumulated 17 years of experience, 11 of which at Lamb Weston Meijer, where he ended up as Head of the Southern European and Brazilian Commercial Business Unit.

F2-13

Our future sustainability outlook for potatoes: innovation and partnerships are key drivers for a sustainable transformation of global food systems

Veerle Mommaerts

Bayer AG, Monheim, Germany

Overview

New solutions and approaches are needed to coop with the changing market environment that is taking place at a Global scale. More than ever a close cooperation along the potato food value chain is a must to respond to the overarching challenges humanity is facing like climate change, food security, our impact on the environment. As a global leader of crop protection solutions, seeds and technology, Bayer is convinced that every investment in innovation should be an investment in sustainability. This is reflected in our 30/30/100 bold transformational commitments set for 2030. We strongly believe in integrated crop management solutions. This includes seeds/varieties, crop protection (chemicals and biologicals), combined with new technologies -for example: optimized, targeted application (e.g., digital solutions)- as well as irrigation and fertilization amongst all other services necessary. Holistically working on sustainable intensification for farmers of all sizes to support the transition towards regenerative agriculture by improving soil health and optimizing the needs for water and inputs is a key focus area. Beyond this, we encourage knowledge sharing through partnerships with all actors along the potato food value chain to create value from farmer to consumer and as such build together a sustainable and consumer centric potato production.

Invited speaker photograph

Invited speaker biography

Born in Belgium, daughter of a table grape & vegetable grower I was already at a very young age connected with agriculture. My interest in biological processes stayed and guided me through my education; in 2010 I obtained a PhD in the Biological and Bio-engineering Sciences, followed by a post-doctoral degree with a key focus on bumble bees. Committed to a science-based approach and my

passion for agriculture I switched to Biobest NV and then to Bayer. In 2020, after 8 years of experience in the agro-food sector I started as Global Key Relation Manager at Bayer; being responsible for encouraging dialogue with various food value stakeholders on the challenges throughout our food system and for promoting partnerships, Food Chain Partnership wherein win-win is created from farmers up to consumers to support a sustainable food production.

F2-14

The sustainability credentials of the potato

Elmar Schulte-Geldermann

Bingen University of LifeSciences, Bingen, Germany

Overview

The potato (Solanum spp.) crop is the most important non-grain commodity in the global food system. The extraordinary adaptive range of the crop combined with its relative ease of cultivation, high nutritional content and relatively stable consumer prices have promoted steady increases in potato consumption especially in developing countries. Recent uncertainties in world food supply and demand have placed the potato in the upper echelon of recommended food security crops. With a yield potential of 216 MJ/ha per day in a short growing season (90-150 days), its productivity in terms of energy produced is the highest of all major arable crops, almost double that of wheat and rice (Scott et al., 2000). Under increasing population pressure, such intensification of food production is urgently needed also documented by the fast-increasing potato production in densely populated countries such as China, India, Bangladesh and Rwanda. The corresponding virtue of the potato was highlighted in a Harvard University research study stating that “the introduction of the potato accounts for approximately one-quarter of the growth in Old World population and urbanization between 1700 and 1900” (Nunn & Quian 2011).

The crops short and highly flexible vegetative cycle fits well with the double cropping season in many tropical highland agro-ecologies. In the developed countries of the north the importance of the crop is shrinking, but nevertheless has an important role in the diets and a well-developed potato industry. However, events of climate change e.g. increasing temperatures, erratic rainfall, will most probably lead to new or more severe abiotic and biotic stress challenges in potato production systems globally. For several countries, particularly in the tropics and subtropics, predicted yield reductions can reach up to 20–50%, This contribution will present adoption potential through innovations and pathways for closing current yield gaps.

Invited speaker photograph

Invited speaker biography

I grew up on a farm in Germany and studied agriculture. For my master thesis I decided to work on late blight control in organic farming systems. Ever since the crop and its management fascinated me and showed me the world. In my time as potato program leader for Africa at the International Potato Center (2009 to 2018), the crop revealed its potential for food security to me. Since late 2018 I am continuing to work on the crop in my role as Professor for organic farming and sustainable cropping systems at the Bingen University for Applied Sciences in Germany.

F2-15

Sustainability and the future of food

Charlie Angelakos

McCain Foods, Toronto, Canada

Overview

We need to have a frank discussion about the future of farming and food production.

Globally, more than a quarter of the carbon emissions that contribute to climate change come from the growing and processing of food — and a population boom is only going to exacerbate that problem. If we don't change the way we produce food, feeding the world in 30 years will require an 87 per cent increase in carbon emissions and the entire global food system could be at risk.

Charlie Angelakos, Vice President of Global External Affairs and Sustainability for McCain Foods, will share the path McCain is following to grow and produce food in ways that will help feed the planet sustainably for generations to come, as part of its pledge to implement regenerative agricultural practices across 100 per cent of its potato acreage – 370,000 acres worldwide – by 2030.

Invited speaker photograph

Invited speaker biography

Charlie Angelakos is Vice President, Global External Affairs and Sustainability at McCain Foods. In this role, Charlie leads the company's external communication, public affairs and sustainability strategy across 160 countries.

Before joining McCain, Charlie worked at Labatt Breweries of Canada for 18 years, most recently as Vice President, Legal and Corporate Affairs. He also spent time in Canadian politics, working as an advisor to Canadian Prime Minister Jean Chrétien and Ontario Premier Dalton McGuinty.

Charlie is actively involved with the Jays Care Foundation and the Harbourfront Centre, along with several other charitable endeavours in Toronto, Canada. He currently serves on the National Advisory Board of the Walrus, an award-winning independent news outlet. In 2012, Charlie received the Queen's Jubilee Medal for his support of the True Patriot Love Foundation.

F2-16

The future is here - organic potatoes!

Andrew Skea

Skea Organics, Dundee, United Kingdom

Overview

The market for organic food has followed different paths across Europe. In general, the market in more prosperous countries has developed faster. The UK has been a significant outlier in this pattern with slow growth relative to similar wealth neighbours in Northwest Europe and even Ireland. Some of this difference might be down to Government support for Organic Agriculture – the EU has set a target of 25% organic by 2030; while the UK government has no such target.

The culture, consumer demand and retail landscape are also different. The UK grocery market is dominated by a small number of powerful retailers. These companies hold significant sway over the choice of produce offered to the consumer and margin on sales and shelf space are critical. The UK Agriculture and Food Industries have also done a good job of providing assurance to consumers that organic is not an essential factor in food selection. There are several other assurance schemes that compete with organic in the consumers' minds, including red tractor and supermarket own brands.

The organic sector does not have exclusive ownership of the drive to improve food safety and the environment. The sector is evolving and adopting new techniques and practices. There is room for organic and non-organic farming to learn from each other and it should be acknowledged that the non-organic sector in the UK has adapted to answer many of the concerns that have attracted consumers to Organic.

While one the headline 'benefits' of Brexit as advertised was the escape from over regulation in the EU this is not likely to form part of reality. The UK has often been at the forefront of tightening regulation of active ingredients. Environmental protection in the UK is also fairly strict. These attitudes to regulation have contributed the retained market share of non-organic foods.

Invited speaker photograph

Invited speaker biography

Andrew started his business, in 1999, based on the family farm near Dundee in Scotland. The original focus was production of organic seed potatoes for the UK market. He aims to supply a service both to growers looking to source organic seed and to breeders looking to have their varieties promoted to the UK organic market.

Exports to the EU developed into a large part of the business until Brexit. Andrew was on the AHDB Levy Board until its demise and on British Potato Trade Association Council since 2006, including two years as President.

Other interests include his family, curling, bee-keeping, the environment and food production around the world.

F3-01

Dreamers who do. Focus on a sustainable potato processing industry

Filip Wallays

Agristo NV, Wielsbeke, Belgium

Overview

One of the challenges companies in the potato processing sector face is: how do we feed the expanding population in a sustainable way? In recent years, the sustainability of the potato processing sector in North Western- Europe has often been challenged. Can the potato crop in Europe be called sustainable? Demand for processing potatoes grows every year. Potatoes need a lot of water and pesticides and the crop has an impact on soil fertility and land use. Also, the processing of the potato itself has an environmental impact: we are an energy intensive industry and use a lot of water. Agristo alone uses the equivalent of 85.000 households in energy and 1.000 Olympic swimming pools filled with water on a yearly basis. At the end the finished product has to be transported to the consumers worldwide which contributes to greenhouse gas emissions. The last decades we've come a long way and the sector invested in growth but also in alternative energy and water sources. We've taken measures together with farmers, to reduce the environmental impact of the potato crop reducing the use of pesticides, protecting biodiversity and improving soil health. At the processing level we are reducing our CO2-emissions, optimizing our water-use efficiency and minimizing (food) waste across the value change. Along the supply chain, we try to minimize the carbon footprint of our transport activities. But there is still a long way to go in the future. As Agristo we believe that it is possible for the potato processing sector to reduce the negative impact of our activities to the absolute minimum. We also believe this is a must if we want to maintain and grow our business on the long term. A climate neutral potato processing industry: a faraway dream or a reality on its way?

Invited speaker photograph

Invited speaker biography

Filip Wallays has graduated as Master of Science in Bio-Engineering, and is co-CEO of Agristo. He started his career as engineer in the company in 2006, and worked in different departments (Personnel, Purchase, Sales), until he became co-CEO in 2018.

Since 1986 Agristo has developed into a world player for the development and production of frozen potato products. As a Belgian company with their headquarters in Wielsbeke and more production units in Nazareth, Harelbeke and Tilburg (The Netherlands) they specialize in offering an extremely wide range of fries and derived potato products, made to measure for each client. As a private label producer, Agristo partners with retail and food service players worldwide. Agristo manages the entire production chain, from seed potatoes to distribution. In this way they guarantee very high quality and flexibility. Their modern and well-equipped premises house a state-of-the-art range of machinery. In 2021 Agristo produced 800 000 tonnes qualitative potato products which are delivered all over the world.

F3-02

The Production and Marketing of Frozen French fries in North America

Bret Nedrow

JR Simplot Company, Boise, USA

Overview

North American production of frozen potato products is highly concentrated in the western part (Idaho, Oregon, Washington, and Alberta Canada) where there are the highest yields produced in North America. Other processing facilities are in the Northern part in the center (North Dakota, Minnesota, Wisconsin, Manitoba Canada) and east coast (Maine, New Brunswick Canada, and Prince Edward Island). Processing capacity in the past 5 years have expanded to meet increasing demand.

The North American frozen potato market is a mature but growing market. Demand for frozen potato products continue to demonstrate growth. Frozen potato products are a prominent menu item across all market sectors. While there are few large processors the market continues to be highly competitive. Frozen potato markets are segmented into key sectors; retail, QSR (quick service restaurants, and food service). The pandemic of 2020 through and into 2022 has destabilized the market but since has returned back to pre-pandemic levels.

Invited speaker photograph

Invited speaker biography

Bret A Nedrow started his life and career in potatoes on a seed potato farm in Ashton, ID. Educated at the University of Idaho with a B.S. in Agribusiness Management and a M.S. in Agricultural Economics. Bret has been involved in the potato processing world for 24 years starting with Nestle Food Service in Moses Lake WA. He also assisted with the start-up of the grading company Ag World Support Systems LLC. Bret currently works for The JR Simplot Company and has for 22 years in Washington, Idaho, North Dakota, and Portage la Prairie Manitoba in various positions in potatoes. He is currently Director of Raw Procurement overseeing Simplot Food Group potato operations, raw development, and

sustainability for Simplot Food Group. Bret is also a current member of The Potato Association of America and a World Potato Congress board director.

F3-03

Process management and IT solutions in sustainable raw material procurement

Jaroslaw Wankowicz

Farm Frites Poland SA, Lebork, Poland

Overview

Managing potato procurement in “The Changing World of the Potato” requires different skills and tools from management teams. Farm Frites Poland S.A. has changed the management structure into a process orientated one instead of the traditional department approach. It is quite unique and was the milestone on the way to sustainable sourcing of the raw material and development of own ERP system. A tailor-made IT system visualising the entire process and clearly defined roles and responsibilities allows Farm Frites Poland to manage sourcing of potatoes for processing and optimise it through the entire process.

Invited speaker photograph

Invited speaker biography

Jaroslaw graduated from the University of Life Sciences in Poznań and MBA studies at the Faculty of Economics of the University of Gdansk. He started working at Farm Frites Poland SA in 2001 as an Agronomist, then Potato Logistics Specialist, Business Controller and Potato Procurement Manager. Since 2018 he is Raw Material Supply Chain Director. At work he appreciates the opportunity to take on new challenges and their implementation in the professional group, which is a source of personal development and satisfaction.

F3-04

Unique potato-based innovations from Sweden

Emma Källqvist[1], Graham Stonadge[2], Eva Tornberg[1]

[1]Veg of Lund, Lund, Sweden. [2]Veg of Lund, London, United Kingdom

Overview

We dug deep and discovered a new, plant-based alternative for making drinks: the genius potato. DUG is a delicious, creamy and vegan-friendly plant-based drink. It's made from potatoes, has a really low climate footprint and can be used just like any other milk. Genius.

DUG is a Swedish brand with its roots in science and research by Professor Eva Tornberg at Lund university. It's where our patented emulsion technology was developed, and where we continue to develop new ways to harness the power of potatoes.

The DUG brand is owned by Veg of Lund.

Invited speaker photograph

Invited speaker biography

Graham Stonadge, UK Sales Director, Veg of Lund

Graham has over 30 years in senior commercial roles. He has worked for big brands such as PepsiCo, Nestlé, Twining's, Weightwatchers & HK Scan as well as several start-ups. His experience covers leading major account & field sales teams across most FMCG trade sectors.

Emma Källqvist, Acting CEO and CFO

Emma has been Head of one of the two audit departments at KPMG Malmö and worked at KPMG Corporate in Melbourne, Australia. Emma has auditing experience from a broad portfolio of companies

where she has led projects and been responsible for audits of both national and international companies.

Eva Tornberg, R&D Director, Board member, co-founder

Eva Tornberg has a doctorate in technology and is a professor at Lund University. She works as an inventor and is responsible for research and development in Veg of Lund. She has previous experience as head of research at the then called Meat Research Institute, which was owned by Scan AB. She has solid research experience with a total of 189 scientific publications and five patents.

F3-05

Wireworm in the UK. Recent work to improve risk assessment and detection of this cryptic pest

Martyn Cox

Blackthorn Arable Ltd, Downham Market, United Kingdom

Overview

My talk will explain how the problem has got worse in the UK and other countries. I have reviewed work carried out all over the world to improve our chances of detecting larvae and improve our risk assessments, this has allowed us to improve our chances of finding larvae and also understanding the implications of adult monitoring with pheromone traps. My work rejects the commonly held belief that damage only happens later in the season and I will show how we have improved monitoring in growing crops. As is the case with other problems, research activity often tends to reflect the extent of the problem and we carried out a massive amount of work between the two World Wars, this was triggered by problems encountered after ploughing up grass for crop production. After the development of the persistent organochlorine insecticides, the problem largely went away and so did the bulk of the research. With the loss of these insecticides and farming systems which are more suitable for the pest, we have an increase in problems and research is once again increasing. I will present interesting information found when reviewing the old work and bring this up to date with our most recent work on detecting the pest, identifying high risk situations and possible solutions. I will also discuss current developments in the UK and the reason we are taking the direction we are.

Invited speaker photograph

Invited speaker biography

I trained in the crop protection industry in the 1970s and am now one of the few people still working as an agronomist who remembers the days before glyphosate. I worked as a crop protection specialist and held technical management roles in national distributors, I also worked hard getting I.T. systems working for agronomists. Around 21 years ago I took the plunge and set up as an independent agronomist

managing a range of crops, but specialising in potatoes. Covering organic and conventional potato crops including a big area of salads, I am never far away from a battle with wireworm, a firm believer in the value of ICM, I have carried out a lot of research into the wireworm issue in recent years. During the last two years I have co-authored a scientific review into wireworm and potatoes in the UK with Dr Marc Allison at NIAB CUF. I am involved in several projects currently and am doing my own work on bait trapping and risk assessment.

F3-06

Irrigation and nitrogen management

Mark Stalham[1], Marc Allison[2]

[1]Mark Stalham Potato Consultancy Ltd, Cambridge, United Kingdom. [2]Marc Allison, Cambridge, United Kingdom

Overview

Potatoes are particularly responsive to nitrogen (N) fertilizer and water. High yields require the uptake of large quantities of N to develop the canopy and maintain it for as long as the season or crop requires. N uptake by roots is sensitive to the rate of mass flow for widely spaced roots with high N uptake capacity, but not for closely spaced roots or roots with low uptake capacity. Research has demonstrated that the majority of N uptake that contributes to potato yield is taken up in the first 4 weeks after emergence: to ensure that this occurs, soil compaction must be minimised or eliminated and water supply must be adequate.

Overlying this, the principle of determinacy in defining N rates was based on research conducted at Cambridge University Farm and recognising this has both reduced and improved the sustainability of N use and guided fertilizer use in the UK. Cultivation for potatoes typically involves moving large volumes of soil at planting, often more than once, when soils are wet and warming. This can liberate large quantities of N from the soil, particularly where soil organic matter is appreciable. Understanding this and capturing soil N more efficiently allows N fertilizer use to be reduced, improving sustainability. However, research demonstrates that there is large variability in the quantity of N available in soils at planting and the optimal N rate varies considerably, even on soils with the same soil texture, cropping history and cultivation management.

N is labile and easily leachable below rooting depth: these factors often lead to practices of splitting N in the seedbed and as top-dressings later in the season to avoid loss of N. The risks and disadvantages of doing this will be discussed.

Invited speaker photograph

Invited speaker biography

Mark Stalham, until 2020 Head of the potato research group at NIAB CUF, Cambridge, UK, is now a consultant at Mark Stalham Potato Consultancy Ltd. He was awarded his PhD on crisp quality from Queens' College, Cambridge in 1990 and his subsequent research expertise lies mainly in irrigation and soil and cultivation management. He now works for a range of clients, from corporate multi-nationals to growers and still regularly communicates on the transfer of science into practical solutions for the industry.

F3-07

The role that nature plays: microbial technologies in potato production

Nicolas Body

Alltech Crop Science, Lexington KY, USA

Overview

Explore how natural solutions derived from microbial technologies can benefit potato producers around the world, helping them manage common issues: from agronomic challenges in the soil or during the cycle, to the loss of key active ingredients due to regulatory changes, including meeting the higher standard of the requirement of the consumers and the industry.

Invited speaker photograph

Invited speaker biography

Nicolas Body is the European technical manager for Alltech Crop Science. In this role, he provides technical support for those who sell and/or use Alltech Crop Science solutions. He also aids in setting up trials around the world in order to demonstrate the efficacy of the products and to ensure that they are properly registered.

Prior to joining Alltech, Body was an agronomist specializing in sustainable farming systems, focusing on the areas of sustainability, scientific discoveries, and producer interests in France. He also took part in field studies of soil microbial changes for the department of forestry and natural resources at the University of Kentucky.

F3-08

Potatoes under climate stress - the ADAPT project

Markus Teige

University of Vienna, Vienna, Austria

Overview

Currently heat- drought- and flooding events are increasingly threatening potato production and cause severe losses of harvest. The EU-funded Horizon 2020 Research and Innovation project ADAPT utilizes the complementary expertise of 10 leading academic research institutions, 4 potato breeders and a screening technology developer to investigate mechanisms underlying multi-stress resilience in potato. ADAPT stands for “Accelerated Development of multiple-stress tolerant potato”. The researchers will combine different research approaches in molecular biology and stress physiology with data science in systems biology and analytics as well as engineering and molecular breeding. ADAPT will also include end-user driven agencies for variety testing and potato trading to translate findings into practise. Arising from the mechanistic understanding of stress tolerance, ADAPT aims at developing knowledge networks to identify future markers for breeding of stress resilient potato varieties. The project started in July 2020 and first field trials and pilot studies in glasshouses have been performed.

Invited speaker photograph

Invited speaker biography

Markus Teige is Senior Lecturer at the University of Vienna and Research Group Leader of the Plant Signalling Group at the Faculty of Life Sciences. He studied Chemistry and obtained his PhD in Biochemistry from the University of Hannover and he works for more than 20 years in the field of stress acclimation in plants. His particular interest is to uncover how plants can deal with abiotic stress such as heat or drought and which strategies they have to survive. This is also the central research question in the EU Horizon 2020 project ADAPT.

F3-09

Tracking the deployment of functional disease resistance genes in cultivars to inform breeding

Ingo Hein[1,2], Micha Bayer[1], Xinwei Chen[1], Lynn Hunter-Brown[1], Yuhan Wang[1], Amanpreet Kaur[2,3], Miles Armstrong[2], Drummond Todd[4], Vanessa Young[4]

[1]James Hutton Institute, Dundee, United Kingdom. [2]University of Dundee, Dundee, United Kingdom. [3]TEAGASC, Carlow, Ireland. [4]James Hutton Limited, Dundee, United Kingdom

Overview

Methods to track and verify the integrity of multiple disease resistance genes that are effective against late blight, PCN and viruses are needed for potato crop improvements. Diagnostic resistance gene enrichment sequencing (dRenSeq) enables the high-confidence identification and complete sequence validation of known functional resistance genes in crops. As demonstrated for tetraploid potatoes, the methodology is more robust and cost-effective in monitoring resistances than whole-genome sequencing and can be used to appraise gene integrity efficiently.

Evaluation of the historic patterns of resistance gene deployment in over 300 established potato varieties grown since the time of the Potato Famine, including currently cultivated major varieties in Great Britain, Europe, the US and China, reveals a very limited base of utilised resistances. Further, current breeding programs for disease resistance have thus far only mobilised a limited number of new and effective genes. Combined with molecular pathogen studies, we have revealed the impact of resistance gene deployment on pathogen avirulence gene diversity and population structure.

Using existing RenSeq data, we have developed and deployed highly informative molecular markers for breeding. Further, the data enable powerful association studies (AgRenSeq) to characterise resistances effective against Globodera rostochiensis (H1) and Globodera pallida (Gpa5) amongst other pathogens.

Invited speaker photograph

Invited speaker biography

Ingo is the Associate Leader of potato research at the James Hutton Institute and a Reader at the University of Dundee. His research connects the disciplines of plant pathology and potato genetics to deliver crop protection against biotic threats. He is exploring the diversity of resistances in established cultivars and the Commonwealth Potato Collection. His research is aimed at combining resistances in breeding programs.

F3-10

The bright future of new breeding techniques

Haven Baker

Pairwise, Durham, USA

Overview

Progress on CRISPR-applications to addressing genetic diseases in humans is reported on a regular basis in news media and in the scientific literature. Significant progress is also being made in crop plants important to global agriculture. Pairwise is using the tools of gene editing to improve 14 different crops species, with potential applications in potato. In this presentation I will introduce CRISPR technology, including approaches to editing plants and its complementarity to other breeding methods that, taken together, can result in transformative, high throughput crop improvement. We will discuss the intellectual property landscape as pertains to CRISPR as well as the increasingly favourable regulatory environment and consumer perception data. Finally, I will share insights into the many ongoing field trials at Pairwise and introduce the inaugural products that Pairwise is bringing to market that have been improved using the tools of gene editing. This talk will lay the ground for potato breeders to think about gene editing applications for this globally important staple for the improvement of agronomic and consumer-facing traits.

Invited speaker photograph

Invited speaker biography

Dr. Haven Baker co-founded Pairwise and serves as Chief Business Officer. Haven is the former Senior Vice President / General Manager of Simplot Plant Sciences, where he led the team that launched the innovative, non-browning Innate® potato. He holds a PhD in chemistry from Northeastern University, an MBA with Distinction from Harvard Business School, and a BS in biomedical engineering from Yale University. A lover of the outdoors, Haven enjoys fishing and hiking in his native Pacific Northwest.

Details of interests

Pairwise is a private, gene editing start-up company and I am a founder. The presentation of the topic will be factual and forward-looking, but our company has a commercial interest in the success of the technology and the products they create.

F3-11

Re-sequencing potato primary dihaploids to inform diploid and tetraploid breeding

Laura Shannon[1], Xiaoxi Meng[1], Robin Buell[2], Paul Bethke[3], David Douches[4], Shelley Jansky[3], Ek Han Tan[5], Jeffrey Endelman[6]

[1]University of Minnesota, St Paul, USA. [2]University of Georgia, Athens, USA. [3]USDA, Madsion, USA. [4]Michigan State University, East Lansing, USA. [5]University of Maine, Orono, USA. [6]University of Wisconsin, Madison, USA

Overview

In conjunction with the worldwide effort to transform potatoes into a diploid inbred-hybrid crop, US potato breeders have developed a multi-pronged team-based strategy to create diploid potatoes appropriate to our market classes. In the interest of preserving alleles selected over the last 200 years we are taking a dihaploid approach where prickle pollination of commercial tetraploids and advanced tetraploid breeding lines with IVP101 is used to create diploid potatoes from gametes produced by tetraploid parents. These primary dihaploids serve as the base for our breeding programs. Reinventing a crop provides the unique opportunity to understand the founding population and trace the evolution of the crop over time. To that end, and to facilitate imputation and genomic selection, we are re-sequencing 100 promising primary dihaploids with ~20X coverage using Illumina short reads. Thus far we have sequenced 61 primary dihaploids: 22 chip, 23 russet, and 16 red clones. These sequence data will not only support diploid breeding but provide new information about US tetraploid breeding populations and haplotypes as sequencing at this scale is much more feasible in diploids than tetraploids. The first 61 samples exhibit heterozygosity rates of between 0.75 and 1.15%, in line with previous estimates. Notably, this level of diversity is maintained at the population level, with nucleotide diversity (π) between 0.009 and 0.010 for all three market classes. This suggests that the market classes in the US are panmictic populations with minimal inbreeding or population structure within class. Deviations from this may indicate regions of selective constraint. For example, chromosome 10 stands out as a low diversity region for both reds and russets with below 0.006. These sequences also shed light on haplotype structure within the tetraploid germplasm, the prevalence of deleterious variation, and the way in which introgression shaped the selection of US potato varieties.

Invited speaker photograph

Invited speaker biography

Dr. Laura Shannon is an assistant professor of potato breeding, genetics, and genomics in the Horticultural Science Department at the University of Minnesota. She did her graduate work at the University of Wisconsin studying maize domestication with Dr. John Doebley and then two postdocs, one studying dog domestication with Dr. Adam Boyko at Cornell and one back in Wisconsin studying potato diversity with Dr. Jeff Endelman. She has been in Minnesota since 2017, her breeding program works at the diploid and tetraploid level, developing red, yellow, chip and russet varieties.

F3-12

What's happening with the regulation of new breeding techniques in Europe?

Ewen Mullins

Teagasc, Carlow, Ireland

Overview

The European Union's Green Deal strategy highlights the strategic goal of reducing chemical inputs by 50% by 2030. To achieve this ambitious target, multiple strategies need to be considered to assist farmers in reducing their current reliance on inputs against major crop diseases. Wild sources of genetic resistance to late blight disease have been well documented in the literature but the transfer of this resistance into commercial varieties through conventional breeding practices is as we know time consuming due to the complexity of the potato genome. Novel breeding techniques (NBTs) such as cisgenesis have illustrated the potential to accelerate the process and reduce average fungicide input significantly. But what future does this material have within the EU? In 2021, The European Commission published a 'roadmap' to revisit the legal framework for plants obtained through NBTs (e.g., gene editing, cisgenics). The study indicated that the current regulatory system is not fit-for-purpose in light of scientific advancements, and that further policy action should aim at enabling NGT products to contribute to sustainability while addressing societal concerns. The impact of this report is significant and more recent events highlight the expectation that developments will advance further in the months ahead as the EU strives to develop crop production systems with the potential to contribute to the objectives of the Green Deal.

Invited speaker photograph

Invited speaker biography

With a background in pathology and genetics, Ewen's research interest center's on the efficacy of breeding techniques, disease diagnostics and surveillance to support sustainable crop management practices, with a particular emphasis on reducing chemical inputs to offset pest/disease incidence. Currently Ewen is Head of the Teagasc Crops Research Department in Oak Park, which is focused on

delivering through to practice, science-led solutions that underpin both the profitability and environmental sustainability of Ireland's cropping systems. A member of the European Food Safety Authority's GMO panel since 2018, Ewen is the chair of that panel since 2021.

F3-13

Small Farmer Large Field (SFLF) model – rural communities in India

Sampriti Baruah

International Potato Center (CIP), New Delhi, India

Overview

"Small Farmers Large Field (SFLF)" is a collective action model implemented by the International Potato Center (CIP) in various states of India to overcome the disadvantages faced by millions of small and marginal farmers due to diseconomies of scale and lack of bargaining power in the supply chain.

This model is participatory and flexible and allows small farmers to benefit from achieving economies of scale by organizing themselves into groups and synchronizing and harmonizing selected operations such as land preparation, planting, and harvesting. The SFLF farmers purchase inputs (seed and fertilizer) and sell their produce as a group to increase their bargaining power in price negotiations. Each participating farmer collectively commits as a group to follow the same cropping calendar, production practices, and product selling plan. Within a patch, which is formed by individually owned contiguous plots, every farmer is responsible for cultivating his/her own plot. This presentation will focus on the results from several pilots and projects implementing the SFLF model – which showed that the participating farmers were able to cut the cost of production and also could almost double their profits. Apart from the monetary benefits, these farmers saved time in many joint activities, including input (seed and fertilizer) purchase and sale of produce. Other important benefits of the harmonization and synchronization of farming operations were social harmony and sustainability of the farming system.

SFLF sites will also serve as demo plots to showcase the combined benefits of improved potato varieties and production practices, better pest and disease management, and water and nutrient management.

Invited speaker photograph

Invited speaker biography

Dr. Sampriti Baruah is presently the Project Coordinator for Asia at the International Potato Center (CIP), working on several projects in India, Vietnam and the Philippines. She holds her Ph.D. in Development Studies from the College of Public Affairs of the University of the Philippines Los Baños (UPLB) with her dissertation on “Small Farmers, Large Field Model: A Participatory Research to Improve the Livelihood of Small Farmers in India through Synchronized Collective Actions”. Also, she earned an M.A. in Social Development and Sustainable Livelihood from the University of Reading, United Kingdom and an M.A in Social Work from Tata Institute of Social Science, India. She brings many years of experience as an Associate Scientist for the Social Sciences Division and as a Ph.D. scholar with the Agri-Food policy platform for The International Rice Research Institute (IRRI). Later she joined the International Potato (CIP) as Development and Innovation Specialist in Delhi, India.

F3-14

Irish Potato Coalition of Ethiopia - a platform for learning and collaboration

Mesfin Kebede Retta

Vita/IPCE, Addis Ababa, Ethiopia

Overview

The Irish Potato Coalition concept emerged during a CIP-Vita project in Ethiopia in 2011. Expanding the collaboration concept to access the benefits of mutli-country experiences has led to the setting up of the East African Potato Coalition. This initially consists of the Science Partners (CIP, Teagasc), Development Partners (Vita, Self Help Africa, Concern Universal, Gorta) and Business Partners (European). The Coalition will initially work across six countries, Ethiopia, Tanzania, Kenya, Mozambique, Malawi and Uganda and will be coordinated by Vita in Ethiopia. The Potato Coalition will provide a practical approach, defining the necessary steps to set up a collaborative framework, a common approach for baselines and impact indicators and best practice guidelines to create effective, sustainable and equitable value chains. Vita presented the Potato Coalition Vision in Brussels in March 2013 under the Irish EU Presidency. Since then, the concept has gained traction and support culminating with a Coalition learning event held in March 2015.

The Irish Potato Coalition of Ethiopia established to transform potato research and production in Ethiopia to Improve the lives and resilience of smallholder potato farmers, traders and processors in Ethiopia through increased productivity, profitability, and sustainability of potato value chains, with a particular emphasis on women, youth, and vulnerable groups. The principles of this collaborative approach include local ownership & community empowerment; shared learning and transfer of best practices; promotion of research into use and transfer of technologies; active engagement with the private sector and focus on delivery and on measurement of results.

Invited speaker photograph

Invited speaker biography

Mesfin has MSc Degree on Planning and Coordination in Natural Resources Management from International Institute for Geo-information Science and Earth Observation (ITC) of the Netherlands and BSc Degree in Agricultural Economics from Haromaya University of Ethiopia.

He has extensive research, training and management experience in the areas of value chain development, rural marketing, food Security, disaster risk management and emergency support, resilience building, natural resource management, climate-smart agriculture, water sector development, gender, development, mainstreaming HIV/AIDS, organizational capacity building, monitoring and evaluation, and policy advocacy.

Mesfin has worked with Ethiopian governmental organizations at different levels and with international NGOs like Actionaid, International Development Enterprise (iDE) and Vita in the capacity of Agricultural Economist, Rural Development Coordinator, Program Officer, Program Coordinator, Project Manager, Consortium Coordinator and Program Manager over the last 20 years. Mesfin is currently working as Agriculture and Livelihood Program Manager for Vita based in Addis Ababa, Ethiopia. Vita is a smart, successful, next-generation Irish development partner that has been supporting farmers and communities in Africa for nearly 33 years.

F3-15

About 'hot potatoes' a resilient gold for farmers and cities in low-income countries

Gabriela Quiroga

AgriCord, Brussels, Belgium

Overview

Potato and sweet potato are two rapidly growing value chains in various countries where AgriCord intervenes. AgriCord is a global alliance of 12 agri-agencies mandated by professional farmers' organisations and their cooperative businesses from countries in the European Union, Canada, Africa, Asia and Latin America.

In nutritional terms, both potatoes and sweet potatoes have important strengths. These are a good source of protein, fiber, vitamin C and play an important role in food security. Potato produces more food per unit of water consumed than any other main food crop. Potatoes and sweet potatoes are generally more resistant to climatic hazards. According to the FAO "…the resilience of the potato, its relatively short period of maturity, its nutritional characteristics, and employment and income possibilities make it a resilient crop that can secure livelihoods for vulnerable populations even under the effects of climate change and the changing market environment".

However, these advantages should not mask the difficulties linked to the development of the potato and sweet potato. Access to healthy plants is one of the major constraints mentioned by various of our FO's partners, diseases are a growing problem for growers. Other constraints present relate to soil fertility decline (acidification, compaction, destructuring, etc.), suitable agricultural equipment, access to water (water scarcity, irregular access, water quality and impact on the spread of diseases, etc.), insufficient technical knowledge of producers on the sectors, lack of market structuring and non-existence of policies favorable to the development of the two sectors.

These two sectors also constitute a source of financial income for producers. Farmers Organisations represent an organisational innovation to help potato and sweet potato growers reach not only scale but also local and regional markets and to develop sound partnerships for further wealth creation and employment at the local and national levels.

Invited speaker photograph

Invited speaker biography

Gabriela Quiroga Gilardoni holds a Master's Degree in International Development Studies from the University of Amsterdam. She has more than 25 years of experience in rural innovation development action-research and advice for a wide variety of national and international organizations, both governmental and non-governmental, in Europe, Latin America, the Caribbean and West Africa. Since 2021, she manages the strategic partnerships of AgriCord (an alliance of agri-agencies mandated by farmers organisations) where she contributes to building and maintaining collaborations with key farmers' organisations at various levels, financial and technical partners through strong and long-term relationships with key stakeholders.

F3-16

Successful poverty alleviation through the "Potato Empire " strategy in SW China

Peter VanderZaag

Sunrise Potato, Alliston, Ontario, Canada

Overview

Much of SW China is a Himalayan mountainous plateau with a population comprised of many ethnic groups living in very remote communities. Potatoes were introduced several centuries ago and became a staple food. With the lack of infrastructure, technical support and degenerated seed potatoes of moderately late blight susceptible varieties like Mira, the bulk of the population lived in poverty.

Numerous public institutions along with the cooperation of CIP (starting in 1986) much was accomplished in developing late blight resistant varieties such as Cooperation 88 and high-quality seed potato production. How does one translate this into helping alleviate poverty for the remote rural poor? The example I will talk about is the determination of the now former Party Secretary Yalin Yang of Zhaotong city (comprising 13 counties with a total population of 7M) initiated an aggressive program of improved potato cultivation to help alleviate poverty in these rural communities. This was initiated in 2016 with all the county leaders and staff assigned to making a successful program where by every day 1,000 people were to be brought out of poverty! High quality seed potato production of the best varieties was successfully done and this seed was provided to each county for distribution to farmers. The farmers were organized into groups working together as teams. Bank financing was made available to some groups and county level large subsidies were also granted. Through this very large multi-pronged approach the positive impact was improved productivity, more food on the tables of the rural poor and also the sale of potatoes brought many groups of farmers out of poverty. These remote highland locations are ideal locations for production of seed potatoes which are now transported to lowland locations for commercial winter season crops after the rice harvest in China as well as the neighbouring countries such as Vietnam and Myanmar. It is appropriate to name this region the “Potato empire!”

Invited speaker photograph

Invited speaker biography

Peter VanderZaag is a Canadian farm boy. After obtaining his PhD, he spent many years working to help farmers in Africa and Asia. He joined the International Potato Center (CIP) and lead work in Central Africa, based in Rwanda and later as the CIP Regional Director for SE Asia based in the Philippines. Peter initiated the CIP work in China and was fortunate to collaborate with a young MSc student named Qu Dongyu starting in 1986! He closely cooperated with scientists and farmers in the subtropical SW China as a Visiting Professor at Yunnan Normal University and the Joint Academy of Potato Science. Peter then focused on the introduction of improved CIP germplasm and high-quality seed potato production. For his work in China, Peter received the “National Friendship Award “in 2014, the highest honor given to a foreigner. He served as a CIP Board of Trustee member and also as Chair.

Peter is a partner in a large potato farm: SunrisePotato.com. He is also a private potato breeder in Canada and serves as a Director of the WPC.

P-001

Resilience building through larger drip irrigation: lessons and best practices - a case of Dedza and Balaka Districts in Malawi (in draft form)

Welton Phalira, Charles Mkomwa, Reuben Kainga

United Purpose, Dedza, Malawi

Overview

A study was conducted in January, 2022 to document key lessons and best practices associated with implementation of the Larger Drip Irrigation (LDI) under the FtF-AgDiv project implemented by United Purpose (UP) in Dedza and Balaka in Malawi.

The overall objective of the project was to contribute to reduction in poverty, gender inequality, and stunting in the targeted districts. The specific objective was to increase the adaptive capacity of female and male smallholder farmers to respond to the impact of climate change and improve their nutritional status. The study approach involved systematic review of literature, key informant interviews, focus group discussions and direct observation. The data was analyzed thematically following the OECD-DAC evaluation criteria of relevance, effectiveness, efficiency, impact and sustainability in combination with World Bank Framework for Analysis of Best Practices that emphasizes that best practices have to demonstrate innovation, effectiveness in addressing a common problem, replicability, potential for up-scaling, and identifiable conditions for success.

The results show that the LDI is an innovative, effective but volatile water lifting technology that can not only contribute to “breaking the cycle of food insecurity in Malawi” but also propel smallholder agriculture production towards higher productivity and commercialization. Its volatility emanates from weak components around the pump driving wheel that easily wear away. As spare parts are not readily available in rural settings, the equipment is often rendered dysfunctional within two years of operation. Given its high investment rate, the LDI would best be targeted to progressive small-medium scale farmers that are capable of servicing loans over a short period. Farmers’ adoption of this technology should be accelerated by Government’s and development partner’s integration of the intervention in loans, subsidies and grants schemes, particularly targeting the small-medium scale farmer. In addition, designers of the LDI should use durable components to ensure clients get value-for-money.

P-002

Application of active and passive optical sensors for phosphorous management in potatoes (*Solanum tuberosum* L.)

Ayush Sharma, Amanpreet Sandhu, Julia Barra Netto Ferreira, Bortolozo Fernando Rodrigo, Aditya Singh, Lincoln Zotarelli, Lakesh Sharma

University of Florida, Gainesville, USA

Overview

Potato is the third-largest food crop grown globally and widely consumed across all the continents. Potato has low phosphorous (P) uptake efficiency and the development of best management practices for P management is crucial. Remote sensing has shown promise in nutrient management in agriculture. The aim of this study was to assess the ability of active and passive sensors to estimate yield under different P rates. Eight P-fertilizer rates (0, 28, 56, 84, 112, 140, 168 and 224 kg/ha of P) were applied pre-planting as (TSP 46% P2O5). Active optical sensor (Holland Scientific Corp Circle ACS-435) and passive sensors (Quantix recon with 18 MP RGB and Multispectral sensor) were used to measure normalized difference vegetation index (NDVI) recorded at 70 DAP. NDVI recorded from the passive sensor shows a significant difference; however, the active optical sensor could not find any difference in NDVI. With the passive sensor, maximum NDVI (0.71) was reported with 224 kg/ha P, followed by 140, 112, 84, 168, 56, 28, and 0 kg/ha of P. Maximum tuber yield (407 cwt/acre) was reported from the highest 224 kg/ha of P but it was nonsignificant across all other treatments, except control. The lowest yield (258.1 cwt/acre) was reported from the 0 kg per ha of P. Besides that, we also reported that NDVI reported by the passive sensor has the potential to use for the potato yield prediction (R2 = 0.57) compared to the NDVI recorded by the active optical sensor (R2 = 0.027). But more frequent data need to be collected for different crop stages to make a more firm prediction model using the passive sensors.

P-003

Growth and yield characters of potato genotypes grown under different practices at Karnali Province, Nepal

Binod Prasad Luitel

Horticulture Research Station, Nepal Agricultural Research Council, Dailekh, Nepal. National Potato Research Program, Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal

Overview

Potato is an important income generating crop for smallholder farmers in Karnali Province of Nepal. In the Mid-Western region variable rainfall and recurrent drought in spring season limits the production of potato as well as income of the farmers. To address this problem, a two-year field experiment (2019-2020) was conducted in Horticulture Research Station, Dailekh (28°13'6.18"N, 83°58'27.72"E, and 1255 m elevation) to investigate twelve potato genotypes (T-304347.6, T-393371.58, T-304350.1, T-304351.109, T-302498.7, T-304405.47, T-303381.3, T-396311.1, T-396311.1, T-397029.1, T-304368.46, Desiree and Cardinal) with different growing practices (partial irrigation, rain-fed and straw mulching) for their growth and yield. The experiment was laid out in split-plot design where three different growing practices were allotted as main plots and twelve genotypes as sub-plots and it was replicated three times. Partial irrigation (50% of full irrigation) was given manually to potato crop between two rows. Rainfall was the major source for rain-fed potato and straw mulch (80 mm thickness) was used as mulching throughout crop growing season. The combined analysis for plant and yield characters revealed that growing practices significantly affected on-ground cover, plant height, stem number plant-1, marketable tuber number plot-1, marketable tuber weight (kg plot-1) and yield (t ha-1). Genotypes showed significant effect on all the plant and yield characters. The interaction between growing practices and genotypes exhibited insignificant effect in all the traits. Potato grown with straw mulching gave 28.7% and 21.6% higher marketable tuber yield than partially irrigated and rain-fed potato, respectively. Genotypes T-304351.109 and T-397029.1 imparted 22.9% and 17.4% higher marketable tuber yield than Desiree, standard variety, respectively. Therefore, high yielding genotypes T-304351.109 and T-397029.1 along with straw mulching can be recommended to increase the potato productivity under rain-fed condition at Karnali Province, Nepal.

P-004

Effect of the use of windbreaks and irrigation on the quality and yield of potato crops in Magallanes Southernmost Chile

Carolla Martínez, Nicolas Ojeda

Instituto de Investigaiciones Agropecuarioas INIA, Punta Arenas, Chile

Overview

The climate of Magallanes hinders the development and decreases the productivity of potato cultivation, causing irreversible physical damage that causes economic losses with average yields of 8 t/ha without windbreak and irrigation technology. Implementing technologies that meet water needs and protect the crop from the wind would improve quality and increase yields, counteracting crop production losses. Therefore, our objective was to evaluate the effect of three different technologies on yield parameters and crop quality. The treatments evaluated were: 1. control without technology (ST); 2. windbreak and irrigation system (CR); 3. windbreak system (C) and 4. Irrigation system (R). Three plots per treatment (n=12) were established. The variables evaluated were yield (t/ha), number of tubers per plant and size during three seasons (2015-2018). The results were statistically analyzed using ANOVA and Duncan's test. In relation to yield, the differences were significant ($P<0.05$). CR obtained the highest yield (47±2.65 t/ha) followed by C (31±4.36 t/ha), being this one higher than R (9±1.74 t/ha) and then ST (4±2.19 t/ha) which were not different between them. The differences related to the number of tubers/plant (tub/p) were significant ($P<0.05$). CR showed the highest number of tub/p (10±0.5 tub/p) followed by C (8±0.7 tub/p) being higher than R (4±0.5 tub/p) and ST (3±0.7 tub/p) which were not different between them. The waste size (<3.5cm) decreased from 12% (ST) to 2% with the use of CR. Consumption size (>6.5 cm) increased from 0 (ST) to 20.8% with the use of CR. Our results demonstrate the importance of using technologies to improve productivity (t/ha) and quality (tub/p and size) rates in potato cultivation, indicating that CR is the best productive alternative for Magallanes.

P-006

Physiological response and yield components under nitrogen deficiency stress in three potato varieties under greenhouse conditions

Leire Barandalla[1], Alba Alvarez-Morezuelas[1], Enrique Ritter[1], Maite Lacuesta[2], Patrick Riga[3], Leire Benedicto[3], Jose Ignacio Ruiz de Galarreta[1]

[1]NEIKER-BRTA. Campus Agroalimentario de Arkaute, Vitoria, Spain. [2]UPV-EHU, Pº de la Universidad 7-01006, Vitoria, Spain. [3]NEIKER-BRTA. Parque Tecnológico de Bizkaia, Derio, Spain

Overview

The objective of this study was to analyze the differential response of physiological and yield components in three potato varieties under nitrogen deficit conditions. A greenhouse trial was performed with two different nitrogen levels in the varieties Agria, Kennebec and Monalisa. Twenty tubers per variety were planted in pots. Ten pots were fertilized with Calcium Ammonium Nitrate 27% corresponding to 300 Kg/Ha when plants emerged (day 11) and tuberization start (day 29) (control). The other ten did not receive any fertilizer (stressed). One week after the second treatment, several physiological parameters were measured: chlorophyll content, fluorescence and IRGA gas exchange. Leaves were collected to estimate leaf area and fresh/dry weight of leaves. On day 49 of the cycle, the aerial part of half of the plants was harvested for evaluating biomass. LECO analysis was performed on dry leaves for determining minerals, macro and micro nutrients, total carbon, total nitrogen, and ashes. At the end of the cycle total yield, tuber number and average tuber weight were determined. Monalisa was the variety with worst nitrogen efficiency, losing 30% of yield, highest loss of photosynthesis and leaf area in unfertilized plants. LECO analysis revealed that Monalisa had the lowest total nitrogen in leaves of unfertilized plants, indicating a reduced efficiency in nitrogen uptake. The variety with best behavior under nitrogen deficiency was Agria, showing the lowest production loss. Indirect selection based on parameters associated with nitrogen deficiency, such as photosynthesis measurements, leaf area, and LECO analysis can be useful tools in potato breeding programs for the identification of more stress tolerant varieties.

Acknowledgments

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P-008

Development of nitrogen fertilizer strategies using yield goal for chipping potatoes

Lincoln Zotarelli[1], Tara Wade[2], Gary England[3], Christian Christensen[3]

[1]University of Florida, Gainesville, USA. [2]University of Florida, Immokalee, USA. [3]University of Florida, Hastings, USA

Overview

Florida's potato growers are required by law to enrol in the State Best Management Practices (BMP) Program and implement applicable BMPs, or conduct water quality monitoring to demonstrate the total maximum daily loads for nitrogen (N) and phosphorus are within the water quality standards. The objective of this study was to develop N-fertilizer recommendations for maximizing potato crop yield and economic return while minimizing N losses to the environment. Twenty-two field trials in randomized complete block design were conducted between 2010 and 2014 on commercial production areas. N-fertilizer treatments consisted of rates between 112 and 336 kg/ha of N with varying application timings (pre-plant, planting, emergence, tuber initiation). Utilizing ^{15}N isotope, the N-fertilizer use efficiency for each application timing was 11%, 18%, and 57-62% for pre-plant, planting, and emergence-tuber initiation stages, respectively. The average total tuber yield was 37.1±7.6 Mg/ha (± std. dev.) with a median plant N uptake of 140 kg/ha of N; 90% of the observations were between 85-190 kg/ha of N. A significant linear correlation between tuber total yield (TTY) and plant N uptake was determined (N_{uptake}=25.2876+TTY*0.2980, p<0.01, r^2 = 0.32, n=576). Maximum TTY, as the response of a quadratic model, was reached with N-fertilizer rates of 252 kg/ha N (TTY=205.8476+1.3908 N_{rate}– 0.0031N_{rate}^2, p<0.01, r^2=0.17, n=155). N-fertilizer application rates above 280 kg/ha of N did not increase tuber yield. An enterprise budget estimated the N-fertilizer and application costs, expected marketable yields, selling price, average net return, profit margin, and the average return per dollar spent in N-fertilizer for the range of N-fertilizer rates used in the study. The information generated in these field trials supports the adjustment of a recommended N-fertilizer rate range of 224-280 kg/ha based on a tuber yield goal and economic return.

P-010

Effect of five frost control systems on foliage protection and yield of potato crops in the subantarctic region of South America.

Nicolas Ojeda, Carolla Martinez

National Institute for Agricultural Research (INIA), Kampenaike Regional Research Center, Punta Arenas, Chile

Overview

Among potato crops, the losses in yield due to frosts vary from 30 to 100% in Magallanes Region of Chile, South America. This variation depends on the presentation and severity of freezing events, which varies from 3 to 28 days during production season, and primarily on the technology level each production has access to. Aiming to find the most effective alternative to reduce production losses, our objective was to assess the effect of five different frost control systems in the protection and yield of potato crops. Potato crops were established in eighteen plots (n=18) during the 2020-2021 season, which had a total of 4 frosts. The experimental treatments included: mineral Cryoprotectant (CP1), organic film Cryoprotectant (CP2), Polypropylene row cover (RC), Flipper sprinkler irrigation (FL), MicroJet sprinkler irrigation (MJ) and a control with no protection (CO) (3 plots per treatment). Foliage loss, number of tubers per plant, and average yield (t/ha) were measured as indicators of treatment effectiveness. Data was analyzed using ANOVA. RC, FL and MJ preserved foliage after each frost event. CP1, CP2 and CO had a complete foliage loss in every frost, nevertheless, they recovered after 10 days. There were no differences ($P>0.05$) in number of tubers per plant among RC (18.1±2.7), CP1 (18.8±2.7), CP2 (18.0±1.9), FL (20.0±5.9), MJ (17.2±3.5), and CO (18.9±2.8). Similarly, the average yield in RC (46.166±10.047), CP1 (54.726±4.998), CP2 (45.526±11.382), FL (55.919±18.593), MJ (51.324±11.604), and CO (47.976±12.981) did not differ ($P>0.05$). It is estimated that frosts were belated and during a physiological stage with less susceptibility, where a significant part of the yield was already defined. This would explain the lack of difference between protection treatments. These results are part of the first season (of a total of 3) of investigation

P-011

Can drought stress explain potato yield variability in the Netherlands?

Arie Ravensbergen, Nicole Ramsebner, David De Wit, Corné Kempenaar, Pytrik Reidsma, Martin van Ittersum

Wageningen University and Research, Wageningen, Netherlands

Overview

Ware potato yields in the Netherlands are highly variable with reported minimum and maximum yields ranging from 30 to 100t/ha. Lower yield levels are unfavourable because of lower food production, lower economic returns and lower resource use efficiency leading to higher environmental impact. To address these issues, it is necessary to understand causes of yield variability in ware potato production. In this study we assessed the effect of drought stress on ware potato yield variability in the growing seasons of 2020 and 2021. In both years we collected data from 48 commercial potato fields on field conditions, crop development, yield and crop management through biweekly field visits. In addition, we simulated potential and water-limited yields and transpiration reduction in each field using the crop growth model SWAP-WOFOST. The studied fields were equally divided over sandy soils (cv. Fontane) and clay soils (cv. Innovator) throughout the country. On sandy soils average actual gross yield was 64t/ha (2020) and 68t/ha (2021) with a yield range of 40 to 85t/ha (2020) and 55 to 88t/ha (2021). On clay soils average actual gross yield was 65t/ha (2020) and 55t/ha (2021) with a yield range of 50 to 80t/ha (2020) and 45 to 65t/ha (2021). In 2020, every 10 mm transpiration reduction increased the yield gap by 2.5% on sandy soils. On clay soils such relationship was not significant. Looking at individual fields, drought stress explained up to 27% of the yield gap on sandy soils and up to 18% of the yield gap on clay soils. Drought stress is expected to have a much lower effect on the yield gap in 2021 given the smaller yield range and much wetter conditions; simulation results for that year will be added to the presentation.

P-012

Using agronomic forecasting tools to improve crop value and efficiency of production

Robert Allen, Joseph Mhango

Crop4Sight, Peterborough, United Kingdom

Overview

Agronomically efficient potato production is essential for the continuing profitability of the industry, and i will contribute to supply chains meeting obligations of environmental stewardship and climate change mitigation.

Research has defined the agronomic principles that control tuber populations and how these can be managed to optimise tuber size profiles for different market types, varieties and achieved final yields. Yet to date, they remain underutilised in commercial production. A key reason for this is that crop planning and management decisions which affect final crop outcomes are spread across the crop life cycle from seed planning to harvest. These management decisions are often poorly recorded and rarely combined to allow meaningful analysis of crop performance. Effective proactive crop management requires integrated forecasting tools that can predict likely outcomes at different stages of crop growth. This functionality remains absent from documentary style farm management solutions.

Crop4Sight, a UK based potato specific crop management platform, has integrated forecasting technologies across the crop production cycle. Which allows grower agronomists and supply chain users to plan, monitor and benchmark crop development. Pre-season seed models tailor seed rates for the variety, chronological age, planting date and commercial yield target. In-season benchmarking provides a yield potential at emergence, target groundcover and tuber population. In-season yield forecasting provide timeseries of actual yield, tuber size distribution and financial value throughout the burndown period. Deviations from original crop targets to be identified and the commercial implications quantified. Management plans can be adjusted to revised crop requirements, to ensure maximum crop value can be achieved at season end.

Real world applications of the seed module, in-season crop benchmarking and yield forecasting will be presented that demonstrate the financial value of using agronomically based forecasting technology in commercial potato production.

P-013

Examination of 2 different irrigation crop models for automated irrigation of potatoes under the Idaho/east Oregon climate conditions

Ami Gips[1], Yechiam Gets[1], Ofer Halperin[1], Prof Clinton Shock[2], Erik Feibert[2]

[1]Netafim AG Department, Magal, Israel. [2]Oregon State University, Ontario, USA

Overview

2 automated irrigation scheduling methods for potatoes were examined for 2 growing seasons in the Oregon State research station at Malheur County, (OR, USA). The methods were tested using both drip & sprinkler irrigation systems with 2 varieties tested for each combination of Irrigation scheduling X Irrigation system X variety. Each combination was repeated 5 times in a random block trial design.

The irrigation scheduling that was tested were:

1. OSU model: automatic open of the irrigation system according to pre-defined threshold of soil water tension values, with fixed amount for each irrigation event

2. Netafim crop model: Soil water balance Irrigation scheduling based on soil type, climate and crop phenology with auto corrections by soil sensors and remote sensing imagery

All plots were monitoring through the season with different types of soil sensors, petiole and soil samples, phenology tracking, drones & satellite imagery, yield levels & size distribution.

The results of both treatments had reached high values of yield (over 90 ton/Ha) with high quality, uniformity and storage capacity. The water amounts were varied between different combinations of treatments and ranged from 700 to 1000 mm of irrigation per hectare. Analyzing sensors patterns, reveals different behavior of plant water uptake, response to high evaporative demand, irrigation interval, fixed Vs changing amount and more, despite the resemblance in yield and quality final results.

P-015

Comparison of the standard and adapted calculation of Area Under Canopy Cover Progress Curve to evaluate potato nitrogen use efficiency

Lāsma Rābante-Hāne[1,2], Ilze Skrabule[1], Ilze Dimante[1], Inese Taškova[1,2]

[1]Institute of Agricultural Resources and Economics, Crop Research Department, Priekuļi, Latvia. [2]Latvia University of Life Sciences and Technologies, Jelgava, Latvia

Overview

Area Under Canopy Cover Progress Curve (AUCCPC) use more frequently to predict potato yield and Nitrogen Use Efficiency (NUE). However, the AUCCPC is difficult to access. Looking for a different approach, similarities were found between the AUCCPC and Area Under Diseases Progress Curve (AUDPC) equations.

The set of 20 potato genotypes grown in four growing conditions were used to evaluate NUE. For the AUCCPCk, we used the methodology of Khan et al. (2013) but for the AUCCPCa we altered the AUDPC using beta thermal time and integrated percentage maximum canopy cover.

The absolute values of AUCCPCa under conventional conditions were higher than AUCCPCk, while under organic conditions it was the opposite. One possible explanation could be that in AUCCPCa we used unfit values while for AUCCPCk the values were fitted as required for each phase of the temporal course. However, in all cases, AUCCPCa maintained the same trend between genotypes and N supply as AUCCPCk. The results obtained show a strong correlation between AUCCPCk and AUCCPCa ($r=0.92$, $p<0.001$).

Furthermore, a significant correlation was found between both AUCCPC, yield, and NUE under organic conditions ($p<0.05$). No significant correlation was observed between both AUCCPC and NUE under conventional conditions, but there was a significant relationship between both AUCCPC and yield (($p<0.05$). The pattern found corresponds to the fact that NUE is better expressed in environments with lower N availability, which is often detected in organic conditions.

Overall, these results suggest that AUCCPCa can be used as an alternative to the AUCCPCk method for further potato yield and possibly, NUE evaluation.

Acknowledgments

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P-017

Evapotranspiration partitioning, crop coefficients, tuber yield and irrigation water productivity for a potato crop under water-limited conditions in southern Chile

Rafael López-Olivari[1], Sigfredo Fuentes[2], Carlos Poblete-Echeverría[3]

[1]Instituto de Investigaciones Agropecuarias, INIA Carillanca, km 10 camino Cajón-Vilcún s/n, Casilla 929, Temuco, Chile, Temuco, Chile. [2]Digital Agriculture, Food and Wine Sciences Group, School of Agriculture and Food, Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Parkville, VIC 3010, Australia, Melbourne, Australia. [3]South African Grape and Wine Research Institute (SAGWRI), Department of Viticulture and Oenology, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa, Stellenbosch, South Africa

Overview

The evapotranspiration (ET) process is essential for many agricultural water management studies and its partitioning into soil evaporation (E) and plant transpiration (T) is key for optimizing the irrigation water use under scarce water resources. A field experiment was carried out on a drip-irrigated potato crop (var. Puyehue INIA) during the maximum atmospheric demand period (season 2020/2021). The experimental trial was located at the Research Center Carillanca (INIA), La Araucanía Region, Chile (38º 41' S, 72º 24' W, 188 m above sea level). The potato plants were subjected to three different irrigation levels (IL) namely IL1 (full irrigation), IL2 (75% of IL1) and IL3 (60% of IL1) in a surface area of 300 m2 each. For each IL, a set of five FDR probes were installed in a representative area for continuous measurements of volumetric soil water content along the growing season. Also, morphological, physiological, and micrometeorological measurements were performed. The ET and reference evapotranspiration (ETo) were determined through the soil water balance method and FAO56 approach, respectively. The crop coefficient (Kc) was computed for the mainly phenological potato stages. Fifteen pots installed in-row and thirty PVC microlysimeters (in- and between-row) were used for determining the T (the pots were covered with plastic wrap to prevent evaporation) and soil evaporation (E), respectively. At harvest the yield tuber and irrigation water productivity were determined. The partitioning of T/ET was higher than E/ET for IL1, while for IL2 and IL3 the ratios were similar. The same tendency was observed by T/ETo compared to E/ETo. The Kc values for IL1, IL2 and IL3 were between 0.43-0.90, 0.30-0.85, and 0.26-0.75, respectively. The irrigation water productivity was close to 20, 25, and 29 kg/m3 for IL1, IL2 and IL3, respectively.

P-018

Applications of machine learning to improve crop management

Robert Allen, Joseph Mhango

Crop4Sight, Peterborough, United Kingdom

Overview

In-season data describing crop development is essential for making critical crop management decisions such as irrigation scheduling, yield forecasting and maximising crop value at burndown. Yet in time-poor farm environments data collection is often perceived as onerous and not treated as essential. Automating collection of key agronomic data is essential to making crop management tools more accessible to agronomists and growers and help drive improvement sin efficient potato production.

Crop4Sight, a UK based potato crop management platform, includes machine-learning-based methods for automating crop groundcover assessment using satellite imagery and in-field tuber sizing of yield samples using computer-vision and augmented reality.

For groundcover, predictive models were produced by engineering relevant features from spatio-temporal variations observed in optical and radar reflectance data in satellite images, using supervised learning algorithms. Crop4Sight's archive of Georeferenced ground-truth field recorded groundcover data was used for the supervised learning and model benchmarking.

Groundcover timeseries are essential for irrigation scheduling services and to calculate absorbed radiation, a key component of forecasting models used to predict end of season yields. Spatial variation in groundcover within a crop is useful for assessing spatial variation in crop water use.

Tuber size grading of yield samples has been automated using video analysis of the sample, using annotated video of in-field yield samples combined with an innovation for transforming 2D pixels to linear units of measurement. A convolutional neural network was trained to estimate the major and minor axes of individual potatoes. The total weight of the sample and size distribution is derived using a machine learning model trained using Crop4Sight's database of tuber weights and widths. Sample weights and size distribution from are used to forecast final size distribution and net yield from mid-season onwards.

P-019

Using natural elicitors to improve rapid wound healing responses in cut potato tubers

Pradeepika Chintha[1,2], Dipayan Sarkar[1], Ramnarain Ramakrishna[1], Munevver Dogramaci[3], Edward Lulai[3], Kalidas Shetty[1]

[1]North Dakota State University, Fargo, ND, USA. [2]ICAR-Central Tuber Crop Research Institute, Thiruvananthapuram, Kerala, India. [3]United States Department of Agriculture, Agricultural Research Service, Fargo, ND, USA

Overview

Bruising and wounding of potato tubers is a serious post-harvest challenge, which causes significant economic losses to the potato industry. Therefore, improving wound healing (WH) responses of cut and bruised tubers is essential to counter tissue damage and to control subsequent infections and maintain higher tuber quality. The main objective of this study was to investigate the efficacy of natural elicitors, such as water-soluble chitosan oligosaccharide (COS), and bioprocessed cranberry pomace for improving WH responses in cut potato tubers. Certified seed potato tubers of cv. Russet Burbank and Russet Norkotah were targeted using a standardized disc model system for the WH response of cut tubers. The role of protective redox-linked and anabolic pentose phosphate pathway (PPP) was investigated as key steps for potentially improving WH responses and suberization processes in cut potato tubers after four days of wounding. Enhanced WH response in cut potato tubers with improved accumulation of suberin biopolymers was observed in COS elicitor treated cut discs. Additionally, improved PPP-linked redox regulation with high glucose-6-phosphate dehydrogenase activity and higher soluble phenolic content was also observed in COS treated tissues. These results indicated that natural bioprocessed elicitors, such as COS, can be utilized to improve WH related metabolic responses, consequently, to increase the efficiency and quality of cut seed tubers, as well as to counter the post-harvest damages caused by unintended wounding.

P-023

Occurrence of fungicide resistance in anastomosis groups of Rhizoctonia solani in Idaho

Katie Malek[1], Alan Malek[1], Shelbie Anderson[1], Phillip Wharton[1], James Woodhall[2]

[1]University of Idaho, Aberdeen, USA. [2]University of Idaho, Parma, USA

Overview

Stem canker and black scurf (caused by Rhizoctonia solani anastomosis group 3) is an important disease of potatoes in Idaho causing yield losses of up to 30%. In 2020, a fungicide sensitivity survey was conducted to determine the effectiveness of known fungicides against different anastomosis groups (AG) of R. solani isolated from field crops growing in Idaho. Thirty-one isolates were collected and screened for resistance to nine different fungicides. Fungicide sensitivity testing was done using spiral plate dilution gradients. Fungicide solutions were applied to PDA in a 2.5-log dilution in a continuous radial concentration gradient using a spiral plater. Fungal inoculum was placed in radial lines across the gradient. Fungicide sensitivity was expressed as an EC50, the fungicide concentration at which a fungal isolate's radial growth was equal to 50% of the average growth of the isolate on non-amended PDA. Results showed that R. solani isolates were sensitive to the majority of the fungicides tested with the exception of the fungicide pencycuron. Twenty five percent of R. solani isolates tested showed resistance to pencycuron. Interestingly, it was the binucleate isolates of AG-A, AG-D and AG-I that were most resistant to pencycuron. However, pencycuron is not currently registered for control of Rhizoctonia on potato in Idaho. All the AG-3 isolates from potato were still sensitive to fungicides that are currently registered for control of Rhizoctonia in Idaho. This is the first comprehensive study looking at fungicide resistance in multiple anastomosis groups of Rhizoctonia solani in Idaho.

P-024

Developing redox-based technology for early detection of environmental stresses and leaf diseases in potato plants with whole-plant imaging technology.

Matanel Hipsch, Shilo Rosenwasser

The Robert H. Smith Faculty of Agriculture, Food and Environment. The Hebrew University of Jerusalem, Rehovot, Israel

Overview

Environmental stresses are among the major factors that limit crop productivity and plant growth. Various non-destructive approaches for monitoring plant stress states have been developed. However, early sensing of the initial biochemical events during stress responses remains a significant challenge.

In this work, we established whole-plant redox imaging using potato (*Solanum tuberosum*) plants expressing a chloroplast-targeted redox-sensitive green fluorescence protein 2 (roGFP2), which reports the glutathione redox potential (E_{GSH}). Ratiometric imaging analysis demonstrated the probe response to redox perturbations induced by H_2O_2, DTT, or a GSH biosynthesis inhibitor. We mapped alterations in the chloroplast E_{GSH} under several stress conditions including, high-light (HL), cold, and drought. An extremely high increase in chloroplast E_{GSH} was observed under the combination of HL and low temperatures, conditions that specifically induce PSI photoinhibition.

We also examined the ability of chloroplast targeted roGFP2 to report the early signs of the oomycete Phytophthora Infestans (*P.Infestans*) infection, which is known for causing the late blight disease, one of the most crucial potato diseases. Therefore, identifying the early stage of P. *Infestans* infection is the key to maintaining crop safety. By examining spatially resolved patterns of the *chl-*E_{GSH} in infected plants, we revealed the direct effect of the pathogen on the chloroplast redox state. Notably, those redox changes were observed before the appearance of irregular-shaped spots, the typical infection symptoms, or stress responses as observed using chlorophyll fluorescence and multispectral imaging. Thus, we demonstrate the possibility of non-destructive monitoring of *P. Infestans* infection using whole-plant redox imaging.

The presented observations suggest that whole-plant redox imaging can serve as a powerful tool for the basic understanding of plant stress responses and applied agricultural research, such as improving phenotyping capabilities in breeding programs and early detection of stress responses in the field.

Hipsch, M., (2021), Plant Physiology, 187(2), 618-631.

P-025

Bacterial wilt infection burden in the seed potato system in Ethiopia: A case of Oromia and SNNP regions

Lemma Tessema[1], Rogers Kakuhenzire[2], Ebrahim Seid[3], Kasaye Negash[1]

[1]Researcher, Addis Ababa, Ethiopia. [2]Assistant Scientist, Project coordinator, Addis Ababa, Ethiopia. [3]Researcher, Holetta, Ethiopia

Overview

Potato is among the top root and tuber crops in Ethiopia contributing for food security to more than 5 million households. However, the productivity of potato is constrained by many diseases and bacterial wilt is among the most production threat in the country. Considering this, latent bacterial wilt (BW) assessment was conducted in Oromia and SNNP regions, Ethiopia in October 2021. The number samples collected represented 70.5 ha of potato crops from which 25 to 250 tubers per filed were collected depending on the field size adjusted for the standard of 250 tubers that would be collected per hectare. Tuber samples were strictly collected from fields that completely had not presence of potato plants showing BW infection symptoms. The target was to collect samples from potato crops that would ordinarily be passed as healthy using the current protocol for quality assurance of quality declared seed (QDS) potato using visual assessment. The testing for latent bacterial wilt infection was conducted at Holetta Research Centre plant pathology laboratory following a standard NCM-ELISA protocol for potato tubers. Results of latent Rs detection indicated that 26.4% of analyzed samples were infected. However, infection was highest in SNPP (39.6%) than in Oromia (23.1%) region. These potato crops therefore if they were to be passed as good for quality seed basing visual assessment as is the current QDS protocol in Ethiopia, it would be an indisputable means of spreading BW infection further. Basing on this data, it can be concluded that QDS produced by Farmers Seed Grower Cooperatives (FSGCs), and quality assured by visual examination in this study area will carry high levels of BW infection unless the seed is tested by more sensitive and novel diagnostic methods to eliminate fields that might be latently infected with bacterial wilt.

P-027

Phytosanitary situation of three RNA viruses from potato (*Solanum tuberosum*) using RT-PCR in the main potato seeds production zones of Peru

Maria Julia Gonzales Llontop[1], Hans Carreño Fernandez[2], Cesar Obed Cotera Huayhua[2], Edgar Neyra Valdez[2], Ladislao Palomino Flores[3]

[1]Instituto Nacional de Investigación en Glaciares y Ecosistemas de Montaña, Lima, Peru. [2]Universidad Peruana Cayetano Heredia, Lima, Peru. [3]instituto Nacional de Innovacion Agraria, Cusco, Peru

Overview

Potato (Solanum spp.) can be infected by different viruses reducing potato yield and quality. This reduction can be greater than 50%, reaching up to 90% in susceptible varieties. Potato is the third most important food crop in the world after rice and wheat. Despite the importance of this crop in Peru, it has not had a phytosanitary evaluation in 20 years, regarding the viral infection. For this reason, in the present study the prospecting was carried out to evaluate the phytosanitary status in 21 potato seed production zones which were Cusco, Junín and Ayacucho.

Molecular testing was divided into two phases: the first one consisted of standardizing molecular diagnostic techniques RT-PCR for detection of Potato virus X (PVX), Potato virus Y (PVY), Potato virus S (PVS) using specific primers reported. And consequently, the second phase was to determine the prevalence, incidence and distribution of these viruses. A 532 potato seeds were collected from several varieties, such as: Yungay, Canchan, Peruanita, Tumbay, Única, Capiro, Perricholi, Andina, Bella, Serranita y Cicca. The collected seeds were propagated under greenhouse conditions for 2 months.

The results indicated that from a total of 532 samples analyzed, a viral infection percentage of 82.31% was found. The highest incidence percentage value (% of diseased seeds) was 66.92% for PVS infection, while the PVY and PVX viruses obtained a lower incidence percentage of 55.26% and 39.29, respectively. With respect to the prevalence values (% potato seed production zones affected) were 95.24%, 90.48% and 90.48% for infection for PVS, PVX and PVY, respectively. The results showed the importance of PVS virus within the parameters of incidence and prevalence.

The findings, show us the phytosanitary reality of potato seeds in Peru and would help us improve phytosanitary control and certification programs in potato seed centers, in order to obtain virus-free potato seeds.

P-029

Mechanisation: one helpful tool for reducing pesticide use

Michel Martin[1], Cécile Roques[2], Coraline Dessienne[2]

[1]ARVALIS-Institut du végétal, Estrées Mons, France. [2]ARVALIS-Institut du végétal, Boigneville, France

Overview

Considering an increasing demand for safer potato production for the environment and the consumer, the use of pesticides temps to be progressively reduced in the field and during storage, till the commercialisation of tubers. This reduction could be achieved by replacing synthetic pesticides by more natural products, by decreasing the number of applications thanks to more and more accurate decision support systems (DSS) but also by introducing innovations or new developments in mechanisation in some parts of the technical itinerary where such modifications are relevant.

For weeding, traditional ridgers can be replaced by more sophisticated equipment allowing hoeing the ridge sides when weather conditions are appropriate. Only if necessary, herbicide application can be limited at the top of the hills. Harrows with adjustable tine pressure are now available for working in large widths.

For haulm destruction, multiple alternative solutions to chemicals have been developed over time using very different but sometimes complementary approaches: thermal haulm control with gas, fuel oil or vegetable oil, haulm flailing, haulm pulling, root cutting and most recently the very innovative plant electrocution.

For tuber storage, the better management of outside air ventilation and the implementation of mechanical cooling appear more and more as real issues for a good control of tuber sprouting since the ban of chlorpropham in a context of global warming.

For each of these mechanical levers, the discussed recent works provided practical results to assess their effectiveness compared to the conventional use of pesticides while also pointing out their technical limits. Their integration into the SYSTERRE® multi-criteria analysis also made it possible to specify their economic and environmental impact for a sustainable reasoned choice in a multidimensional assessment supplementing their simple impact on the treatment frequency index (TFI).

P-030

ScabEomics: Effector-based breeding for resistance to *Spongospora subterranea* (powdery scab) in potato

Maria de la O Leyva Perez[1,2], Theo A.J. van der Lee[3], Denis Griffin[2], Marga P.E. van Gent-Pelzer[3], Jeanne Mehenni-Ciz[2], Dan Milbourne[2], Ueli Merz[4], Leah Tsror[5], Jack H. Vossen[1]

[1]University of Wageningen and Research. Department of Plant Breeding, Wageningen, Netherlands. [2]Teagasc. Department of Crop Science, Carlow, Ireland. [3]University of Wageningen and Research. Department of Biointeractions and Plant Health, Wageningen, Netherlands. [4]Plant Pathology/IBZ, Zurich, Switzerland. [5]ARO, Gilat Research Center, Negev, Israel

Overview

Powdery scab caused by *Spongospora subterranea* sp. *subterranea* (Sss) can cause significant yield losses in potato. Lesions on potato skin affect marketability and provide entry points for other pathogens. Moreover, Sss can spread Potato MopTop Virus (PMTV). Efforts to breed for Sss-resistant varieties are impaired by troublesome phenotyping methods.

Plants possessing a specific resistance (*R*) gene are resistant towards a pathogen that produces the corresponding avirulence (*Avr*) gene product, also known as effector. Highly expressed effectors that do not trigger hypersensitive response (HR) in susceptible plants, are considered candidate AVRs. Effectors triggering HR are most prominent among the diverse part of the secretome (Van de Vossenberg *et al*., 2019). Therefore, candidate AVRs can be identified using comparative genomics, and transcriptomics of the secretome.

In order to identify genetic diversity and potential *Avr* genes, we sequenced the genomes of over 20 different Sss isolates from 15 different countries in 5 continents. We mined the secretomes and selected candidate *Avrs* based on their diversity across different isolates and expression analysis with RNAseq data. These candidate *Avr* genes will be used to screen a germplasm collection and accessions in which hypersensitive responses are triggered will be selected. The plant components involved in the HR will be genetically identified, and may provide novel *R* gene sources which can be easily selected in breeding programs.

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P-031

Pre- and postharvest treatments to control potato black dot - an integrated approach.

Marta Sanzo-Miró[1], Faisal I. Rezwan[2], Daniel Simms[3], Leon A. Terry[1], M. Carmen Alamar[1]

[1]Plant Science Laboratory, Cranfield University, Bedfordshire MK43 0AL, United Kingdom. [2]Department of Computer Science, Aberystwyth University, Penglais Campus, Aberystwyth SY23 3FL, United Kingdom. [3]Centre for Environmental and Agricultural Informatics, Cranfield University, Bedfordshire MK43 0AL, United Kingdom

Overview

Potato black dot is a foliar and tuber blemish disease that has become an economically important problem in the past years. Black dot is caused by the fungus *Colletotrichum coccodes* and is characterized by silvery lesions on the tuber skin leading to lower quality of potato. The importance of the high-quality tuber appearance has increased considerably due to the growing demand for washed and pre-packed potatoes. Potato black dot not only develops in the field but also after harvest. Therefore, both field conditions and postharvest management are crucial factors to control the disease and reduce food loss and waste throughout the food supply chain. Previous studies showed that continuous ethylene supplementation applied from the first indication of sprouting and during postharvest storage is beneficial to suppress sprouting. Yet, little is known about the effects of exogenous ethylene supplementation applied during postharvest cold storage on black dot severity. In this study, potato tubers cv. Maris Piper with different levels of black dot (i.e., low, moderate, and severe) at harvest were stored under two different postharvest treatments: air (control) and continuous ethylene supplementation (10 ppm) in combination with cold storage (3°C and 99% of relative humidity). Moreover, the impact of different fungicide timing applications and crop durations has been evaluated. The effect of both pre- and postharvest treatments on potato physiology and black dot development throughout storage will be discussed. Results will be part of an integrated approach that would contribute to reduce food loss and waste, helping to achieve the United Nation Sustainable Development Goal of reducing food loss and waste by 50% by 2030.

P-032

Dual fungicide resistance in A*lternaria solani* and A*lternaria alternata* field isolates in South Germany

Michael Zellner, Mathias Nottensteiner

Bavarian State Research Center for Agriculture, Freising, Germany

Overview

Reduced sensitivity of *A. solani* and *A. alternata* field isolates towards fungicides of the Quinone outside inhibitors (QoI) class (strobilurins) has been observed in the European Union. QoI-insensitive *A. alternata* isolates characteristically carry a G143A amino acid exchange caused by a single nucleotide polymorphism (SNP) in the cytochrome *b* gene. *A. solani* has evolved a similar F129L mutation that reduces sensitivity towards QoIs. In this study, 55 *A. alternata* and 47 *A. solani* isolates were collected in 2016 from major potato growing areas in south Germany to update the current status of QoI mutation spread. 85.1 % of *A. solani* and 74.5 % of *A. alternata* field isolates showed the F129L and the G143A mutation, respectively. We found 74.5 % of *A. solani* isolates to belong to genotype II with a 100 % of them carrying the F129L mutation. However, we also found the F129L mutation in genotype I with a frequency of 41.7 %. Reduced sensitivity of *A. alternata* and *A. solani* field populations towards succinate dehydrogenase inhibitors (SDHI) fungicides (boscalid), which are the other major compound for Alternaria control, are recognized as an emerging problem in Europe. We randomly selected 23 of our *A. alternata* and 19 of our *A. solani* field isolates and screened them for the presence of SDHI mutations in the subunits SDHB, SDHC and SDHD of the succinate dehydrogenase enzyme complex (SDH). 43.5 % of *A. alternata* and 42.1 % of *A. solani* isolates were found to carry a mutation in one of the examined SDH subunits. Mutations in the SDHB subunits were with a frequency of 26.1 % of isolates predominant in *A. alternata*. It was in 83.3 % caused by the H277Y mutation. The H278Y mutation of subunit SDHC was with 36.8 % of isolates most common in *A. solani*.

P-033

Strategy for detection of *Rpi* genes in potato cultivars, breeding lines and wild *Solanum* species

Paulina Paluchowska[1], Marta Janiszewska[1], Erik Lysøe[2], Simeon Rossmann[2], Mirella Ludwiczewska[1], Zhimin Yin[1], May Bente Brurberg[2,3], Jadwiga Śliwka[1]

[1]Plant Breeding and Acclimatization Institute - National Research Institute, Młochów, Poland. [2]Norwegian Institute of Bioeconomy Research, Ås, Norway. [3]Norwegian University of Life Sciences, Ås, Norway

Overview

Late blight caused by *Phytophthora infestans* (Mont.) de Bary, is one of the economically most important potato diseases. Intensive research on potato late blight has led to the discovery of resistance genes against *P. infestans* (*Rpi* genes) in wild potato species (*Solanum* spp.), and some of these *Rpi* genes have been introduced into potato cultivars. Currently, more than 70 *Rpi* genes have been identified in tuber-bearing and non-tuber-bearing *Solanum* species and, nearly 50 *Rpi* genes have been cloned. However, we do not know which *Rpi* genes are present in the potato gene pool, especially since the resistance conferred by many of them has been overcome by a rapidly evolving *P. infestans* population. The goal of our work is to investigate the incidence of 12 *Rpi* genes and to analyse their diversity in potato cultivars grown in Poland and Norway (109), breeding lines (69) and in wild potato species (53). Included potato cultivars were selected based on high resistance to late blight and/or popularity among consumers.

Plant material was initially screened for the presence of *Rpi* genes using PCR targeting short fragments of *Rpi* genes. Subsequently, the entire coding sequences of the genes were amplified. The obtained products will be sequenced using PacBio long read technology. This will allow us to obtain data on the diversity of genes crucial for the potato defence against *P. infestans*.

The research leading to these results has received funding from the Norwegian Financial Mechanism 2014-2021, project DivGene: UMO-2019/34/H/NZ9/00559

P-034

Efficacy of 3 R-gene late blight resistant potato cultivars in preventing infection by *Phytophthora infestans* in confined field trials in Indonesia

Phillip Wharton[1], Ineu Sulastrini[2], Kusmana Kusmana[2], A. Dinar Ambarwati[3], Tri Joko Santoso[3], David Douches[4], Karen Hokanson[5]

[1]University of Idaho, Aberdeen, USA. [2]Indonesian Vegetable Research Institute, Lembang, Indonesia. [3]ICABIOGRAD, Bogor, Indonesia. [4]Michigan State University, East Lansing, USA. [5]University of Minnesota, Minneapolis, USA

Overview

Development of late blight resistant potato cultivars by classical breeding is continuously under threat due to the rapid evolution of the late blight pathogen *Phytophthora infestans*. The USAID Feed the Future Biotechnology Potato Partnership has developed bio-engineered potatoes with 3 R-gene late blight resistance. To study the efficacy of this Rpi-gene stack in the varieties Granola and Diamant, randomized complete block variety x fungicide, confined field trials were carried out at the Indonesian Vegetable Research Institute in Lembang, Indonesia in 2020 and 2021. In these trials Diamant and Granola 3 R-gene late blight resistant lines were compared to non-genetically modified Granola and Diamant varieties in fungicide sprayed and non-sprayed plots. Late blight is endemic to Indonesia and the disease appeared in buffer rows two weeks after planting. Late blight ratings were started when the first symptoms were observed in the non-sprayed control plots and carried out weekly until harvest. No late blight lesions were found in any of the 3 R-gene lines in either the sprayed or non-sprayed plots throughout the whole trial up to harvest. After harvest, tubers were kept for 30 days and then assessed for late blight tuber symptoms. No tuber late blight was found in any of the treatments. These results showed that the 3 R-gene stack was able to provide complete resistance to infection by the *P. infestans* strains present in Indonesia.

P-035

Differentiation between *Pectobacterium* and *Dickeya* species based on their volatile signatures

Leah Tsror, Zipora Tietel

ARO, Gilat Center, Israel

Overview

Potato blackleg and tuber soft rot diseases, caused by the pectinolytic bacteria Pectobacterium and Dickeya spp., result in severe yield losses worldwide. Early and accurate detection of infections caused by these bacteria is an important tool in disease management for sustainable potato production. The objective of the current study was to profile the volatile organic compounds (VOCs) of tubers inoculated with pectinolytic bacteria and identify biomarkers for infections. Three species of Pectobacterium and two species of Dickeya, a total of 24 strains were used. A sampling of inoculated potato discs was performed using Solid Phase Micro Extraction (SPME), coupled to a Gas Chromatography-Mass Spectrometry (GC-MS). Strains demonstrated a unique volatile profile, differentiated at the genus, species, and strain levels. Dimethyl ether was increased in samples inoculated with all pathogens, hexanal was increased by Dickeya compared to Pectobacterium, 2-methyl butanol and 2,3-octanedione differentiated between Pectobacterium species, and 2-pentyl thiophene differentiated between Dickeya species.

Early detection of pectinolytic bacteria using VOCs allows to determine the presence of infected tubers by sampling the atmosphere, rather than testing single tubers, thus providing the grower a rational tool in the management of seed and ware potato tubers in storage and shipments, avoiding severe economic damage and global product loss.

P-036

Sensitivity of different potato cultivars to the presence of *Ralstonia solanacearum* bacteria in *in vitro* cultures

Włodzimierz Przewodowski[1], Dorota Szarek[1], Dorota Michalowska[1], Grzegorz Gryn[2], Katarzyna Salamonska[1], Małgorzata Łabańska[1], Agnieszka Przewodowska[3]

[1]Plant Breeding and Acclimatization Institute - National Research Institute, Bonin, Poland. [2]Plant Breeding and Acclimatization Institute - National Research Institute, Bydgoszcz, Poland. [3]PMHZ, Strzekecin, Poland

Overview

The presence in potatoes' dangerous diseases caused by numerous pathogens is usually associated with significant economic losses.

Particularly troublesome for potato cultivation are quarantine diseases, including bacterial wilt of potato, caused by *Ralstonia solanacearum* (Rs) (Smith) Yabuuchi et al. - one of the most important quarantine potato pathogens.

There are several factors that can stimulate the uncontrolled spread of R. solanacearum in the environment. One of them is the lack of an effective biological or chemical method of utilization of those in potato tissue. Moreover, R. solanacearum is capable of infecting more than 200 species of various plants and, although it is a thermophilic pathogen, it can relatively easily adapt to colder climates. In the era of progressive climate change related to global warming and the occurring drought, the more and more frequently used irrigation of plantations favors the uncontrolled spread of Rs bacteria, which can survive and move in the water. The presence of R. solanacearum in low concentrations in potato tissue is particularly dangerous, as is the inhibition of symptoms of infection by tolerant cultivars, which in turn contributes to the rapid spread of these pathogens in the environment.

In all of the above cases, these bacteria put future potato generations at risk.

Therefore, the purpose of the presented research was to determine the sensitivity of different potato cultivars to the presence of Ralstonia solanacearum. Due to the high level of the disease expression symptoms and the simplicity of multiplication, potato varieties in form of in vitro cultures were used for research. The obtained results allowed for the determination of the influence of the examined Ralstonia solanacearum strains, on the level of expression symptoms on the tested in vitro plants and for comparison with the obtained result of the molecular test.

P-038

Chloropicrin soil fumigation in potato production used to reach on-farm environmental and economic sustainability goals

Chad Hutchinson

The Trical Group, Pinehurst, USA

Overview

Chloropicrin soil fumigation in potato production used to reach on-farm environmental and economic sustainability goals. Environmentally and economically sustainable potato production are two principles that should be pursued together to assure the long-term supply of potatoes in all market segments. Soilborne disease is the main limiter to achieving sustainability goals as disease negatively impacts crop health and marketable yields. Higher marketable yields per hectare reduces crop production resource demands on land resources, chemical and nutritional inputs, and labor. A safe and effective method to reduce soilborne disease is required to reach sustainability goals. Chloropicrin soil fumigation is a relatively recent soilborne disease control practice adopted in potato production. Chloropicrin soil fumigation is gaining acceptance because it suppresses troublesome soilborne diseases such as *Streptomyces scabies*, *Verticillium spp*., and *Colletotrichum coccodes*. Long-held assumptions regarding soil fumigation such as soil fumigation sterilizes the soil and the idea that once a farmer starts soil fumigation, the practice cannot be stopped are inaccurate and outdated. Relatively recent improvements in DNA technology have provided evidence of the actual impact of chloropicrin soil fumigation on the soil microbial community. Research will be shared showing that chloropicrin soil fumigation promotes the growth of beneficial soil microorganisms such as *Bacillus spp*., *Pseudomonas spp.*, and *Trichoderma spp*. while reducing disease and increasing potato yields. Microbial soil health is just one benefit of chloropicrin soil fumigation. An in-row application methodology will be described that incorporates cover crops and topsoil stabilization into the application process. Chloropicrin, an older residue-free, tolerance exempt chemistry is an excellent tool to help the potato industry reach on-farm, industry, and societal environmental and economic sustainability goals.

Details of interests

I am the director of research for The TriCal Group. I conduct and sponsor research on chloropicrin soil fumigation in the potato industry. The TriCal Group manufactures and sales chloropicrin for soil fumigation in the potato industry.

P-039

Potato psyllid and zebra chip disease risk assessment in Idaho, USA

Erik Wenninger[1], Jennifer Dahan[2], Nora Olsen[1], Alexander Karasev[2]

[1]University of Idaho, Kimberly, USA. [2]University of Idaho, Moscow, USA

Overview

Zebra chip disease (ZC) is an emerging disease of potato in which tubers are produced with striped necrotic patterns that make them unmarketable. ZC is associated with the bacterium "Candidatus Liberibacter solanacearum" (Lso), which is transmitted by the potato psyllid, Bactericera cockerelli (Šulc) (Hemiptera: Triozidae). First found in Idaho, Washington, and Oregon (USA) at the end of the 2011 season, ZC continues to be a costly consideration in potato management programs in this region. Management is heavily reliant on insecticide applications that target the vector. However, psyllid and Lso incidences are highly variable among years. Determining whether and when to apply foliar insecticides targeting psyllids requires regular monitoring of fields. We have been monitoring potato psyllids and Lso in commercial potato fields across Idaho each year since 2012 and providing weekly updates to producers to aid in timing of insecticide applications. The observed relationships among psyllid abundance, Lso incidence in psyllids, and ZC prevalence in potato fields suggest that our monitoring program is effective at identifying the level of risk of ZC to Idaho potato growers. For example, a combination of high psyllid abundance and high Lso incidence during 2012 was associated with high prevalence of ZC in potato fields during that year. Psyllid abundance during subsequent years has varied considerably, but Lso incidence has been relatively low each year, and ZC prevalence in fields has also been low. Growers in Idaho can use our estimates of local psyllid abundance and Lso incidence to assess risk of ZC, often delaying or eliminating sprays, thereby reducing input costs.

P-040

Implementation and impact of a warning system for potato late blight control in Latin America

Ivette Acuña[1], Florencia Lucca[2], Cristina Tello[3], Rodrigo Morales[4], Arnulfo Gutiérrez[4], Rodrigo Bravo[1], Constanza Sepúlveda[1]

[1]Instituto de Investigaciones Agropecuarias INIA Chile, Osorno, Chile. [2]Instituto Nacional de Tecnología Agropecuaria INTA Argentina, Balcarce, Argentina. [3]Instituto Nacional de Investigaciones Agropecuarias INIAP Ecuador, Pichincha, Ecuador. [4]Instituto de Innovación Agropecuaria IDIAP Panamá, Ciudad de Panama, Panama

Overview

Late blight, caused by the oomycete *Phytophthora infestans* (Mont.) de Bary, is considered a re-emerging problem in the potato crop worldwide, due to the variability of the pathogen and the climatic instability that favors its presence and dispersion, with a high incidence and severity. Therefore, farmers use pesticides excessively and inopportunely, increasing environmental impact and risk to users' health. The objective of this work was to implement an early warning system as tools to support decision-making in family farming in Latin America, in order to reduce the losses caused by this disease, in a sustainable and safe way for the user. During the 2018 to 2020 seasons, experimental plots were established in Argentina, Chile, Ecuador and Panama, with varieties of different susceptibility to the disease. The treatments were based on fungicide applications according to the early warning systems, fixed schedule and no fungicide control. Early warning systems validated in each country were used. Control efficacy was assessed by determining foliage damage and tuber yield. The results show a reduction of more than 45% in the number of applications, 53% in the environmental impact and 53% in the reduction of costs of fungicide control. These results show the high impact of the implementation of these support systems for sustainable intensive agriculture.

Acknowledgements: BID and FONTAGRO for its support of the Project “Early warning for the management of potato late blight” ATN/RF 16678-RG

P-041

Using of broad-spectrum resistance genes against P. infestans for breeding a new potato cultivar suitable for organic agriculture – preliminary results from Ecobreed project.

Jarosław Plich, Beata Tatarowska

Plant Breeding and Acclimatization Institute - National Research Institute, Młochów, Poland

Overview

Potato late blight, caused by Phytophthora infestans Mont. de Bary, is one of the most important problems for both, conventional and organic potato growers. Since fungicide protection is not possible in organic agriculture, the only way to combat with this pathogen is growing of resistant cultivars. However, the number of cultivars combining good level of agronomical characteristics with very high level of late blight resistance is still far insufficient. In the frame of Ecobreed project 65 potato cultivars hypothetically suitable for organic conditions were selected and assessed in terms of its resistance against late blight. Among these cultivars only 17 showed very high level of late blight resistance which allows to grow them without chemical protection. All these cultivars possess an R genes, which are considered to be highly effective since provide resistance against broad spectrum of P. infestans races. Unfortunately, in most cases these genes appeared in cultivars singly (or combined with low-effective R-genes) which can decrease durability of effective resistance provided by such genes. It is believed that pyramiding of the broad-spectrum resistance genes can help to produce potato cultivars durably resistant to late blight, because it is less likely for a pathogen to simultaneously gain virulence towards a plant with several highly effective R-genes. Therefore, donors of various broad-spectrum resistance genes were crossed, and progenies with pyramided R-genes were selected. Since phenotypical selection of such genotypes requires use of many different isolates of the pathogen, the use of marker assisted selection (MAS) was also applied. This method proved to be highly effective in selection of potato individuals combining two or more R-genes and will be broadly applied in the next stages of Ecobreed project.

P-042

Major aphid vectors of potato virus diseases in farmer-based seed potato production areas in Kenya

Joseph Machangi[1,2], John Nderitu[2]

[1]Ministry of Agriculture, Livestock and Fisheries, Nairobi, Kenya. [2]University of Nairobi, Department of Plant Science and Crop Protection, Nairobi, Kenya

Overview

A formal survey was conducted in three major potato growing areas in Kenya namely **Tigoni** in Agro-Ecological Zone (AEZ) lower highland 1(LH1) & upper midland 1,2,3 (UM1,2,3), **Njabini** in AEZ upper highland 2 (UH2) and **Molo** (in UH1) to identify the major aphid vectors of potato virus diseases. For each area, 20 potato fields were surveyed and farmers interviewed making a total of 60 farms with preference on seed potato farms. Potato leaf samples were collected from the potato plant (three leaves per plant from the top, middle and bottom parts respectively) and later examined for the presence of aphids. Tigoni area had the highest aphid populations, 1464, followed by Njabini with 504 then Molo with 240 aphids. Four major aphid species were identified. On average, the most encountered species was *Aphis gossypii* (61.8%) followed by *Macrosiphum euphorbiae* (20.5%), *Myzus persicae* (14.9%) and lastly *Aulacorthum solani* (2.8%). These results show that potato production is threatened by the presence of these pests since they are the major vectors of virus diseases in potatoes. The aphid population was highest in the lower altitude area of Tigoni and lowest in the higher AEZ of Molo. Proper control measures of the aphid pests in order to reduce virus spread are therefore necessary for sustainable potato production in this region especially in the lower altitude areas.

P-043

A survey on pesticide use and application patterns among potato farmers in Bomet County, Kenya

Judith Oyoo[1,2], George Abong'[2], Michael Okoth[2], Moses Nyongesa[1]

[1]Kenya Agricultural and Livestock Research Organization (KALRO), Limuru, Kenya. [2]University of Nairobi, Nairobi, Kenya

Overview

Potatoes are loved by infants, children, women and men in Kenya as food while potato snacks are consumed more by youth, women and children. Pesticides are greatly used in production and storage of potatoes with potential contribution to pesticide residues in harvested produce both in field, storage and processed products, posing great risk to humans, aquatic life and environment. To establish usage and application patterns of pesticides, a cross-sectional survey was conducted in February 2021 involving potato producers in Bomet County using a structured questionnaire administered through face-to face interviews with 305 potato farmers and 19 key informant interviews of agro-input dealers, farmer leaders and extension officers. The survey respondents were 71.2% male and 28.2% female. Most of the respondents had attained minimum education of primary school level with 68% having reached secondary school level and above. Respondents applied fungicides (83.6%), insecticides (14%) and herbicides (below 1%). Among the fungicides applied, 94.8% used Mancozeb which is carbamate based (WHO class U) followed by a combination of Metalaxyl plus Mancozeb by 13.3% (WHO class II). Most of the farmers (86%) did not apply insecticides while the few who applied used pyrethroids (WHO class II). Some farmers (4.8%) sprayed Dimethoate and/or Diazinon to control pests although these pesticides are banned or of restricted in use. With regard to spraying frequency, 77% of farmers sprayed fungicides once in a season, 18% sprayed twice and 6% sprayed thrice. Fifty three percent of farmers had received training on pesticide handling and among those trained 88% wear protective clothing during spraying. There is need for more intensive trainings on choice of less harzadous chemicals of lower WHO class and the use of protective gear during spraying.

Acknowledgement - Kenya Climate Smart Agriculture Project and University of Nairobi

P-044

Achieving rapid adoption of IPM in potato crops

Paul Horne

IPM Technologies Pty Ltd, Melbourne, Australia

Overview

Integrated Pest Management around the world is typically characterised by low rates of adoption and very long time periods before there is significant uptake of IPM strategies. This is despite significant government support for IPM in many countries. It seems that slow rates of adoption of IPM are accepted even if that is not what is desired. However, this does not need to be the standard, and this paper describes recent work in potato crops in Australia that shows that this certainly does not need to be the norm. The paper describes how IPM adoption can be rapid and offers examples (case studies) from three different sectors of Australian potato production. The three case studies from Australia presented are: 1. Seed Potato crops, 2. Processing potato crops and 3. Ware potato crops.

IPM is now the most widely adopted method of pest management in potato crops in Australia. In addition to looking at rates of adoption, the reduction in reliance on insecticide spraying and the benefits in terms of sustainable production methods are discussed. It is proposed that the approach described in this paper could be used as a model for adoption of IPM in potatoes, anywhere in the world.

P-045

In vitro evaluating alternatives products against pathogens that affect the potato tuber

Brenda Zulema Guerrero-Aguilar[1], Ramiro Rocha-Rodriguez[2], Juan Angel Quijano-Carranza[1]

[1]Instituto Nacional de Investigaciones Forestales Agricolas y Pecuarias, Celaya, Guanajuato, Mexico.
[2]Instituto Nacional de Investigaciones Forestales Agricolas y Pecuarias, Celaya,Guanajuato, Mexico

Overview

In Mexico potato production faces various phytosanitary problems, some of which directly affect tubers and generate great losses in the yield and quality of the final product. The most recurrent phytosanitary problems are black scab (*Rhizoctonia solani*), dry rot (*Fusarium spp*.), wet rot (*Erwinia carotovora*), and anthracnose (*Colletotrichum*). A great variety of chemicals and organic products have been used in the control of these organisms, without having to date a treatment that can be considered successful, so the investigations continue. As part of this research, the present work set the objective of evaluating alternative products against pathogens that affect the potato tubers under *In vitro* conditions. 10 products were evaluated: PAA, Germicidal soap, MB, common soap, common soap+ Headline, Headline, an organic compound, Potassium soap, a compound of 2 microorganisms and a compound of 4 microorganisms. The evaluation consisted of determining the degree of control of these products on eight pathogens, four of de genus of *Fusarium, Rhizoctonia solani, Colletotrichum cocoides, Erwinia,* which were isolated from potato tubers and *Phytophthora capsici*, isolated from chili plants. A medium denominated as "poisoned"; with the 1% products was prepared, a 0.5 cm fragment of active mycelium was transferred onto the medium, radial growth was measured at 5, 10 and 15 days, until the control (PDA medium) completely invaded the petri dish, finally the percentage of radial growth inhibition (PICR) was calculated. three products reached 100% inhibition (without growth on the evaluated pathogens) being PAA, Germicidal soap, and organic compound. These products appear to be a promising alternative for the control of pathogens that affect the tuber.

P-046

In vitro antagonist of *Trichoderma* against *Rhizoctonia solani* Kuhn

Jesus Orlando[1], Ramiro Rocha[2]

[1]Universidad Tecnológica del Sur del Estado de Morelos, Puente de Ixtla, Mexico. [2]INIFAP, Celaya, Mexico

Overview

Abstract. *Rhizoctonia solani* has a wide geographic distribution, as well as a large number of hosts. This fungus causes heavy losses to various agricultural crops and can remain in weeds and soil for a long time. For its control, fungicides are basically used. A viable alternative in its management is the use of Trichoderma; High efficiency agent as antagonist of root pathogens, in addition, it is a growth stimulator in plants and used as a bioremediation agent. The objective of the present work was to evaluate *in vitro* the antagonistic capacity of *T. viridie; T. koniingii; T. harzanium and Trichoderma* spp versus *R. solani* isolate. For this, samples with natural infection by *R. solani* were taken in the potato crop, variety Fiana, the pathogen was isolated in Petri dishes containing Agar Sabouraud culture medium and confrontational tests with the antagonists were carried out. The results obtained reflected that *T. harzianum and T. koningii* showed, 66.7 y 67.5% respectively, highest percentages

P-049

Agronomic versus economic efficiency of using high microplant densities in a small minituber production entity

Ilze Dimante[1,2], Zinta Gaile[1]

[1]Latvia University of Life Sciences and Technologies, Jelgava, Latvia. [2]Institute of Agricultural Resources and Economics, Priekuļi, Latvia

Overview

High potato microplant densities (PD) in greenhouses can help make use of the greenhouse area more efficiently, reduce the number of growing containers and substrate needed for minituber production.

A three-year study at the Priekuli Research Centre (PRC) of the Institute of Agricultural Resources and Economics, Latvia aimed to the determination of the effects of increased PD on a subsequent number of minitubers per unit area of three locally bred varieties ('Monta' early, 'Prelma' medium early and 'Mandaga' medium late) from both agronomic and economic perspectives.

The actual production situation in the center corresponds to a small minituber grower (up to 60 000 minitubers per year) which also maintains a disease-free collection of microplants and propagates them for minituber production. Baseline PD in greenhouse is 63 microplants m-2. An additional three PDs (95; 142 and 184 microplants m-2) were included in the study.

Partial budget analysis method including dominance analysis and marginal rate of return analysis was used to estimate the economic efficiency of changes in microplant densities that were compared using stepwise manner. The method is based on CIMMYT training manual "From agronomic data to farmer recommendations". Four production scenarios were compared. The baseline scenario was based on production costs (microplant cost of 0.54 € and minituber cost of 0.41 €).

From the agronomic perspective, the highest PD (184 microplants m-2) was the most efficient density as it allowed to obtain the highest number of minitubers above 3 g (the minimum acceptable weight at present production conditions). The economic assessment revealed that in the baseline scenario only shift from PD 63 to PD 95 microplants m-2 was efficient for one of three varieties. This was mainly due to production costs of microplants, which account for the bulk of the production costs of minitubers

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P-050

Production of Irish potato certified seeds in Elgeyo Marakwet County-Kenya

Grace Kipkoech

Agriculture, Iten, Kenya

Overview

The Light of Kapkachur is a group which was formed in Elgeyo Marakwet County in 2012 as a table banking group with the intention of improving the livelihoods of its members who are both men and women. Their objective was to plant potatoes for ware but due to lack of knowledge and funds, we were unable control diseases particularly blight. In 2014, Agricultural Sector Development Support Programme (ASDSP) which is funded by the Swedish government, the EU and the Government of Kenya started working on potato value chains and we opted to participate as value chain actors on certified seed production. ASDSP partnered with Kenya Plant Health Inspectorate and the Department of Agriculture and provided training for the value chain actors on new innovations and technologies.

Some of the requirements to produce quality seed included; use of virgin land, soil sampling, disease and pest management, earthing up, dehaulming, inspection, phytosanitary controls, sorting, grading, packaging, storing and labeling. ASDSP supported the group by providing potato certified seeds, fertilizers, fungicide and pesticides. The programme also provided us with a solar powered irrigation system so that we can produce seeds even during the off season. Elgeyo Marakwet County is the second largest potato producer in Kenya but productivity is very low. The group has harvested their seed and managed to get 22.5 tons per ha up from their previous yield of 10 tons per ha. This is a great milestone. All the members of the group are seed multipliers and they have undergone 'Training of Trainers' (TOT) so that they can train others. As a group we have a dream of owning a cold storage facility where we will store seeds to sell to other farmers in the county so as to improve on food and nutrition security. The productivity is still low and this can be improved through mechanization, introduction of high yielding varieties and good agricultural practices.

P-051

Community led potato seed production, multiplication and distribution in Eritrea

Medhanie Mehari Arefe[1], Abraham Araya Habte[2], Tiberh Gayame Tekle[2]

[1]National Agricultural Research Institute, Asmara, Eritrea. [2]Department of Agricultural Extention, Asmara, Eritrea

Overview

Potato is an important and widely grown vegetable crop in Eritrea. The crop contributes to food security directly as a food source to the whole society and as a cash crop to potato farmers. Potato production is concentrated in the highlands and midlands of Eritrea ranging from 1500 to 2600 meter above sea level by subsistence and commercial farmers. In the year 2020 the Ministry of Agriculture estimated a total area of 2,159 hectare of land was under potato cultivation.

The national potato productivity is estimated 14.2 ton/ha below the world average (21t/ha) and African average yields (15t/ha) in 2019 according to FAOSTAT published in 2021. The core problem for the low productivity is mainly due to inadequate supply of clean seed and weak seed system. To overcome this, a community-based potato seed multiplication and supply project was initiated in 2015 by Vita, Teagasc, Irish Aid and EU. The project supplies imported seeds to selected farmers for further multiplication and supply to a wider cohort of farmers. The intervention has boosted the productivity and production through the supply of quality declared seed of climate smart varieties as well as agricultural inputs, formal training and close supervision.

This project has been able to support 4,344 farmers through the provision of 5,990 tonnes of quality declared seeds. Formal training on agronomic practices of the crop has been provided to 470 direct beneficiaries while other farmers have accessed the training informally through a video and booklet guidelines, supplied through the extension channels. This in turn produced 68,794 tonnes of potato tubers both for seed and ware as a result of increased productivity from 12.1ton/ha in 2001 to 20ton/ha in 2020 for most of the beneficiary farmers. Consequently, the potato farmers livelihoods are improved from the increased production and sale of the crop.

P-052

Apical rooted cuttings of potatoes revolutionized how generation1 seed potatoes are produced in the Philippine highlands

Cynthia Kiswa[1], Teresita Masangcay[1], Jocelyn Perez[1], Jennie Balao[1], Jophr Galian[1], Victoria Demonteverde[2], Peter Vander Zaag[2,3]

[1]Benguet State University, La Trinidad, Benguet, Philippines. [2]Potato Systems Research and Training Center, Canlaon, Philippines. [3]Sunrise Potato, Alliston, Canada

Overview

Initially, Apical Rooted Cutting (ARC) technology was introduced by the International Potato Center (CIP) and refined over the years by the Benguet State University particularly the Northern Philippines Root Crops Research and Training Center (NPRCRTC) to rapidly evaluate germplasm in on-farm trials. As a result of these trials an outstanding new potato cultivar named Igorota was selected with durable late blight resistance, excellent virus resistance and low reducing sugars. To meet the highland farmers high demand for seed, NPRCRTC launched an aggressive program of producing both the ARCs for sale to farmers as well as assisting farmers and cooperative groups to multiply Igorota themselves to supply their own demands for seed potatoes as well as for neighbouring farmers. This strategy was adopted by nine associations and individual farmer ARC multipliers with NPRCRTC providing the starting plant material. The multipliers established simple greenhouses to maintain the mother plants to produce the ARCs ordered by generation 1 seed potato growers, who store only the harvested seed they need for their potato production. All orders for generation 1 seed are immediately sold to farmer clients who ordered them after the harvest. With a cultivar of good virus resistance like Igorota, farmers can now keep their own seed supply for at least 5 cycles of replanting prior to getting a new supply of minitubers or generation 1 field grown certified seed. With good management, farmers can obtain up to 40 t/hectares good yield. Overall average yields have increased to around 20t/ha. The ARC technology has dramatically improved both sustainable and profitable potato production in the highlands of the Philippines.

P-053

Pioneered and efficient aeroponic potato mini-tuber production in the double cropping zone of China

Wei He[1], Kexiu Wang[1], Mingxia Tang[1], Jianjun Hu[1], Peter VanderZaag[2]

[1]Sichuan Academy of Agricultural Sciences, Chengdu, China. [2]Sunrise Potato, Alliston, Canada

Overview

Abstract

Aeroponic pre-basic production in large scale has shown high efficiency compared with the conventional medium production where a single plant would only produce few mini tubers. It could save greenhouse area and un-renewable medium resources (e.g. vermiculite and perlite), and easily control common scab or powdery scab, etc. The high efficiency can be basically attributed to its physiological mechanism involving three major merits over the conventional techniques: the complete darkness, zero mechanic resistance for tuberization, and frequent balanced nutritional/water/oxygen supplies to the roots within the box. Since 2007, we have pioneered and refined our aeroponic production system through experimentation in both the spring and autumn growing seasons of Sichuan China.

Optimizing plant growth and mini-tuber numbers/plant during both the spring season going into longer warmer days and the autumn season of going into cooler shorter days have been established. Long day adapted cultivars such as Favorita and Mira are ideal for the spring season whereas Andigena background cultivars are best suited for the autumn season. Management of nitrate and ammonium N ratios and calcium concentration in solution are critical for optimizing plant development and tuber numbers. Foliar applying the plants with GA3, calcium nitrate, ABA to potato plants of cvs. Favorita and Mira during the contrasting spring and autumn seasons favored the tuber weight and number by 49%~73% and 35%~90% respectively. Repeated harvesting un-rooted apical cuttings from hydroponic plantlets substantially increased tuber number. Whole hydroponic plantlets had the head start and out yielded in vitro plantlets in the both seasons by over 36%. In addition, maintaining nutrition medium temperature below 17°C and keeping medium thresholds at EC 2.5 and pH 5.8 favored the growth and tuber production. The potential aeroponic seed tuber production can be further explored through prioritizing nutritional media, agronomic and eco-physiological management.

P-055

Tackling food security and household income through multiplication and promotion of quality seed potato in Uganda

Tindimubona Stephen, Mucunguzi Levic Kagooro

Uganda National Seed Potato Producers Association (UNSPPA), Kabale, Uganda

Overview

Potato is an important crop for food and income generation in Uganda and was recognized in the 2010/11 – 2014/15 national development strategy and investment plan (DSIP) as a strategic commodity with potential to make remarkable contribution to increasing rural incomes and livelihoods, improving food security and nutrition.

Uganda National Seed Potato Producers Association (UNSPPA) was formed in 1995 (www.unsppa.com) to address seed potato gaps so as to enhance constant and adequate seed potato production while enabling farmers to adopt improved farming technologies. The main objective of the Association is to promote production and distribution of quality seed potatoes in Uganda. Specific objectives of the association include; improving on the production magnitude of quality seed potato, promoting farmer-researcher linkage in order to facilitate technology transfer, food security, nutrition and poverty alleviation.

The activities conducted by UNSPPA to achieve its objectives include; Promotion of quality seed potato production, promotion of farmer-based early generation seed production and promotion of potato management technologies like negative and positive selection, pests and disease management, seed plot, rapid multiplication techniques of seed potato and post-harvest handling practices. These technologies have been disseminated through training programs of farmers using the farmer field school approach and field days and exchange visits. The wide application of improved technologies and use of quality seed has led to the increase in potato production from 7 tons per hectare to 10 tons per hectare.

Increased income in potato growing areas has led to improved standards of living not only among potato farmers but also among the value chain actors evidenced by improved housing, expansion of landholding committed to potato growing, acquisition of transport facilities to ease their movement and marketing, ability to support their children attain education up to university level and enhanced adoption of potato production and post-harvest handling technologies.

P-056

Towards a sustainable seed potato multiplication system in Ethiopia

Retta Worku, Gerrit Holtland

SNV, Addis Ababa, Ethiopia

Overview

Irish potato is the dominant root crop In Ethiopia with 181,000 ha (59% of all root crops) coverage. One of the main limiting factors for potato production is the lack of good quality seed potatoes. A detailed analysis of the seed system showed that:

1. Minitubers from plantlets are the best starting point (G0) for seed multiplication

2. G1 seeds produced from minitubers are too expensive to be sold on the market

3. When this G1 is retained by the farmer to produce G2, the cost is more than halved and the G2 can be sold with a good profit margin.

However, individual smallholder farmers cannot afford to invest in a 2-year production cycle. Cooperative can do it, but only when they combine the benefits from both cycles. The best way is to:

1. Use contract farming in the first year. The farmers are paid for the land and labor, but the cooperative retains ownership of the seeds

2. Provide the G1 in the second year as credit in kind to members who repay in a ratio of 1: 2.5. With a seed rate of 2 MT/ha and an extra yield of 10 MT/ha, this is still hugely profitable for members.

To start a new sustainable system, Horti-LIFE bought 410,000 minitubers for distribution to 17 selected cooperatives. In three cycles, in total 16,000 farmers with 0.25 ha each, will be able to get certified, quality seed potato for ware potato production.

We also work with the IPCE to harmonize the approach of projects working on seed potatoes. Generally, they ask farmers to repay seed potatoes in a ratio of 1:1.25. This needs to be changed as it means that farmers benefit handsomely indeed, yet their cooperatives remain too poor to buy new EGS.

P-057

Cutting the generations: Innovations in potato transforming livelihoods of young farmers

James Nyambura

Farm Input Promotions Africa, Meru, Kenya

Overview

The Irish potato is the second most important staple crop grown in Kenya, after maize, and before rice. It is currently estimated that 800,000 people in Kenya directly benefit from potato farming production while potatoes provide a source of income for over 3.3 million people employed in the value chain. Majority of those employed in the value chain are older people yet the youth is struggling with unemployment and poverty. Over 90% of potatoes are grown on smallholdings on less than 0.5 acres of land making this suitable for women especially where women do not have autonomy over land. Seed shortages are a perennial challenge. Farm Input Promotions Africa is promoting youth and women-led enterprises to increase supply of clean and certified seeds that would be accessible to small holder farmers. The seed enterprises use potato rooted apical cuttings as starter material for production of clean seed-potato while using new varieties that are high yielding, tolerant to drought and disease. A youth led seed merchant (Jungu Farm Enterprise) has been registered. The business is managed by a youth and grows 5-8 acres of potato every season earning USD 3000 net profit in a year. The farm uses Potato Rooted Apical Cuttings as starter materials. The small businesses aggregate their produce for better bargaining power. The farm has supported 400 other youths to enter potato business in the County and organised multiple youth groups to grow and sell potato for ware. As a result of these activities, the director of the Jungu farm have been voted as a board member of the local potato cooperative society.

P-058

Cutting the generations: Impact of decentralized Rooted Apical Cuttings nurseries in potato seed systems, Meru County Kenya

Mercy Chepkwony

AgRevive Africa Limited, Nairobi, Kenya

Overview

The seed sector does not meet the seed potato demand in Kenya. Seed-potato is bulky and expensive to transport. Farmers either travel long distances to purchase seed potato from a small number of certified seed potato producers. Women and poorer farmers are particularly disadvantaged, as they struggle to travel to access the seed. When farmers do travel to reach the suppliers, they often find there is not enough seed available or not of their preferred varieties

In order to support farmers, overcome these challenges, AgRevive Africa Limited is promoting potato rooted apical cuttings as starter material for production of clean seed while using new varieties that are high yielding, tolerant to drought and disease, as well as having high marketability potential. The aim is to produce cuttings in a Small-Scale Cuttings Nurseries closer to farmers, thereby empowering farmers to produce their own seed and reducing cost, and the barriers for women and poorer farmers.

One nursery hub and six spoke nurseries have been established in Meru County with a capacity to produce 1 million cuttings within a year. In the past 6 months 500,000 cuttings have been produced and sold to farmers for own farm seed production. The nursery has also been a source of employment for 12 casual labourers who take part in day-day activities. Over 7,000 farmers have gotten the opportunity to plant the rooted apical cuttings. The technology serves women and youth as the start-up capital is affordable yet the returns are high. The cost of constructing a nursery with a capacity 80,000 cuttings per season is USD 1,460. If the farmer produces 80,000 cuttings in a season with the cost of production being USD 0.05 per cutting, a farmer will make a net profit of USD 2,000 meaning the farmer can recover the initial investment in just one season.

P-059

Village Based Potato Advisor model on potato technology dissemination

Florah Kirira

Farm Input Promotions Africa, Nairobi, Kenya

Overview

The Irish potato, *Solanum tuberosum*, is the second most important staple crop grown in Kenya, after maize, and before rice. Over the years the demand for Irish potatoes is growing. It is currently estimated that 800,000 people in Kenya directly benefit from potato farming production while potatoes provide a source of income for over 3.3 million people employed in the value chain. Over 90% of potatoes are grown on smallholdings on less than 0.5 acres of land making potato an important crop for food security as well as an important cash crop. Even so, perennial seed shortages are a major challenge for potato farmers.

In order to help farmers, Farm Input Promotions Africa is promoting potato rooted apical cuttings as starter material for production of clean seed-potato while using new varieties that are high yielding, tolerant to drought and disease, as well as having high marketability potential. The aim is to produce cuttings in a Small-Scale Cuttings Nurseries closer to farmers, thereby empowering farmers to produce their own seed.

Activity 1: Create demand for cuttings

Over 7,000 farmers have been trained on the importance of using potato rooted apical cuttings and they have tried this in their own farms. A total of 50 Village Based Potato Advisors (VBPAs) have been selected and well trained on potato management practices and their farms are being used to develop demonstration sites for everyone in their villages to learn and observe. The VBPAs are also key in disseminating new potato varieties to all farmers in the village. From the demand the VBPAs create, they can liaise with certified seed suppliers and agro-chemical companies to offer services and products and this micro-business can generate income even after the project is finished.

P-060

Biomio: Pre-selling native potato crops in the Colombian Andes

Marc de Beaufort

BioMio, Choachi, Colombia

Overview

Faced with competition from large-scale industrialised agriculture and poor infrastructure, small farmers in Colombia face the impossible task of securing a sustainable income in a skewed marketplace, so rural poverty increases along with environmental degradation. BioMio is an innovative, subscription-based model that directly links farmers and consumers, guarantees a fair income and strengthens ecosystems with regenerative agriculture. Clients pay a monthly subscription to receive deliveries of quality, organic produce less than 10 hours after harvest, guaranteeing harvest sales, eliminating intermediaries and doubling farmers' income.

We drastically reduce our carbon footprint, strengthen our ecosystems and track rates of soil regeneration while 100% organic, locally-sourced agricultural inputs greatly reduce costs and environmental degradation. Regenerative agriculture increases levels of carbon sequestration and microbial growth measured through chromatography, effectively transforming our natural environment. We focus on native potato varieties that were in danger of being lost but that command a much higher premium in the top end of the market. We strengthen capacity-building and local traditions through the production of high-end artisanal products. Any excess production of potatoes is turned into high end vodka using traditional distilleries in the region therefore reducing food loss and turning it into a considerable new revenue stream.

BioMio follows a Market Intermediary Social Enterprise Model. We ensure economic growth, income security and capacity-building for smallholder farming families by creating a subscription-based sustainable produce purchase model for a high-end urban clientele that ensures a fair market for both consumer and producer. We are effectively pre-selling native potato harvests reducing the risks of small potato farmers and offering them higher premiums for native potato varieties. In 2021 our model was awarded MIT's prestigious Solve Award for innovation in the creation of resilient ecosystems.

P-061

Women groups in Potato Value Chain Investment

Stephen Ruchu, Ann Sylvia Kamau

Utopian Supplies Kenya Limited, Nairobi, Kenya

Overview

Kenya has about 14,000 recognized women's organizations. They include everything from renowned international committees and academic groups to small grassroots organizations. These groups exist to influence public policy, promote social welfare, and better the members' overall economic situation (Ouko 2015). In Kenya rural areas, most of these women groups are informal and relatively small in term of membership, averaging between five to fifty members contributing between one pound to seventy pounds a month. Membership in this groups consist of less literate people with little knowledge of financial management and investments. With this limitation, the funds contributed every month will lay idle until they have enough funds to undertake whatever investments they are set to pursue.

Many these rural women groups are specifically formed to improve the financial status of the members and they have limited investment opportunities and knowledge, a partner that can bridge this gap is of immense value. At Utopian, a company licensed to produce seed potato, we meet this women group and educate them about potato farming. We encourage them, instead of having the contributed funds just lying idle, they invest in our potato farming business and we guarantee them a minimum return of 10% quarterly.

Since the inception of this program, we have been able to onboard thirty-six women groups with membership between nine and forty-nine women. Out of this number, eleven women groups have already ventured into potato production on their own and their living standard greatly improved. Furthermore, 2 women groups have requested us to be sending their interest earned monthly as a motivation for them to save more. Growth of this project is clear as we have witnessed six more women groups being formed specifically to save and Invest in the potato value chain through Utopian.

P-062

Potato value chain enhancement in Kenya

Christopher Gasperi, Ashley Gasperi

FreshCrop, Nakuru, Kenya

Overview

FreshCrop invests in solutions to significantly increase potato production in Kenya (with expansion to Africa) by empowering farmers along the entire value chain using climate smart agricultural practices, contributing to increasing food security. To achieve this goal, FreshCrop carries out the following activities:

• Availing quality potato seeds to smallholder farmers. FreshCrop utilizes tissue culture/apical root cuttings for rapid seed multiplication and has established an out-grower system for multiplication of the seeds

• Continuous linkage of farmers to key service providers such as financial institutions, agro input dealers, mechanization and market linkages

• Training farmers on climate smart potato production practices to increase their production, profits, and cushion them on climate change impacts via a 'train the trainer' (ToT) model.

FreshCrop has established hubsites with outgrowing schemes in 3 counties, produced 3,000+ tons of certified Irish potato seeds, trained 2,000+ small holder farmers on climate smart potato production via on ground demo sites (80) led by a FreshCrop ToT, and leveraged economies of scale within the FreshCrop network to secure markets and financing. In the past year FreshCrop has increased efficiency by implementing partial mechanization into planting, harvesting and sorting of potato seeds. FreshCrop also utilizes climate smart agricultural practices such as solar powered irrigation, integrated pest management and water management. FreshCrop is planning to expand into value addition of chips processing in the near future to offer even more secure markets and stabilize prices for its farmers. FreshCrop's model is inclusive and promotes quality while including all actors along the value chain and most importantly small holder farmers.

P-063

National situation analysis of the potato sub-sector in Burundi, a partner State of East African Community (EAC)

Pierre Nintije[1], Fidele Gahungu[2]

[1]CAPAD, Bujumbura, Burundi. [2]ONCCS, Gitega, Burundi

Overview

In Burundi, potato is among the most important food and income generation crops (6th position). In the last five years, seed potato production has increased from 244 MT to 1226 MT with the increase resulting from expansion of acreage under potato rather than from improved productivity. This indicates that innovations and new technologies such as high-quality seed potato, new varieties and good agricultural practices have either not been adopted or adoption has failed to reach the necessary threshold to increase productivity in the subsector. Low productivity and limited rate of use of quality seed potato by less than 8% of farmers remained key bottlenecks in Burundi.

At the same time with other East African Community (EAC) member States, the study conducted in Burundi analyzed the current potato situation, quantified the seed potato gap and identified key challenges with the participation of the main seed potato actors. The study also highlighted the areas of recommended interventions for improved seed potato production and trade. From the findings, strategies have been proposed in order to improve seed potato production and trade in Burundi as well as in EAC partner States. Two strategies have been developed so far for the overall EAC Partner States: (i) The EAC gender strategy (2021-2026) and (ii) the EAC potato strategy and action plan (2021-2031). The study also identified the challenges which are likely to affect seed potato trade and the ways to overcome them. One of the main actions is the implementation of harmonized seed regulations to allow seed potato trade within the EAC partner States.

P-064

Development of a multi stakeholders value chain as a model of sustainability: The case of national potato multi stakeholders and investors platform Nigeria.

Steve Bawa, Sarah Kwarpo

National Potato Multi stakeholders and investors platform Nigeria, Jos, Nigeria

Overview

Despite the global importance of potato as one of the most important food crops and in spite of Nigeria's great potential for its production, it is not a priority crop in Nigeria. Only a fraction of the country's requirement is produced locally due to the following:

- Fragmentation of actors with uncoordinated activities
- Low investment by private sector and inadequate financing
- Low value addition and limited agribusiness activities
- Low yields, high disease incidences, lack of suitable varieties and inputs
- Limited production, distribution and lack of high-quality seeds
- Non-compliance with regulations, contracts and standards
- Poor marketing infrastructure

The National Potato Multi-stakeholders & Investors Platform ('The Platform') was registered as a non-profit non-political group on February 7, 2020 as an umbrella organisation for all stakeholders and actors in the potato value chain in Nigeria to help ameliorate the above issues. The aims and objectives of the platform as follows:

- to transform the potato sector in Nigeria into a viable and sustainable industry for income generation, employment and nutrition security.
- to create a platform for information management and experience sharing and capacity building for the various value chain actors.
- to promote best practices for quality standards, improve productivity and enhance value addition in order to thrive in local, regional and global markets.
- to ensure and enhance the welfare of all members

Membership of the Platform is open to the public and private sectors, non-government organisations, bilateral agencies and individuals. As part of its support for activities of stakeholders, the Platform in conjunction with GIZ, Agfin, Sterling Bank and Fruits & Veggies signed an MOU and organised the first seed multiplication scheme in February 2021.

The Platform is collaborating with GIZ, CIP and Fruits & Veggies on the use of Rooted Apical Technology (RAC) to produce seeds locally which will lower cost, make seeds available and provide more varieties.

P-065

The Good Potato Initiative

Humphrey Mburu, Carol Valentine

Sereni Fries, Nairobi, Kenya

Overview

In Kenya, potato farming has not been fully embraced as an agribusiness. The crop is majorly grown for subsistence uses and not as a cash crop. This reluctance may be attributable to failures that have occurred due to poor production practices, rainfall failure and gaps in the potato value chain. For a long time, there has been no government regulations and interventions towards the value chain to protect the different players especially farmers who have been exploited by middlemen making ware potato farming unsustainable.

In an effort to develop the potato value chain, a private Kenyan company, Sereni Fries developed a business model championing collaboration with local ware potato small holder farmers. They play an active role of onboarding and training the farmers on climate smart agriculture (CSA) and GAPs to beat snags in land preparation methods, incorrect use of farm inputs, inappropriate use of pesticides, and lack of adequate and timely weather information. Sereni has been engaging directly with farmers through their groups and in partnership with key sector stakeholders including the Kenya Plant Health Inspectorate Services (Kephis), and Kenya Agricultural and Livestock Research Organization (KALRO) and National Potato Council of Kenya to offer requisite training in these areas.

Sereni then contracts the trained farmers to grow the preferred ware potato variety. With assured year-round (ware potato bought and stored in our cold storage) quality and quantity potato supply, we concentrate on adding value to the ware potato by processing, marketing and selling quality; fresh cut potato products, potato crisps and soon the frozen fries product.

We are actively committed to government lobbying and often holding consultative meetings with the different players in the potato value chain that will see Irish potato become a valued cash crop in our country and in neighbouring regions.

P-066

Creating efficiency in input ordering, extension and market linkages

Gladys Kahindo

Viazi Kings Limited, Nairobi, Kenya

Overview

Initiative Objective

Low potato productivity and poor quality continue to persist mainly because farmers lack sufficient information on recommended inputs, effective application regimes and proper crop management practices. In addition, limited storage facilities, lack of collective marketing, and weak linkages to markets have led to high transaction costs and low farmer bargaining power. Farmers also package the potato in mixed varieties and different sizes which lowers the quality of potatoes and makes them unsuitable for processing and specialized utilization. To address the challenges, the initiative aims at aggregation and collective procurement of inputs, reduced transaction costs through provision of logistics services in input delivery to farmers and ware potato delivery to markets, as well as provision of extension services for increased productivity and profitability.

Activities & Progress

The company (Viazi Kings) is working with the National Potato Council of Kenya through an e-commerce ecosystem known as Viazi Soko in procurement and distribution of inputs. From that system, a total of 900 farmers from all potato producing counties purchased 170.5 tonnes of certified seeds in 2021. Provision of logistics services at reduced costs has positively impacted the postharvest management process. Contract farming has greatly benefitted potato farmers because of reliable markets and better prices. Through that 300 farmers have been supported to date with a target of 5,000 farmers in the next two years. Conversely, Viazi Kings has benefited through consistent supply of quality potatoes and in the required quantities.

Impact

The distribution of quality certified seeds has led to increased yields per ha and reduction in disease risk. About 5,000 farmers have been supported to sell their produce leading to increased profitability and a reduction in market unavailability. Employment opportunities have been created in; aggregation, sorting and grading of potatoes and majority of potato farmers can now access quality inputs and use them appropriately with minimal wastage.

P-067

Challenges and opportunities for the potato sector in the Andean region in the context of COVID-19

Andre Devaux[1], Miguel Ordinola[2]

[1]International Potato Center (CIP), Louvain-la-Neuve, Belgium. [2]International Potato Center (CIP), Lima, Peru

Overview

Food security in the Andean region depends largely on small family farming representing around 70% of food resources such as milk and dairy products, potatoes, legumes and vegetables. The COVID-19 pandemic, which has spread rapidly and widely around the world since early 2020, has had profound implications for food security and nutrition, especially in the most vulnerable segments of the population.

The poster will first illustrate the evolution of the potato production sector in the Andes in the last decades showing an increase, mainly in Peru and Colombia, while in Bolivia, Ecuador and Venezuela, production did not show significant changes. It will then analyze the effects of COVID-19 on the potato value chain and its actors as well as the consequences of the pandemic on the food security of producer families.

The analysis of the situation in potato-based systems shows that on average there was no significant decrease in potato production due to COVID-19. However, problems related to marketing of potato products were observed. They were mainly related to difficulties in product transportation, lower sale price and lower income for the value chain actors. These negative effects on the producers' incomes have worrying implications first for the profitability of the crop that may influence the effective continuation of family farming production and future planting decisions. Secondly, the income reduction affected the food security of producer families, reducing dietary diversity and increasing cheap staple foods consumption with effects on malnutrition.

The COVID-19 crisis highlighted the problems of family farming and the high vulnerability of producers because their main products such as potatoes are perishable, they do not have alternative marketing circuits, they lack storage and distribution infrastructure, and processing is not yet widespread. It is necessary to promote a more dynamic and innovative sector that responds effectively to challenges and opportunities.

P-068

Private Seed Sector Development in Burundi

Astere Bararyenya[1], Ernest Vyizigiro[1], Gilbert Buhanza[2,2], Simbashizwubwoba Cyriaque[2]

[1]Institut des Sciences Agronomiques du Burundi, Bujumbura, Burundi. [2]IFDC, Bujumbura, Burundi

Overview

The Private Seed Sector Development (PSSD) project is a market systems project that aims to increase the production and incomes of 178,000 farmer households in Burundi. The project works with private and public sector partners to promote the development of a private sector-led seed industry that is able to provide farmers with sustainable access to high-quality seed and agricultural advisory services. Funded by the Embassy of the Kingdom of the Netherlands in Burundi, PSSD activities run from 2018 to 2022. The project incentivizes and supports Burundian and international seed companies to pilot innovations related to seed production and sales. The project focuses on the development of sales strategies that are tailored to farmer household requirements, including: the sale of seeds in micro-packs, the development of last-mile distribution capabilities such as rural points of sales and mobile sales agents, micro-demonstration plots and consumer education-focused communication strategies tailored to farmers. PSSD furthermore supports initiatives to improve the business-enabling environment to foster the development of a private sector-led seed industry in Burundi. Its work include: strengthening of the Burundian national seed producer association; facilitation of dialogue between public and private sector stakeholders on seed sector-relevant regulations in order to promote policy and regulatory coherence; and promotion of seed distribution strategies that help, rather than hinder, the development of a private sector-led seed industry in Burundi. Results so far include a vibrant seed business in cereal sector, a large minituber production enterprise, an increased number of professional seed entrepreneurs and a high-income generation across seed entrepreneurs and a more organized seed industry in Burundi.

P-069

Improving food security and economic empowerment for smallholder farmers in Africa

Charles Shem[1], Christine Murphy[2], Solomon Kebede[3], Esvenia Viola[4]

[1]Action on Poverty, Nairobi, Kenya. [2]Action on Poverty, Sydney, Australia. [3]VITA-Ethiopia, Addis Ababa, Ethiopia. [4]United Purpose Mozambique, Maputo, Mozambique

Overview

Project /Initiative Objective:

The project aims to improve food security through the sustained productivity of the local potato industry, and to increase farmers' income through value chain and business development. The project is being implemented in Ethiopia, Malawi and Mozambique.

Activities & Progress:

Activity 1. Improving access to locally produced potato to quality seed of improved varieties

Progress: The project has developed best practice systems that enable market-driven systems to emerge, based on local quality assurance systems.

Activity 2. Improving nutrition and food security through increased productivity and consumption of farmers for potato

Progress: The project has promoted the use of quality seed and good farming practices resulting in increased yield. Increased yields have contributed to enhanced food security and reduction in hunger months amongst targeted beneficiaries

Activity 3. Improving farmer incomes arising from improved and diversified market access for potato

Progress: The project has enhanced the capacity of farmers to generate income from sale of surplus produce by organising cooperatives/groups/individual farmers to access potential markets. It has provided skills for farmers to analyse markets and facilitated linkages to those markets.

Impact:

Improved food security: The project contributed to improved food security through a reduction in hunger months of target communities of between 1.1 to 2.9 months.

Increased yields: Potato yields have increased to of 20-25 tons/ha which is double or triple what farmers were producing previously

Increased incomes. Farmers have increased their incomes by an additional AUS$150-AUS$300 mainly due to increase to improved yields and better prices obtained from selling improved varieties.

P-070

Strengthen certified organic production of native potatoes and potato products through sustainable technologies that allow adaptation to climate change in the potato chain in Ecuador

Lieve Van Elsen[1], Glenda Azucena Ocaña Ocaña[2], Luis Abelardo Montesdeoca Medina[2]

[1]Trias, Riobamba, Ecuador. [2]Agropapa, Ambato, Ecuador

Overview

With this project, Trias, AGROPAPA and private company Waltson will:

- validate and disseminate newly developed, innovative climate-smart agricultural techniques among the smallholder farmers of AGROPAPA.

- strengthen producers' capacities in product development and added value creation and generate competitiveness within a framework of equity and sustainability.

These objectives will be realised by the following actions:

1. Generate added value through the production of native organic potato snacks. Improving the quality of these products together with national and international partners (including private companies) to answer the demand of national and international markets. Identifying commercial opportunities in differentiated markets and how to approach them.

2. Development of training programs in integrated potato crop management by Trias and AGROPAPA. Training of potato producers in organic production and its certification standards. Elaboration of manuals for organic potato production. Eliminate the use of toxic agrochemicals, incorporate environmental techniques, define which products can be used and validated. Training of and outreach towards 400 people.

3. Generate networks and alliances with national and international public actors, private actors and between potato producing organizations to expand knowledge, share expertise and develop new markets.

The intended impact:

- Increase income for 70 farmers and their families through added value on potato products and development of new, fair-trade markets.

- Increase food security in the Tungurahua Province by product diversification and quality improvement.

- Positive environmental impact through climate change mitigation and climate-smart agricultural techniques.

P-071

Socio-economic strengthening of the rural communities of Huancavelica through organic production and fair trade

Lieve Van Elsen[1], Maria Avila Quilca[2], Silvestre Quispe Clemente[2]

[1]Trias, Riobamba, Ecuador. [2]Agropia, Huancayo, Peru

Overview

In this project, Trias and AGROPIA promote sustainable agri-food systems by improving the organizational, commercial and productive roles of AGROPIA, with ethical, environmental and gender equity criteria.

We try to reach this objective by the following activities:

1. Training and capacity building activities for the members of AGROPIA in good agro-ecological practices, community leadership, cooperativism and administration, with the objective of strengthening the competitiveness and quality of the products produced in the cooperative and increasing the livelihoods and sustainability of crops for AGROPIA's member farming families.

2. Training to institutionalize gender equity and youth inclusion and to work on the self-esteem and entrepreneurial capacities of the members.

3. In terms of production, activities will take place to improve post-harvest handling and product storage. In addition, the project proposes technological investments and infrastructure improvements.

4. Commercially, progress should be made through the presence of the cooperative in national and international fair-trade markets and the improvement of administrative and accounting management tools.

5. In the area of climate change resilience: implement diversity in production, adaptation and mitigation measures. Conservation of moorlands.

Intended impact:

- This project will impact in a direct way the members of the cooperative AGROPIA: 120 smallholder potato farmers (45 men and 75 women). Because of more and more sustainable production of potatoes, combined with better entrepreneurial skills and infrastructure improvements, they will enjoy a more stable and increased income. This will benefit, in total, 600 people (the family members).

- In an indirect way, this project will contribute towards more food security for the 17 communities where AGROPIA operates, and - through the CSA-practices - to climate change mitigation.

P-072

Impact of Ethiopian Potato Improvement Program on livelihoods improvement of smallholder farmers in Gamo, Ethiopia

Solomon Kassahun[1], Tadele Kodo[2]

[1]Vita, Addis Abeba, Ethiopia. [2]Vita, Arba Minch, Ethiopia

Overview

Vita's potato program in Ethiopia aims to realize the full economic and food security potential of potatoes through intra-linked objectives: Developed systems and enterprises for quality seed production; ensure adoption and scale-up of innovative climate-smart models & practices, and maximized knowledge transfer using the Potato Coalition to establish a strategic and innovative partnership. The community-based seed multiplication system established under the project brought a huge impact to the target and surrounding farmers

Availability, quality, accessibility, and affordability are the main factors that affect the uptake of improved seeds. In order to get seed into the hands of smallholder farmers, projects have increasingly supported initiatives to set up successful farmers' seed enterprises based on a community-based cooperative seed multiplication system owned by farmers. The main source for basic seed for the seed multiplier cooperatives are local research institutes that have limited capacity to provide the required amount of basic seed to the coops. The Ethiopian Potato Improvement Program supports the seed multiplier cooperative to involve in early generation seed multiplication system in the screen houses.

The poster shows the impacts brought as a result of the Potato Improvement Program including:- Potato farmers enabled to have better access to improved agricultural technologies (improved potato seed and technical knowhow); average productivity increased from 8-12 tonnes/ hectare to 20 tonnes/ha; food security of target households improved; and farmers' capacity to engage in early generation seed multiplication improved through project support and strong linkage created with research institutes.

P-073

Partnerships for development: How a Belgian company and NGO step in to combat hunger and climate change with Ugandan smallholder potato farmers

Tine Vanhee[1], Eva Verbist[1], Brian Pimundu[2], Ana Odubi Orwotho[2], Filip Wallays[3]

[1]Trias, Brussels, Belgium. [2]Zodfa - Zombo District Farmers' Association, Zombo, Uganda. [3]Agristo, Wielsbeke, Belgium

Overview

In the Western part of Uganda, in West Nile subregion, the farmers organisation ZODFA has been seeking to make improvements in the value chain of Irish potatoes. Supported by the Belgian NGO Trias, they have already succeeded in better organising the farmers, involving more women and youth, and increasing productivity in the field. In recent years, climate change has further aggravated the challenges: the prolonged droughts and erratic rain patterns lead to pronounced soil erosion, reduced soil fertility, reduced crop yield and floods. More recently, the Belgian company Agristo has joined forces with Trias and the ZODFA in Western Uganda to combat hunger and tackle climate change.

Agristo, is an international potato processing company, with in-depth expertise in Irish potatoes. It will provide ZODFA with technical advice to improve productivity, applying Environmental Smart Techniques which increase soil fertility and aid retention of water as well as providing support in access to high quality seeds, aiming to increase the production of healthy potatoes by at least 50%. Improved storage facilities will furthermore reduce post-harvest loss and increase the availability of fresh potatoes throughout the year. Trias will work on the technical and financial sustainability of the farmers organisation, and will build the resilience of the farmers to climate change.

The results from this collaboration will be disseminated throughout the network of Agricord, a global network of 14 agri-agencies, reaching out to over 600 farmer organisations worldwide. The concerns of the potato farmers will be elaborated and well formulated in workshops, and Trias will assist ZODFA in bringing them to the attention of the local, national and regional political level. Through this speaking opportunity, Trias and Agristo want to inspire and motivate for more global, trans-sectoral cooperation to address local challenges.

P-074

The potato of the future: Opportunities and challenges in sustainable agri-food systems

André Devaux[1], Jean-Pierre Goffart[2], Peter Kromann[3], Jorge Andrade-Piedra[4], Vivian Polar[5], Guy Hareau[4]

[1]International Potato Center (CIP), Louvain-la-Neuve, Belgium. [2]Walloon Agriculture Research Center, CRA-W, Gembloux, Belgium. [3]Field Crops, Wageningen Plant Research, Wageningen University & Research, Lelystad, The Netherland, Wageningen, Netherlands. [4]International Potato Center (CIP), Lima, Peru. [5]International Potato Center (CIP), CGIAR Research Program on Roots Tubers and Bananas, Lima, Peru

Overview

In the coming decades, feeding the expanded global population nutritiously and sustainably will require substantial improvements to the global food system worldwide. The main challenge will be how to produce more food with the same or fewer resources and waste less. Potato, being the third most important food crop after rice and wheat, can contribute to food security worldwide due to its highly diverse distribution pattern, current cultivation, and demand, particularly in developing countries with high levels of poverty, hunger, and malnutrition.

This poster is based on a recently published paper in Potato Research. It uses the agri-food systems approach making a distinction between two contrasting stages of food system evolution, rural and industrial food systems, to analyze the potato contribution to global food security. The research and innovation approaches considered to improve the performance of rural and industrial agri-food systems, in both developed and developing countries, should contribute to promote research options that allow for increased output quantity and quality, while considering agriculture's environmental impact, preserving land and other resources. A summary of the innovation options analyzed will be presented. Potato research and development approaches should be multidisciplinary to allow integration of knowledge rather than focus on a single technology development.

There is a dichotomy between potato-based rural- and industrial-based agri-food systems that will be illustrated in the poster stimulating a reflection about the challenges for sustainable potato cropping enhancement considering the needs to increase productivity in rural-based potato food systems while promoting better resource management and optimization in industrial-based agri-food systems. Locally adapted research and innovation pathways are mandatory as well as identification of potential synergies through scientific and technical knowledge transfer among the different agri-food systems to speed up the innovation process.

P-075

Improving capacities of small holder farmers in climate-smart seed and ware potato production and value chain development Njombe, Tanzania

Faraja Maguhu, Ernest Ng'umbi

NADO, Njombe, Tanzania, United Republic of

Overview

Tanzania is the one of the top five (Malawi, South Africa, Rwanda, Nigeria and Tanzania) producers and consumers of potatoes and potatoes products in sub–Saharan Africa. In the area where they are grown, potatoes are among the leading cash crops for smallholder farmers. For example, over 80% of the potato grown are sold for cash income compared to 40-50% of other crops. Potatoes are also providing calories and nutrition to nearly 350,000 smallholder farming households and millions of urban poor in cities and town in Tanzania. A baseline survey (2017) conducted in southern highland regions (Njombe, Iringa and Mbeya) shows 79% of smallholder farmers were using own saved seeds, had low yields of 10 MT /Ha, as well as 45% post-harvest losses, less adaptive to climate change, no potato storage facilities and an unstructured potato market. Local organisation NADO in collaboration with FFD (Food and Forest Development Finland) introduced a project to improve capacities of small holder farmers in climate-smart seed and ware potato production and value chain development in Njombe, Tanzania. The project empowers smallholder farmers through groups, demonstration plots and peer to peer approaches on utilization of good agronomic practices, use of quality declared seeds, positive selections, use of collective market system and good post-harvest handling practices. This has resulted in increased production of potato by 66% (30 MT/Ha), while income from potato has increased from 1,125,000 Tshs ($563) to 2,850,000 Tshs ($1425) per person per year, and 2% of smallholder farmers store seeds using light diffused store. One potato climate adaptation and mitigation tool has developed and utilized by farmers. To improve climate-smart seed and ware potato production it is recommended to extend utilization of good agronomic practices, use of quality declared seeds, improved storage technologies and collective market systems. Also, strong collaboration among all potato chain actors is highly encouraged.

P-076

Looking backward to find a path forward for the sustainable flow of suitable potato varieties to Eritrean potato farmers

Monica Gorman[1], Fitsumberhan Ghebremeskel Ghebreagziabiher[2,1], John Burke[3], Paul C. Struik[4], Denis Griffin[3]

[1]University College Dublin, Dublin, Ireland. [2]National Agricultural Research Institute, Halhale, Eritrea. [3]Teagasc, Carlow, Ireland. [4]Wageningen University and Research, Wageningen, Netherlands

Overview

Potato is a cash crop for growers and a high nutritional value food crop for consumers in Eritrea. The lack of a sustainable flow of suitable potato varieties is a major contributing factor to the low productivity and production of potato in Eritrea. This study examined the history of potato variety introductions to identify weaknesses, a path forward and enable the sustainable flow of suitable potato varieties to potato farmers. The research approaches included: reviewing the history of potato variety introductions to Eritrea, consultation with local and international stakeholders, and a survey assessing potato variety preference. Over 70 varieties of potato have been introduced and 14 varieties approved through the official system but with only three currently available. Many farmers rely on poor-quality seed from unofficial sources. The analysis led to the identification of priorities for improvement: strengthening research institutions to create networks for potato variety sourcing; strengthening local regulatory institutions to implement registration and release standards; engaging potato farmers in the variety evaluation process; considering Plant Variety Protection and Plant Breeders Rights when establishing potato variety conservation; designing maintenance and multiplication strategies and also allowing the private sector to participate in potato variety seed sourcing and distribution. These options could be the basis of a roadmap making improved potato varieties and seeds available to potato farmers in Eritrea. This research was funded by Teagasc, Ireland through the Walsh Scholarship program and Vita (NGO in Dublin, Ireland).

This abstract is based on the article: Ghebreagziabiher, F.G., Gorman, M., Burke, J., Struik, P.C and Griffin, D., 2021. Looking backward to find a path forward for the sustainable flow of suitable potato varieties to Eritrean potato farmers. International Journal of Agricultural Sustainability, Published online 24 December 2021, 1-15. https://Doi: 10.1080/14735903.2021.2016260.

P-077

Improving capacities of small holder farmers in climate-smart seed and ware potato production and value chain development Njombe, Tanzania

Ernest Ng'umbi, Faraja Maguhu

NADO, Njombe, Tanzania, United Republic of

Overview

Tanzania is the one of the top five (Malawi, South Africa, Rwanda, Nigeria and Tanzania) producers and consumers of potatoes and potatoes products in sub–Saharan Africa. In the area where they are grown, potatoes are among the leading cash crops for smallholder farmers. For example, over 80% of the potato grown are sold for cash income compared to 40-50% of other crops. Potatoes are also providing calories and nutrition to nearly 350,000 smallholder farming households and millions of urban poor in cities and town in Tanzania. According to baseline survey (2017) conducted in southern highland regions (Njombe, Iringa and Mbeya) shows 79 % of smallholder farmers were using own saved seeds which leads to harvest low yields of 10 MT /Ha, 45% post-harvest loses, less adaptive to climate change, no potato storage facilities and unstructured potato market. NADO in collaboration with FFD introduced the project with objective of improving capacities of small holder farmers in climate-smart seed and ware potato production and value chain development Njombe, Tanzania .The project empowers smallholder farmers through groups, demonstration plots and peer to peer approaches on utilization of good agronomic practices ,use of quality declared seeds ,positive selections , use of collective market system and good post-harvest handling practices, this resulted to increased production of potato by 66% (30 MT/Ha) , income from potato has increased from 1,125,000 Tshs ($563) to 2,850,000 Tshs ($1425)per person per year,2% of smallholder farmers store seeds by using light diffused store and 1 potato climate adaptation and mitigation tool has developed and utilized by farmers. To improve climate-smart seed and ware potato production it’s recommended to extend utilization of good agronomic practices, use of quality declared seeds, improved storage technologies and collective market systems. Also, strong collaboration among all potato chain actors is highly encouraged.

P-080

Participatory policy development is key to potato value chain development

Wachira Kaguongo, Henry Chemjor

National Potato Council of Kenya, Nairobi, Kenya

Overview

Supportive policies and strategies are very important in ensuring potato value chain development. A well-balanced and pragmatic strategy requires involvement and buy-in of relevant stakeholders. This is especially critical in a country like Kenya where the government is multi-layered, with national and county government departments each playing different roles in agriculture. The National strategy provides a roadmap for transformation of the potato industry in the country and it is used to inform development of the County potato strategies. County strategies in turn guide potato value chain development at the county levels through identifying opportunities and proposing solutions to emerging issues.

As the National Potato Strategy 2016-2020 approached expiry date the National Potato Council of Kenya (NPCK) lobbied for development of an updated National Potato Strategy 2021-2025, which would be informed by the National government's agenda (Big 4), which includes food and nutrition security. The advocacy led to a number of organizations in the industry committing resources, expertise and time to develop an up-to- date strategy. The government appointed an 11-member committee comprising of various stakeholders to develop the strategy and NPCK was given the responsibility of coordinating the strategy development activities.

A consultant developed a zero draft which was advanced to first, second and final copy through stakeholder meetings for inputs solicitation, validation and approval, respectively. The final draft was launched for adoption and implementation in a stakeholders' forum. Hard copies were distributed while electronic copies are available from NPCK's website: https://npck.org/national-strategy/

The strategy is expected to provide roadmap for potato industry growth, doubling potato's contribution to GDP in five years. It will be used to inform the development of the County potato strategies which offer a roadmap for the growth of potato value chain leading to improved incomes and welfare of potato farmers.

P-081

Rwanda Farmers Potato Academy

Joseph Gafaranga

Rwanda Farmers Potato Academy, PO BOX: 1462 Kigali, Rwanda

Overview

In Rwanda, Potatoes is the one of the most important crops and is one of the government's priority crops falling under the crop intensification program (CIP) which covers 50,000-60,000 ha (3.9%) of total cultivated land per each season and contributes to annual consumption per capita estimated at 145 kg. This crop is currently cultivated in several parts of the country (over 100,000 farmers) with a significant profitability and yield in a short quite production cycle of 3-4 months. However, potato sector is facing with various challenges and weakness such as: low production (12t/Ha) compared to a target of 30t/Ha, Limited knowledge of farmers on potato value chain (GAP, postharvest handling and processing, marketing, market standards and profitability), limited quantity of quality seeds (20%), High pressure of pests and diseases (Bacteriose, Virose, Mildiou), unfavourable weather and climate change, Continuous decrease of soil fertility due to poor rotation and limited use of organic matter. Rwanda Farmers Potato Academy is looking to use its integrated extension approach to contribute to increase knowledge of potato farmers and potato value chain actors into qualified potato professionals and assist farmers in improving their agronomic practices and access relevant information across the value chain to ensure the food security and increase the profitability and stimulate the ownership of stakeholders of potato value chain.

P-082

The use of volatile organic compounds to control postharvest potato diseases

Alan Malek, Katie Malek, Shelbie Anderson, Phillip Wharton

University of Idaho, Aberdeen, USA

Overview

Growers in Idaho produce about 7 million tons of potatoes valued at $1 billion annually, of which about 0.5 million tons ($73 million) are lost during storage to factors such as disease and shrinkage. Currently, few fungicides are registered for direct application to tubers for control of diseases in storage due to concerns about fungicide residue levels on potatoes. Many plant-derived volatile organic compounds are known for their antifungal properties and may offer an alternative to conventional fungicides. However, they have limited use because they diffuse rapidly after coming in contact with air. Previous research has shown that the anti-fungal plant volatile 2E-hexenal is highly effective in controlling potato pathogens in vitro. A preliminary large-scale trial in 2013 also showed that 2E-hexenal has excellent disinfectant properties, reducing levels of bacteria in infested soil from a potato cellar by a factor of 10. Between 2015 and 2017, large-scale storage trials were carried out to assess the efficacy of 2E-hexenal for controlling storage rot pathogens. Results showed, that on average, tubers treated with 2E-hexenal had 85% less pink rot (Phytophthora erythroseptica), Pythium leak (Pythium ultimum) and Fusarium dry rot (F. sambucinum) compared to non-treated tubers. These results suggest that 2E-hexenal is a commercially viable technology that has great potential for protecting potatoes from postharvest pathogens and reducing losses in storage.

P-083

Effect of pre-treatments and drying methods on physical and microstructural properties of potato flour

Ariel Buzera[1,2], Daniel Sila[2], Irene Orina[2]

[1]Université Evangelique en Afrique, Bukavu, Congo, the Democratic Republic of the. [2]Jomo Kenyatta University of agriculture and Technology, Nairobi, Kenya

Overview

The storability of freshly harvested potato tubers is short under tropical weather conditions. Drying is a common practice for preserving perishable food crops. Potato tubers are peeled, then dried using conventional or innovative drying technologies to make potato flour. These processes may cause several structural changes that may affect the physical and nutritional properties of the potato flour. This study evaluated the effects of pre-treatments (blanching (60°C and 95°) and boiling) and drying methods (freeze-drying and oven drying) on quality characteristics of potato flour derived from three potato varieties grown in Kenya, namely Shangi, Unica, and Dutch robjn. The percentage flour yield, color, particle size distribution, flow characteristic, and microstructural properties of the potato flour were determined. Unica recorded the least peeling loss, while Dutch robjn variety had the highest. The color parameters were significantly ($p<0.05$) affected by the pre-treatments and drying methods. Freeze-dried potatoes produced lighter flour ($L^*=92.86$) compared to the other methods. Freeze-dried potato flour had the smallest particle size (56.5µm), indicating poor flowability while boiling followed by oven drying had the largest particle size (307.5µm). Boiling and blanching at 95°C followed by oven drying recorded a low angle of repose and compressibility index indicating better flow characteristics. Microstructural results indicate that boiling followed by oven drying and blanching at 95°C followed by oven drying resulted in damaged starch granules while freeze-drying and low-temperature blanching (60ºC) maintained the native starch granule. Particle size and the solubility index of potato flour showed a strong positive correlation. This study revealed that the pre-treatments and drying methods affected potato flour's physical and microstructural parameters differently, resulting in changes in functionality and the potential food application.

P-084

Reduction of acrylamide contents in French fries by dipping in α-hydroxy acids before par-frying and glazing by dipping or spraying before freezing

Erik Slinde[1], Grete Skrede[2], Hans Blom[2], Anders Skrede[3]

[1]Faculty of Chemistry, Biotechnology and Food Science, Norwegian University of Life Sciences, 1433 Ås, Norway. [2]Nofima - Norwegian Institute of Food, Fisheries and Aquaculture Research, 1433 Ås, Norway. [3]Department of Animal and Aquacultural Sciences, Faculty of Biosciences, Norwegian University of Life Sciences, 1433 Ås, Norway

Overview

Acrylamide is produced from asparagine and a reducing sugar during frying and baking of potato products. Acrylamide is a neurotoxic and genotoxic compound, and reduced intake is of great importance. The present work was carried out to study effects of lactic acid and other α-hydroxy acids on acrylamide formation in French fries. French fries produced by dipping in a 0.4% α-hydroxy acid (lactic, malic, tartaric, citric, ascorbic acid) solution before par-frying showed a reduction in acrylamide of 40-60% depending on equipment and frying conditions. It is suggested that the inhibitory effect is due to formation of a 6-ring ester-acid amine between protonated α-hydroxy acid and free asparagine. A pH corresponding to the pKa of the α-hydroxy acid or lower appeared to be optimal. Dipping in α-hydroxy acid could be used also in the presence of SAPP and Ca-lactate. The highest efficiency was achieved by applying lactic acid in a two-step procedure with acid treatment both before and after par-frying. This process can be adopted to industrial conditions by dipping in an α-hydroxy acid solution after blanching and thereafter by submerging or spraying the par-fried French fries with an acid solution directly after the fryer. Mixtures of acids could also be used. No adverse effects of acid treatments on taste of the final product were detected. Glazing by dip or spraying of the French fries before marketing secure a low acrylamide content when the fries are finish-fried by the end user. The levels of acrylamide were confirmed to be below the current EU-recommended limit of 500 ppb. Thus, this technology will contribute to low acrylamide levels and reduced consumer exposure from French fries. An additional advantage for the producer is a weight increase of up to 5% depending on the equipment and glazing process used.

Details of interests

Inventor and shareholder in the company Zeracryl AS who own the patents rights to the technology

P-085

An innovative technology to reduce sprouting and ethylene-induced sweeting during postharvest potato storage - a mechanistic approach

M. Carmen Alamar[1], Roberta Tosetti[1], Gemma A Chope[2], Rosa Lopez-Cobollo[3], Colin G.N. Turnbull[3], Glenn J. B Bryan4[4], Andrew J. Thompson[1], Leon A. Terry[1]

[1]Cranfield University, Cranfield, United Kingdom. [2]PespsiCo International Limited, Leicester, United Kingdom. [3]Imperial College London, London, United Kingdom. [4]The James Hutton Institute, Dundee, United Kingdom

Overview

Maintaining dormancy and low reducing sugar content during postharvest potato storage has been heavily reliant on the synthetic chemical chlorpropham (CIPC), banned by the European Union in 2020 because of human health concerns. Potato ecodormancy can be extended by low storage temperatures and the application of continuous ethylene supplementation; however, these treatments can lead to cold- and ethylene-induced sweeting. The application of 1-methylclopropene and physiologically targeted ethylene application, can minimise the latter drawback, yet the underlying mechanisms are poorly understood. Herein we investigate how ethylene supplementation regulates dormancy transition by studying the temporal changes in plant growth regulators (*viz*. abscisic acid [ABA], auxins and cytokinins) in the apical meristematic tissue of genotypes from a diploid potato mapping population 06H1. Ethylene treatment caused a reduction in auxin content and a depletion of ABA, which increased at dormancy break. We also elucidate the mode of action (in parenchyma and cortex tissue) of the ethylene analogue and perception inhibitor 1-MCP in combination with ethylene as an alternative technology to extend ecodormancy in UK-grown processing potatoes. Ethylene delayed sprouting and increased reducing sugars, however, combining this with 1-MCP blocked the increase of reducing sugars (and associated respiratory burst), but not the delay in sprouting, showing that ethylene-induced sweetening can act independently from sprout suppression. We demonstrated that stored tubers adapt to ethylene supplementation by activating ABA catabolism, specifically by upregulating the expression of *CYP707A1*_a, encoding catabolic enzyme ABA 8´-hydroxylase; this results in lower ABA levels, but is negated by 1-MCP. It was also clear from transcriptome data that ethylene-induced sweetening and cold-induced sugar accumulation share the same underlying mechanism, i.e. a shift in the dynamic equilibrium between starch biosynthesis/breakdown, and the concomitant robust downregulation of the *Kunitz-type invertase inhibitor* expression; these transcriptome changes were also negated by 1-MCP.

Details of interests

No conflict of interests.

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P-086

Exogenous 1,4-dimethylnaphthalene and jasmonic acid treatments impact dormancy progression in potato tubers by altering phytohormonal biosynthesis and signalling pathways

Munevver Dogramaci[1], Sagar Datir[2], Fernando Finger[1,3], Dipayan Sarkar[2], Kalidas Shetty[2], James V. Anderson[1], Karen Fugate[1]

[1]United States Department of Agriculture - Agricultural Research Services, Fargo, ND, USA. [2]North Dakota State University, Fargo, ND, USA. [3]Federal University of Vicosa, Brazil, Brazil

Overview

Dormancy progression in potato tubers is a critical physiological factor affecting postharvest storage, nutritional quality, and market value. Tuber dormancy and sprout growth are dependent on genotype, environmental conditions during tuber growth, and conditions during postharvest storage. Cold storage (<7°C) can be effective for sprout control but generally reduces postharvest processing quality of tubers. Commercial facilities that store potatoes for the fresh market and processing usually use both cold storage (>8°C) and sprout inhibitors. However, the most commonly used sprout inhibitor (chlorpropham) has been under regulatory scrutiny, and its ban in 2020 by several countries prompted the search for alternatives and more benign methods. Various compounds have been proposed as alternative sprout control agents but their effects on molecular mechanisms regulating tuber dormancy or sprout growth are poorly understood. In this study, dormant Russet Burbank potato tubers were treated with 1,4-dimethylnaphthalene and methyl jasmonate alone or in combination. Tuber meristems were collected 0-21 d after treatments to determine changes in gene expression. Treatment of tubers with these sprout inhibitors caused significant changes in abundance of transcripts involved in cell cycle processes, and phytohormone biosynthesis and signalling pathways. Abundance of transcripts involved in ABA catabolism were increased, while the abundance of transcripts involved in cytokinin biosynthesis and signalling were decreased. Likewise, changes in abundance of transcripts involved in biosynthesis, metabolism and signalling of gibberellic acid, ethylene, jasmonic acid and salicylic acid pathways were observed in response to these treatments. Moreover, biochemical assays helped to elucidate the involvement of pathways associated with critical endogenous defence responses in treated tubers. Understanding how sprout inhibitors impact molecular mechanisms in tubers should help to identify rate limiting steps and new targets for developing novel postharvest management strategies.

P-087

Individual ambient ware potato storage excels in Uganda

Pieter Wauters[1,2], Monica Parker[3], Diego Naziri[4,5], Alice Turinawe[6]

[1]International Potato Center, Kampala, Uganda. [2]Centre for International Migration and Development, Eschborn, Germany. [3]International Potato Center, Nairobi, Kenya. [4]International Potato Center, Hanoi, Vietnam. [5]University of Greenwich, Greenwich, United Kingdom. [6]Makerere University, Kampala, Uganda

Overview

Potato is a key food and cash crop in Uganda, mainly produced by smallholder farmers in the southwestern and eastern highlands of the country. The major production periods are March-July and September-January. National potato production has steadily grown over time to respond to an increasing demand and consumption. Ugandan potato farmers sell majority (≈60%) of their production immediately after harvest. Roughly 30% of the harvested potato is stored as food for later consumption by the household and as seed for planting in the next cropping season. Only a few farmers store small quantities of potato for later sale as ware potato, predominantly in traditional light storage facilities. Due to seasonally fluctuating market prices, most Ugandan potato farmers miss the opportunity to sell at higher price later in the season when potato supply in the market is scarce. To promote potato storage for later sale, improved ambient ware potato storage units were introduced and evaluated in Uganda. Both individual and group stores with a storage capacity of 8 and 50 tonnes, respectively, were piloted. Improved ambient stores ensure that potatoes are kept in the dark and are made from locally available materials. They can maintain marketability of stored potato for up to 3 months by taking advantage of cooler temperatures at night. Only a few of the group storage units generated profits. Furthermore, all of them appeared to present several challenges typical of collective action endeavours. The individual units, however, performed very well with an average payback period of 3-4 years that could even be reduced to less than one year if these stores are used at full capacity. Due to their characteristics, improved individual ambient ware potato stores thus seem to be particularly suitable to increase substantially the income of potato farming households.

P-088

Cold storage, reconditioning and CO_2

Pia Heltoft[1], Erlend Indergård[2]

[1]NIBIO, Ås, Norway. [2]SINTEF Ocean AS, Trondheim, Norway

Overview

Acrylamide has become an important measure when looking at profitability and sustainability in the potato processing industry. Acrylamide is a possible carcinogenic which is formed in starchy foods during high-temperature cooking processes. Crisps and French fries made from processing potatoes are consumed by people of all ages and therefore the pressure on the industry has been large to reduce the acrylamide levels. In the ongoing project POTETFRIT (2019-2022), the aim is to reduce acrylamide content and improve product quality profitability and sustainability in the production of Norwegian crisps and French fries. The aim will be reached through new knowledge about the interaction between potato quality and storage conditions. The effect of different temperature strategies including cold storage (5 ^{o}C) and reconditioning at 15 ^{o}C was tested in eight different varieties (Lady Claire, Kiebitz, Pirol, Lady Britta, Peik, Innovator, Zorba and Gullflaks). The importance of elevated CO2 levels in the potato store on product quality and acrylamide content, was studied in the same potato varieties and in tubers with different maturity levels. Storage conditions in 29 commercial potato stores was also studied, with attention to temperature conditions and CO2 levels in different stages of the storage season. The effect of different ventilation strategies was also studied. So far results show that the varieties L. Claire, Kiebitz and Gullflaks can be stored at low temperature levels without developing high sugar and acrylamide levels and dark fry colour and at the same time keeping sprouting at a low level. In the CO2 trials, none of the varieties tested showed elevated sugar and acrylamide levels when exposed to high CO2 levels (15000 ppm) and also in the commercial stores there was no correlation between high CO2 and high sugar levels.

P-089

Potato production and storage response to in-field heat stress in the Pacific Northwest of the United States of America due to changing weather patterns.

Jacob Blauer, Morgan Southern, Mark Pavek, Connor Buckley

Washington State University, Pullman, USA

Overview

Many factors affect potato crop yield and storage potential each year. While potatoes are best suited for temperate environments, global changes in weather patterns, especially heat events, threaten traditional farming practices due to the timing and intensity of heat stress. During 2021, "heat domes" were measured in the northwest of the United States of America with temperatures reported as high as 48°C in critical production areas. Additionally, peak heat was reached in early July as opposed to the historic average of late July and the seasonal onset of heat began as early as May. Altered timing of heat stress increases the risks of malformed tubers, sugar ends, and poor postharvest sugar maturity, which was observed this past season. Two field trails were evaluated in 2021. The first measured the impact of planting timing on maturity and the second profiled crop maturity indices as it related to genotype and environmental response. We observed that heat significantly impacted all metrics of production with variation dependent upon the developmental stage with the associated heat stress. Generally, three days of extreme heat resulted in an inhibition of tuberization causing a 60% reduction in yield. Sugar partitioning was also impacted with an approximate 20% reduction in specific gravity post heat stress, though plants were able to recover throughout the remainder of the season. Finally, postharvest process color at harvest was approximately 20% darker compared to the previous year. A 35-year historic evaluation of Russet Burbank performance demonstrates the 2021 season had the worst year for shape and fry color. Surveys among growers and major industry processors revealed similar results with concerns about sugar ends and future seed performance. This research improves understanding of heat stress timing and intensity in production systems and gives greater clarity on best grower management practices to mitigate heat stress.

P-090

Nutritional value of potato in hot climates – alterations in the composition of health-related components

Idit Ginzberg

Agricultural Research Organization, Volcani Institute, Rishon LeZion, Israel

Overview

Potato breeding for improved nutritional value focuses mainly on increasing the health-promoting carotenoids and anthocyanins, and controlling toxic steroidal glycoalkaloid (SGA). Metabolite levels are genetically determined, but developmental, tissue-specific and environmental cues affect their final content. Transcriptomic and metabolomic approaches were applied to monitor carotenoid, anthocyanin and SGA metabolite levels and their biosynthetic genes' expression under heat stress. The studied cultivars differed in tuber flesh carotenoid concentration and peel anthocyanin concentration. Gene expression studies showed heat-induced downregulation of specific genes for SGA, anthocyanin and carotenoid biosynthesis. KEGG database mapping of the heat transcriptome indicated reduced gene expression for specific metabolic pathways rather than a global heat response. Targeted metabolomics indicated reduced SGA concentration, but anthocyanin pigment concentration remained unchanged, probably due to their stabilization in the vacuole. Total carotenoid level did not change significantly in potato tuber flesh, but their composition did. Results suggest that growth in hot climates selectively alters tuber secondary metabolism, changing its nutritive value and composition of health-promoting components.

P-092

Establishing a foundation breeding population and associated genomics tools to develop value-added potato varieties for sub-Saharan African agroecologies.

Zeratsion Abera Desta[1], Denis Griffin[1], Susan Otieno[2], Moses Nyongesa[2], Thiago Mendes[3], Dan Milbourne[1]

[1]Teagasc, Carlow, Ireland. [2]Kalro, Tigoni, Kenya. [3]CIP, Nairobi, Kenya

Overview

Developing climate resilient potato value chains is an important goal for future food security and socio-economic wellbeing worldwide. This goal requires understanding of both current and future scenarios and relations in the potato value chain, proposed actions and interventions, and resources to undertake them. The CRRIsP project aims to a develop a toolbox, and pilot several potential elements of this for current and future climatic conditions for the potato sectors along a longitude line from Northern Europe to Southern Africa.

Breeding novel varieties exhibiting traits that enable them to deal with adverse conditions is a powerful approach for dealing with climate instability. However, when addressing the whole value chain, it is important to combine resilience traits with those that have the potential to “add value” for various actors along the chain. A major goal of CRRISP is to develop useful resources to address a specific problem in “whole value chain breeding” in Kenya and similar sub-Saharan African (SSA) regions,

Through the CGIAR Excellence in Breeding (EiB) Platform, KALRO, CIP, and the Kenyan potato seed industry have identified the need for a white skinned, early maturing, mid-dormancy processing potato with resistance to blight, PCN and bacterial wilt, (preferably with drought/heat tolerance). Processing potatoes are a higher value crop, and extend the value chain by supporting downstream economic activity involving processed products. As part of the CRRISP project, we will develop a “starter” breeding population that targets the ideotype described above by combining quality and resistance traits from European varieties with adaptation traits from varieties grown in Kenya. Simultaneously, we will develop low-cost genomic tools to support rapid development of future target ideotypes, whilst developing a template for the collaboration of commercial breeders, NGOs and national research institutes to address the goal of equitable benefit sharing.

P-093

Advances of the Embrapa potato breeding program aiming tolerance to heat stress

Caroline Castro[1], Arione Pereira[1], Giovani Brito[2], Carlos Reisser Júnior[1], Beatriz Emygdio[1], Gustavo Heiden[1], Leonardo Dutra[1], Giovani Olegario da Silva[3], Agnaldo Carvalho[3], Carlos Lopes[3], Guilherme da Silva Pereira[4], Janni Haerter[1], José Faustini de Oliveira[1], Fernanda Azevedo[1], Juliana Coradin[1], Raquel Kneib[5,1], Daiana Wolter[5,1], Ruth Guzmán[5,1]

[1]Embrapa Temperate Agriculture, Pelotas, Brazil. [2]Embrapa Cotton, Campina Grande, Brazil. [3]Embrapa Vegetables, Brasília, Brazil. [4]Federal University of Viçosa, Viçosa, Brazil. [5]Federal University of Pelotas, Pelotas, Brazil

Overview

The Brazilian Agricultural Research Corporation (Embrapa) coordinates a national potato breeding program, as well as hosting the potato genebank. Under its scope, the research activities aim to develop varieties adapted to high temperature and low thermal amplitude conditions of the tropical and subtropical regions of Brazil. To achieve this goal, since 2015, several studies were developed aiming to establish environmental conditions to assess heat tolerant potato germplasm, as well as to identify physiological and morphoagronomic traits associated with heat tolerance. Studies were conducted in growth chambers using a chlorophyll fluorometer (IMAGING-PAM) to reveal the effect of supra-optimal temperature on morphophysiological traits associated with tuber yield and to explore the use of non-invasive phenotyping methodologies as a tool to select heat tolerant genotypes and to uncover the genetic variability for adaptation to supra-optimal temperatures maintained in the Embrapa potato genebank. Our results showed that the temperature did not influence the induction to the tuber initiation stage. However, it extended the period for plant emergence and reduced tuber yield and quality. A methodology for a rapid and non-destructive selection of heat tolerant potato germplasm was established, based on changes of physiological parameters. So far, 24 potato genotypes were evaluated under severe heat stress, control (14 to 27°C) and supra-optimal (24 to 34°C), and 65 clones under moderate stress (19 to 29°C). Important genetic variation was found to be used on germplasm improvement. Next activities will include developing and genotyping multi-parental populations, aiming to incorporate genomics-assisted selection into the routine of the breeding program. All these research activities have been contributing to Embrapa's potato breeding program for the development of successful varieties, which have gained space in the Brazilian market, until recently, supplied almost entirely by imported genetic material.

P-094

Agri-food systems approach for the valoration of biodiversity: the case native potatoes

Miguel Ordinola, Oscar Ortiz, Hugo Campos

International Potato Center, Lima, Peru

Overview

In Peru, potatoes are the main crop of the highlands and small producers, being an important component of the agri-food system. In the highlands, above 3500 meters above sea level, more than 2500 varieties of native potato are grown, had not been reaching wider markets. The Innovation and Competitiveness of the Peruvian Potato (INCOPA) Project of the International Potato Center (CIP), in partnership with more than 20 public and private partners, used an agri-food system approach in order to develop impact-oriented innovations that benefit small producers and the potato sector in general. Operationally, it was based in principles of open innovation, developing and using the Participatory Market Chain Approach (PMCA) approach.

Open and system-oriented innovations generated: Commercial innovations and new products for the market; Institutional innovations and legal norms that supported competitiveness; and Technological, demand-driven innovations. The work done has helped to generate changes at a micro level (producers) and in the potato sector as a whole. Specific studies indicate that producers increased both their yields and their income. At the sectoral level, national per capita consumption of potatoes has increased from 65 to 85 kg in the last decade; and demand for and prices of native potatoes have increased by 55% during the same decade period, despite of their increased production. Small farmers in the Peruvian highlands have benefited significantly from the innovations fostered by this innovation-oriented initiative, that were also facilitated by favorable economic policies and the recent gastronomic boom in the country. Different products have been developed by multiple private and public stakeholders for both national and international markets based on native varieties that are produced mainly by small producers.

P-095

Resilient potato varieties selected from True Potato Seed by Filipino farmers

Victoria Demonteverde[1], Peter VanderZaag[2], Pham Xuang Tung[3], Teresita Masangcay[4], Cynthia Kiswa[4]

[1]Potato Systems Research and Training Center, Canlaon City, Philippines. [2]Sunrise Potato, Alliston, Canada. [3]Institute of Agricultural Sciences, Ho Chi Minh City, Vietnam. [4]Benguet State University, Benguet, Philippines

Overview

In the mid 1980's, CIP introduced TPS to potato farmers on the slopes of Mt Kanlaon, Negros in the Philippines. European potato varieties succumbed quickly to bacterial wilt, viruses and late blight. CIP technician Bianito "Choi" Susana introduced a number of hybrid TPS progenies for farmers to grow as transplants or from minitubers. Farmers on their own started to select the best plants and kept them for their seed. Without any external support the farmers continued to select and grow the most resilient clones. After 25 years, upon our return to the area we discovered several clones they called "Choi" along with a 2nd name to describe the variety. The 4 most popular were indexed for viruses. All were negative to PVA, PVX, PotLV, and PLRV. Two had PVS and PVY without showing any visual foliar symptoms. These varieties exhibited resilience to drought & typhoons, resistance to viruses and diseases. These selected varieties were heat treated, indexed virus free, used to renew the seed supply of these varieties for the farmers around Mt Kanlaon. Since 2015, new TPS populations including some progenies with "Choi" varieties as parents along with proven varieties from the northern highlands (cv Igorota) have been evaluated. None have shown the same resilience or acceptance as the "Choi" varieties! The great learnings from these results are: farmers must be included in all stages of variety selection work; partnerships of various agencies along with farmers create synergy and success.

P-096

Close to the finish line - the biggest potato cryobank worldwide

Rainer Vollmer, Rosalva Villagaray, Mario Castro, Jose Cardenas, Sandra Pineda, Janet Espirilla, Vania Azevedo

International Potato Center, Lima, Peru

Overview

Cryopreservation is the most cost-efficient and reliable method for the long-term conservation of clonally propagated crops. The International Potato Center (CIP) developed a protocol under which a wide range of diverse potato landraces was successfully cryopreserved.

To reach this, shoot tips are excised from cold acclimated in vitro plants, treated with cryoprotectant agents, placed within a small droplet of cryoprotection solution onto an aluminium foil strip, plunged into liquid nitrogen (LN, at -196 °C), and transferred to small cryotubes which are then stored within boxes in a cryotank. A sample of 30 of 150 shoot tips is thawed after minimum 24 hours in LN, followed by full-plant recovery, in order to obtain the specific viability baseline for each accession. Recovered plants can be multiplied and transplanted to the greenhouse or field.

At date, CIP's cryobank holds 3977 potato accessions (~81 % of clonal collection), belonging to seven taxa based on the Hawkes taxonomy, with an average full-plant recovery rate of 61 %. CIP's cryobank has established strict standards for operation, quality, viability assessment, and database management. All process steps are recorded in-real time using bidimensional barcodes.

A separate long-term viability monitoring experiment was set up eight years ago, cryopreserving each year 8-12 additional accessions with 240 shoot tips per genotype. A sample of 30 shoot tips is thawed and recovered after 0, 2, 4, 8, 18 and 32 years, respectively, to assess if the viability rate stays stable after prolongated storage periods. Preliminary results showed that the accessions did not show any decrease in its viability rate after 8-years in LN.

P-097

Revealing the genetic diversity of native landrace potatoes maintained in situ by farmers from Pasco and Sierra de Lima region in Peru

Julian Soto[1], Rene Gomez[1], Noelle Anglin[2], Oswaldo Chavez[1], Maria Scurrah[3], Raul Ccanto[3], Norma Manrique[1], Vania Azevedo[1], Stef De Haan[1], Bettina Heider[1]

[1]CIP, Lima, Peru. [2]USDA, Idaho, USA. [3]Grupo Yanapai, Lima, Peru

Overview

The genetic diversity conserved in situ by farmers in native hotspot highland areas of Pasco and Sierra de Lima in Peru was compared to the ex-situ potatoes maintained in the International Potato Center (CIP) Genebank. A total of 1,075 potato cultivars from ten communities from Pasco and four from Lima were collected in collaboration with 14 farmers (one per community) through the farmer's association AGUAPAN and the NGO Grupo Yanapai. DNA was obtained from sprouted tuber tissues and genotyped using the Illumina Infinitum SolCAP-V4 potato SNP array. The genotype calls of each marker per sample were obtained using the GenomeStudio software. A total of 2,759 markers were used after filtering out markers with low genotyping quality. The SNP data analysis revealed inter- and intraspecific relationships between the CIP collection and the in situ conserved landraces. A total of six taxonomic groups following Hawkes's classification and four ploidy levels (2x to 5x) were identified in the in situ conserved landraces. The community of Caruya (Lima) had the greatest frequency of cultivars identified as S. tuberosum subsp. andigenum (Juz. and Bukasov) Hawkes, the most common species identified in these regions, while the community of Gargar (Pasco) had the greatest diversity of species. We identified 88 unique accessions from the communities that are not present in the CIP collection. These results showed that there is still genetic diversity conserved in situ in Peru that is not represented in the ex-situ collections, highlighting genetic gaps in the Genebank. Integrated conservation based on active linkages between ex and in situ approaches is essential. Through this research and collaboration with Peruvian farmers, new genetic diversity has been identified and the unique materials were added to the CIP Genebank to preserve this diversity into perpetuity in agreement (ITPGRFA-SMTA) with custodian farmers and AGUAPAN.

P-098

Breeding program modernization by the usage of genomic tools designed to meet the demands of autopolyploid genetics

Guilherme Da Silva Pereira[1], Marcelo Mollinari[2], Gabriel De Siqueira Gesteira[2], Cristiane Taniguti[3], Iara Gonçalves Dos Santos[1], Ivan De Paiva Barbosa[1], Carla Cristina Da Silva[1], Bode Olukolu[4], Hugo Campos[5], Craig Yencho[2], Zhao-Bang Zeng[2]

[1]Federal University of Viçosa, Viçosa, Brazil. [2]North Carolina State University, Raleigh, NC, USA. [3]Texas A&M University, College Station, TX, USA. [4]University of Tennessee, Knoxville, TN, USA. [5]International Potato Center, Lima, Peru

Overview

The genetic analyses of autopolyploid species have evolved tremendously over the past years since the development of (i) single nucleotide polymorphism (SNP) genotyping technologies allowing for allele dosage estimation, and (ii) numerous statistical genetics methods taking into account their genome complexities. For instance, we are now able to carry out quantitative trait loci (QTL) studies in potato populations based on highly informative, fully phased genetic maps, and precisely identify which haplotypes should be targeted for selection. Our initiative goals are (i) to develop genomic tools for autopolyploid crops, and integrate these tools in their breeding programs, (ii) to train researchers and breeders about the advances of autopolyploid genetic data analyses to modernize their breeding operations, and (iii) to establish partnerships with researchers interested in deploying molecular breeding programs in their institutions. We have been developing a set of open-source tools in order to help breeders with their activities involving molecular markers (e.g. https://github.com/guilherme-pereira/vcf2sm, https://github.com/bodeolukolu/ngsComposer, https://CRAN.R-project.org/package=mappoly, https://CRAN.R-project.org/package=qtlpoly, https://CRAN.R-project.org/package=viewpoly). These tools are mostly focused on the analysis of biparental populations, but can also work with multiparental populations and multiple traits upon further developments. Examples of applications in potatoes can be found in the literature (e.g. https://doi.org/10.1038/s41437-021-00416-x, https://doi.org/10.1094/PDIS-10-20-2270-RE). In addition to graduate-level courses for Latin American and African students, we have also provided short training sessions for the polyploid breeding community, including potato researchers (e.g. https://youtu.be/NifLfBsQshQ, https://youtu.be/B1i3TqYGzOw). We expect that as knowledge and new tools are available, more people can utilize genomic tools for potato breeding purposes, especially in developing countries.

P-100

Breeding of a new potato cultivars comprehensively resistant to virulent pathotypes of potato wart disease.

Jarosław Plich, Jarosław Przetakiewicz

Plant Breeding and Acclimatization Institute, Młochów, Poland

Overview

Synchytrium endobioticum (Schilberszky) Percival is the Chytridiomycetes fungus, which causes potato wart disease, one of the most important quarantine potato diseases. Chemical control of the pathogen in field conditions is not possible and therefore cultivation of resistant cultivars is the best solution to restrict its spreading. Identification and introduction into potato breeding pool of a highly effective sources of resistance against pathotype 1(D1) of S. endobioticum has allowed development of a number of resistant cultivars, which have significantly reduced the threat of this pathotype. Presently, the virulent pathotypes of the pathogen are spreading in different parts of the world and become a more and more important problem for potato growers. Recently a highly effective resistance gene Sen2 was identified. This gene provide resistance against multiple virulent pathotypes of S. endobioticum, including 2(G1), 6(O1), 8(F1), 18(T1), 2(Ch1), 3(M1) 39(P1) as well as 38 (Nevşehir). Pathotype 38 (Nevşehir) was originally identified in Turkey but currently presence of this pathotype was confirmed also in Georgia and the Netherlands.

The gene Sen2 was identified in 2018 but potato cultivars with this source of resistance aren't commercially available yet. In 2021 in Plant Breeding and Acclimatization Institute (Poland) a new project aimed to develop new potato cultivars with this gene was began. Sen2 gene is broadly introduced into potato breeding-pool to start selection of a new potato clones resistant to multiple virulent pathotypes. To speed-up breeding process a marker assisted selection was applied.

P-101

Mapping resistance to the potato cyst nematode, *Globodera pallida*, in a tetraploid, russet-skinned potato population

Rocio Silvestre[1], Louise-Marie Dandurand[1], Richard Novy[2], Jonathan Whitworth[2], Joseph Kuhl[1]

[1]University of Idaho, Moscow, USA. [2]USDA-ARS, Aberdeen, USA

Overview

Globodera pallida is a quarantined pest of potato in much of the world and has had a significant, negative economic impact on the Idaho potato industry. In the western United States, the predominant market class is for processing and is represented by oblong tuber shape and russet skin. Breeding for potato cyst nematode (PCN) resistance has been lacking for this market class. European *G. pallida* is classified into three pathotypes (Pa1-Pa3) based on their virulence reactions on different potato genotypes. Previous studies have identified, in the Scottish cultivar Eden, resistance locus GpaIV$^{s}_{adg}$ which confers resistance to Pa2 and Pa3. In this study, QTL analysis was conducted on a tetraploid population derived from PCN resistant Eden and susceptible Western Russet. A total of 245 offspring, four cultivar controls and four PCN differential clones were evaluated. Phenotypic evaluation involved transfer of tissue culture plantlets to pots and inoculation with 5 eggs per gram of soil with an average of 10 replicates. The phenotypic data for PCN resistance response was converted to best linear unbiased prediction (BLUP). The SolCap 21,027 SNP chip was used for genotyping the entire population. Quantitative trait linkage (QTL) mapping was performed for five traits related to cyst and egg-related phenotypes. The linkage map and BLUP data were imported into QTLpoly. Results indicate that nine lines were resistant (RS value ≥ 7) to *G. pallida* and 130 lines were classified as partially resistance (RS value 4 to 6) and 106 lines were susceptible (RS value ≤3) when compared with PCN-susceptible Russet Burbank. Moreover, primary QTLs associated with PCN resistance were detected on chromosome 4 and 6 with heritability estimates ranging from 0.10 to 0.20. This study will help to further characterize PCN resistance from Eden and identify genetic regions valuable for PCN resistance in oblong, russet-skinned processing potatoes.

P-102

Examination of changes in gene expression in stored potato tubers and response to treatment with 1,4-dimethylnaphthalene

Michael Campbell[1], Emily Dobry[2]

[1]Penn State Erie, The Behrend College, Erie, USA. [2]Penn State University, University Park, USA

Overview

Post-harvest storage of potato tubers is a major concern for the food industry. Of particular concern is the sprouting of tubers in commercial stores which can result in significant loss to growers and processors. To address loss in storage the potato industry utilizes environmental and chemical control to suppress sprouting. Studies investigating the molecular physiology of tubers during storage, and in response to chemical sprout suppression, can elucidate biological mechanisms as potential targets for new techniques and chemistries to control sprouting. In this study we utilize RNA-seq to evaluate changes in gene expression in potato tubers during storage and in response to the sprout inhibitor 1,4-dimethylnaphthalene (DMN). Following harvest, and entry into storage, potato tubers exhibited a low level of gene expression. As time in storage progressed tubers transitioned from an endo-dormant to an eco-dormant state and this transition involved an increase in gene expression that preceded any visible signs of sprouting. Treatment with the sprout inhibitor DMN elicited changes in gene expression but the level of response was greater in eco-dormant tubers suggesting that there is a differential response to sprout regulators that is linked to the physiological status of tubers in storage.

Details of interests

Research was funded by 1,4-Group, which sells 1,4-dimethylnaphthalene. Funding source will be noted on the poster.

P-103

PotatoMASH - a low cost, genome-scanning marker system for use in potato breeding

Maria de la O Leyva Perez[1], Stephen Byrne[1], Fergus Meade[1], Denis Griffin[1], Tom Ruttink[2], Corentin Clot[3], Lea Vexler[1], Jie Kang[1,4], Dan Milbourne[1]

[1]Teagasc. Crop Science Department, Carlow, Ireland. [2]Flanders Research Institute for Agriculture. Fisheries and Food (ILVO), Melle, Belgium. [3]Wageningen University and Research. Plant Breeding Department, Wageningen, Netherlands. [4]University of Otago. Department of Mathematics and Statistics, Dunedin, New Zealand

Overview

Numerous applications in plant genetics, genomics and breeding are based on genome-wide marker analysis, and although genotyping costs have dropped considerably over the last several years, they are still one of the major barriers in applications requiring the generation of genome-wide data for large numbers of samples. We have developed PotatoMASH (Potato **M**ulti-**A**llele **S**canning **H**aplotags), a novel low cost, genome-scanning marker platform. We designed a panel of 339 multi-allelic regions placed at 1Mb intervals throughout the euchromatic portion of the genome. These regions were assayed using a multiplex amplicon sequencing approach, which allows to genotype hundreds of plants at a cost of €5/sample. We applied PotatoMASH to a population of over 700 potato lines. We obtained tetraploid dosage calls for 2,012 short multi-allelic haplotypes in 334 loci, which ranged from 2-14 different haplotypes per loci. The system was able to diagnose the presence of targeted pest resistance markers, find multiallelic haplotypes associated with fry colour, and to track variation in a segregating population. PotatoMASH efficiently surveys genetic variation throughout the potato genome, and can be implemented as a single low-cost, genotyping platform that will allow routine and simultaneous application of MAS and other genotyping applications in commercial potato breeding programmes.

P-105

Genome-wide association and genomic prediction for late blight and PCN resistance in potato

Salej Sood, Vinay Bhardwaj, Sanjeev Sharma, Aarti Bairwa, Sundaresha S., Ashwani Kumar, Baljeet Singh, Ashwani Sharma, Dalamu Dalmau, Vinod Kumar, NK Pandey

Central Potato Research Institute, Shimla, India

Overview

Potato is the most important tuber crop and is a staple food for ~1.3 billion people worldwide. Late blight and PCN are two important biotic stresses which hamper the quantity and quality of tuber production. Although the potato genome was deciphered in the year 2011, various genetic complexities like autotetraploid inheritance, heterozygosity, etc. constrained the identification of genomic loci's governing these traits in comparison to major crops. The genomic-assisted selection offers an opportunity to improve the efficiency and genetic gain of potato breeding. In this study, we generated genotype data through RAD sequencing on 300 potato germplasm accessions, mostly varieties released across the globe. The phenotype data on late blight was generated in a natural hotspot location, *Kufri* for three consecutive seasons, while data on PCN resistance for both the species i.e. *Globodera rostochiensis* and *G*. *pallida* was generated under controlled conditions at *Kufri*. The phenotype data was associated with genotype data to carry out GWAS and predict genomic selection (GS) and prediction accuracy. A total of 11 SNPs associated with late blight and PCN resistance were detected by additive and simplex dominance models. Using additive model, two major QTLs i.e. chr11_5176739 and chr09_60736234 for late blight resistance, while 3 major QTLs for *Globodera rostochiensis* (chr03_27049362, chr12_619482, chr12_53396900) and one for *G*. *pallida* (chr03_30051088) were identified. The simplex dominance model identified 3 QTLs (chr08_1111466, chr11_5176739, chr09_60736234) for late blight resistance and 2 QTLs (chr01_48615182, chr05_52055419) for *G*. *rostochiensis*. The genomic selection prediction accuracy for late blight, *G*. *rostochiensis* and *G*. *pallida* was 0.57, 0.48 and 0.67, respectively. This study provides insight into the genetic architecture of globally important biotic stress traits for the development of new molecular markers that could be used in potato biotic stress resistance breeding.

P-106

Understanding the components of potato genotype adaptation: Dormancy and sprouting characteristics under different altitudes and seasons in north-west Kenya

Thomas K. Kwambai[1,2], Denis Griffin[3], Moses Nyongesa[4], Stephen Byrne[3], Paul C. Struik[5]

[1]Kenya Agricultural and Livestock Research Organization - Food Crops Research Institute, Kitale, Kenya. [2]Wageningen University and Research, Centre for Crop Systems Analysis, Centre for Crop Systems Analysis, Wageningen, Netherlands. [3]Teagasc Crops Research Centre, Oak Park, Carlow, Ireland. [4]Kenya Agricultural and Livestock Research Organization - Tigoni Potato Research Centre, Tigoni, Kenya. [5]Wageningen University and Research, Centre for Crop Systems Analysis, Wageningen, Netherlands

Overview

Potato seed tubers show different dormancy, which influences their suitability for specific environments. This study investigated how genotype, altitude, season and their interactions influence dormancy and physiological ageing of seed potato tubers under conventional storage in north-western Kenya. We present the dormancy and sprouting characteristics recorded for 47 potato varieties grown at three altitudes during the long and short rainy seasons. The seed tubers were evaluated at one location under dark, semi-ambient storage conditions to assess their days to dormancy release, number of sprouts, sprout weight, sprout length and percentage tuber weight loss. Results showed significant ($p<0.001$) differences between varieties, locations, and seasons and interactions between these factors for the variables assessed. There was a wide variation in time to dormancy release (54 to 136 days); most genotypes showed medium to long dormancy. Genotypes showed longer dormancy when grown at lower altitude than when grown at higher altitudes, while genotypic differences in dormancy were very consistent across environments. There were highly significant interactions between altitude and season for all variables assessed, except for the number of sprouts 45 days after dormancy release and the weight loss after sprouting. Genotypic effects were larger than those of altitude and season and larger than the interaction effects for all factors evaluated.

Dormancy is a trait which should be considered by potato variety breeders to meet the needs for target growing environments, storage and markets. Short dormancy is often required to allow subsequent replanting while long dormancy may improve storability of varieties to enhance household food security. Information obtained on the different varieties will benefit seed companies, farmers and other stakeholders in addition to enabling breeders to meet specific and broad needs for Kenya and Sub-Saharan Africa (SSA).

Details of interests

Denis Griffin is a potato breeder whose research materials were used through IPM Potato Group.

Moses Nyongesa is the Centre Director, KALRO Tigoni Potato Research Centre whose research materials were used.

P-107

Unica or Yusi Maap: a unique potato variety with agro-ecological resilience across the continents

SK Luthra[1], VK Gupta[1], S Rawal[1], Bandana Bandana[1], Vinod Kumar[2], Salej Sood[2], NK Pandey[2], Vinay Bhardwaj[2], Abhishek Rathore[3], MS Kadian[4], S Baruah[4], Sam Mohanty[5]

[1]ICAR-CPRI, Regional Station, Modipuram, India. [2]ICAR-Central Potato Research Institute, Shimla, India. [3]International Crops Research Institute for the Semi-arid Tropics, Hyderabad, India. [4]International Potato Centre, Regional Office, New Delhi, India. [5]International Potato Centre, Regional Office, Manila, Philippines

Overview

Potato (*Solanum tuberosum* L.) is the world's 3rd most important human food crop. Due to diverse agro-climatic conditions, it is difficult to identify a single hybrid suitable for pan India cultivation. The development of wide adaptable, climate resilient and high yielding genotypes is therefore a major thrust area in potato breeding. In this investigation, 5 advanced red skin potato hybrids with eight control varieties were evaluated in RCBD at 19 locations for three consecutive years and data were recorded on total tuber yield, marketable tuber yield and tuber dry matter. The mixed model analysis showed significant differences among genotypes, environment and environment × varieties for total tuber yield, marketable tuber yield and dry matter content. The first two principal components accounted for around 90% of the interaction sum of squares for both total and marketable tuber yield. Among the hybrids, CP4409 (Yusi Maap) was the best performer for total and marketable tuber yield in most of the locations over the years. The varieties Kufri Lalima, Kufri Lalit and Kufri Sindhuri were moderate to poor yielders in comparison to the test hybrids. The red skin hybrid, CP4409 had the highest stability as well as mean yield and is therefore the most promising hybrid for the tested locations. This hybrid, CP 4409 is a unique collection of International Potato Centre, Peru. The CIP clone, **CIP392797.22** has been officially released in different countries as **Yusi Maap** (India, Bhutan), **Unica** (Peru), **Mkanano/ Shangii** (Africa), **Qingshu 9** (China), **Tajikiston** (Tajikistan). This hybrid is presently being evaluated for possible release in Uzbekistan and Georgia. This variety covers ~5% potato area in China. This variety is one of the most adaptable, high yielding and climate resilient potato varieties across the globe.

P-108

An agile potato breeding strategy for tropical and subtropical environments

Pham Xuan Tung[1], Peter Vander Zaag[2]

[1]Institute of Agricultural Sciences for Southern Viet Nam, Ho Chi Minh City, Vietnam. [2]Sunrise Potato, Alliston, Ontario, Canada

Overview

Rationale and Objective

In tropical and subtropical regions, late blight is the most serious obstacle for potato crops, particularly in the highlands during the rainy seasons. Viruses are also an important constraint. Potato cultivars from Europe are generally not well adapted due to high late blight pressure. Locally available agile potato varieties with high level of resistance to late blight and major viruses are in demand.

Since 2014, a breeding strategy was developed in Dalat, Vietnam. The goal is to produce agile potato cultivars having high levels of late blight and virus resistance and adapted to tropical and subtropical environments. The breeding objectives include wide adaptation, resistance to late blight and major viruses, high yield coupled with good culinary and processing qualities.

Activities

Breeding materials are chosen based on the aforementioned criteria to develop hybrid populations with genetic background for the target traits. Population “B” and newer populations from CIP are utilized to incorporate the desired multigenic resistances to late blight and viruses. Locally adapted or specific known varieties are chosen as the other parents in the crosses. Evaluation of the true seed populations and/or tuber families and selection of clones with high level of yielding capacity and resistance to late blight and viruses have been conducted in various locations by research partners in Yunnan and Sichuan (China), Dalat (Viet Nam), the Philippines and Canada. The latest hybridization scheme, in 2021, included also resistance to golden nematode as its prevalence increases in many potato production regions.

Impact

A number of potato clones superior for high yield and resistances to late blight and viruses have been selected, evaluated and are being released as commercial cultivars for fresh and processing markets.

We believe our strategy and our hybrid populations can also be of great interest and value for regions of Africa and the Andes.

P-110

Quantitative trait loci for resistance to potato dry rot caused by *Fusarium sambucinum*

Sylwester Sobkowiak, Marta Janiszewska, Emil Stefańczyk, Iwona Wasilewicz-Flis, Jadwiga Śliwka

Plant Breeding and Acclimatization Institute-National Research Institute, Młochów, Poland

Overview

Tuber dry rot is an important disease of potato caused by soil and seed-borne pathogens of the *Fusarium* genus. These ascomycetes can infect tubers in the field, but the disease develops mainly in the storage, leading to losses reaching 60% of the yield.

The goal of this work was to study the inheritance of the dry rot resistance in two diploid potato hybrid populations with complex pedigrees including several wild *Solanum* spp.: *S. acaule, S. chacoense, S. demissum, S. gourlayi, S. microdontum, S. phureja, S. stenotomum, S. verrucosum,* and *S. yungasense.* We used an aggressive isolate of *F. sambucinum* MF1 for phenotyping both progenies, parents and standard potato cultivars in laboratory tuber tests, in three subsequent years and Diversity Array Technology (DArT) markers for genotyping.

The QTL for dry rot resistance were mapped by interval mapping on genetic maps of both mapping populations, that have been described earlier (Hara-Skrzypiec et al. 2018, Mol Genet Gen 293: 331-342; Śliwka et al. 2016, Theor Appl Genet 129: 131-140).

The most important and reproducible QTL for resistance to tuber dry rot was mapped on chromosome I and additional year- and population-specific QTL were mapped on chromosomes II, VII, IX, XI and XII, confirming polygenic control of this resistance. This is the first study mapping the loci affecting tuber dry rot resistance in potato genome that can contribute to better understanding of potato-*F. sambucinum* interaction and to more efficient breeding of resistant potato cultivars.

P-111

Application of the PotatoMASH genotyping platform to a large panel of diploid potato breeding lines to drive progress towards Fixation-Restitution Breeding.

Lea Vexler[1,2], Maria de la O Leyva Perez[1], Agnieszka Konkolewska[1], Tom Ruttink[3], Stephen Byrne[1], Denis Griffin[1], The Fixation-Restitution Breeding Consortium Consortium[1], Herman van Eck[2], Dan Milbourne[1]

[1]Teagasc, Crops Research, Carlow, Ireland. [2]Wageningen University and Research, Plant Breeding, Wageningen, Netherlands. [3]Flanders Research Institute for Agriculture, Melle, Belgium

Overview

The DIFFUGAT project proposes a new breeding system called Fixation-Restitution Breeding, which allows predictable accumulation and fixation of biotic and abiotic resistances with yield, quality, and nutritional traits. In this innovative potato breeding system, self-compatible diploids are used to accumulate favourable alleles via rapid backcrossing schemes. These lines are subsequently used to rapidly transfer and fix the traits into tetraploid breeding populations by virtue of the ability to produce unreduced diploid pollen, producing viable tetraploids when used in 4x X 2x crosses.

Potato breeders commonly serve several markets with their variety portfolio, such as processing crisps, processing fries, table firm, table semi-firm, export, or starch markets, each requiring a different suite of relevant traits. The partners in the project have accumulated a set of over 600 diploid lines that will serve as the basis of future Fix-Res breeding clones, and are trialling these genotypes to assess them for 20 important agronomic and traits quality (collectively called “utility traits”) for the different market segments. We aim to map those traits in the panel of diploid genotypes and to develop genomic tools for the accumulation and fixation of those traits in the Fix-Res breeding program.

To mediate this, we are using a platform called PotatoMASH (Potato Multi-allele scanning haplotags), a pooled amplicon-based genotyping-by-sequencing approach based on GT-Seq. PotatoMASH scans allelic variation at 340 loci evenly spread at 1Mb intervals throughout the gene rich euchromatic portion of the genome, and combined with SMAP software, combines multiple SNPs across each read to generate multi-allelic short-read haplotypes (haplotags) that better reflect the true allelic composition of the locus than the constituent bi-allelic SNPs. In this poster, we describe the latest results in the application of the PotatoMASH platform to the panel of diploid material that forms the basis of the Fix-Res Project.

P-112

Understanding the genetics of common scab resistance in potato crop

Fatima Latif Azam[1,2], Denis Griffin[1], Dan Milbourne[1], Richard Visser[2], Herman van Eck[2]

[1]Teagasc Research Centre, Carlow, Ireland. [2]Wageningen University and Research, Wageningen, Netherlands

Overview

Common scab, caused by *Streptomyces* spp., is worldwide one of the most important skin blemish diseases in potato, leading to a significant reduction in economic value. Resistant varieties are the most effective way of dealing with this disease, because control by irrigation is expensive and unsustainable in the long term, if not contributing to yield.

The aim of this project is to identify the hereditary factors involved in resistance to common scab. Several sources of resistance are known, such as the old potato varieties Jubel and Hindenburg, as well as modern tetraploid and diploid varieties. These are being used to create mapping populations for field trials. Specifically, we are trying to understand whether resistance is controlled by a single locus or by multiple small-effect QTL with additive effect. Because a vast body of historical data on scab resistance is available, for ~ 500 varieties with SNP array genotypic data, a GWAS-analysis is being carried out. Pot assays and *in vitro* assays will be developed to test for resistance gene by isolate interactions with reference strains of *Streptomyces* spp. Knowledge on the spectrum of resistance is essential to breed for broad-spectrum scab resistant varieties.

Identification of molecular markers associated with alleles contributing to common scab resistance will simplify the long-term objective of breeding resistant varieties with greater efficiency and less expense than in conventional field screening.

Author name	Programme Codes*
Abera Desta, Zeratsion	P-092
Acuña, Ivette	P-040
Alamar, M. Carmen	P-085
Allen, Robert	P-018, P-012
Angelakos, Charlie	F2-15
Arefe, Medhanie Mehari	P-051
Arnold, Tom	PL-14
Azevedo, Vania	P-096, P-097
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Baker, Haven	F3-10
Bararyenya, Astere	P-068
Baruah, Sampriti	F3-13
Bawa, Steve	P-064
Beals, Katherine A.	PL-09
Bhardwaj, Vinay	P-107
Bienkowski, Tomasz	PL-04
Blauer, Jacob	P-089
Body, Nicolas	F3-07
Bourke, Lorcan	F1-13
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Buzera, Ariel	P-083
Campbell, Michael	P-102
Campos, Hugo	C-10, P-094
Castro, Caroline	P-093
Chepkwony, Mercy	P-058
Colombo, Marco Giovanni	F2-12
Cox, Martyn	F3-05
Cunnington, Adrian	F2-06
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Davenport, Jason	PL-10
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Gafaranga, Joseph	P-081
Gasperi, Christopher	P-062
Gets, Yechiam	P-013
Gevens, Amanda	F1-05

Author name	Programme Codes*
Ghebreagziabiher, Fitsumberhan Ghebremeskel	P-076
Ginzberg, Idit	P-090
Gonzales Llontop, Maria Julia	P-027
Gururajan, Vidyanath	C-09
Hein, Ingo	F3-09
Heltoft, Pia	P-088
Herkenrath, Thomas	F1-03
Hipsch, Matanel	P-024
Horne, Paul	P-044
Huang, Sanwen	F1-12
Hutchinson, Chad	P-038
James, Mark	F2-11
Kaguongo, Wachira	P-080
Kahindo, Gladys	P-066
Kainga, Reuben	P-001
Kamau, Ann Sylvia	P-061
Kassahun, Solomon	P-072
Kearns, Robert G.	PL-01
Keogh, Ross	C-01
Kipkoech, Grace	P-050
Kirira, Florah	P-059

Author name	Programme Codes*
Koch, Chris	PL-05
Kreuze, Jan	F2-10
Kropff, Prof. Dr. Martin	PL-11
Kruthaup, Franz-Bernd	C-08
Kwambai, Thomas K.	P-106
Källqvist, Emma	F3-04
Lacomme, Christophe	F1-07
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Luitel, Binod Prasad	P-003
López-Olivari, Rafael	P-017
MacDonald, Evan	F2-09
Machangi, Joseph	P-042
Maguhu, Faraja	P-075
Malek, Alan	P-082
Malek, Katie	P-023
Martin, Michel	P-029
Martínez, Carolla	P-004
Masangcay, Teresita	P-052
Mburu, Humphrey	P-065
McCarthy, Tara	PL-03
McLaughlin, Michael	C-12
McLoughlin, Damien	PL-06

Author name	Programme Codes*
Milbourne, Dan	C-07
Mohanty, Samarendu	F1-09
Mommaerts, Veerle	F2-13
Mullins, Ewen	F3-12
Nedrow, Bret	F3-02
Newbert, Max	F1-06
Ng'umbi, Ernest	P-077
Nintije, Pierre	P-063
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Otiniano, Jose Ronal	F1-04
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Payrastre, Laure	F1-13
Plich, Jarosław	P-041, P-100
Porter, Cedric	PL-07
President, Europatat	C-02
Przewodowski, Włodzimierz	P-036

Author name	Programme Codes*
Quiroga, Gabriela	F3-15
Ravensbergen, Arie	P-011
Retta, Mesfin Kebede	F3-14
Rocha, Ramiro	P-046
Rocha-Rodriguez, Ramiro	P-045
Roulston, Derek	F2-08
Ruiz de Galarreta, Jose Ignacio	P-006
Sangha, Jang Bahadur Singh	F1-10
Sanzo-Miró, Marta	P-031
Schulte-Geldermann, Elmar	F2-14
Scott, Lauren M	PL-08
Shannon, Laura	F3-11
Sharma, Ayush	P-002
Shem, Charles	P-069
Silvestre, Rocio	P-101
Skea, Andrew	F2-16
Skrabule, Ilze	P-015
Slinde, Erik	P-084
Sood, Salej	P-105
Stalham, Mark	F3-06
Stephen, Tindimubona	P-055
Struik, Paul	PL-12

Author name	Programme Codes*
Teige, Markus	F3-08
Tessema, Lemma	P-025
Thomas, Georgia	C-06
Toaspern, John	F1-14
Tsror, Leah	P-035
van de Ven, Martin	F1-11
van der Vossen, Edwin	F2-02
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