Cavity spot of carrot: developing techniques for research and disease management

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Vegetable Genetic Improvement Network

VeGIN
The Vegetable Genetic Improvement Network

- An interactive network of researchers and industry leaders, who work together to promote market delivery of improved vegetable varieties using sustainable production systems.

- Work of four key UK vegetable crops:
  - Carrot
  - Onion
  - Lettuce
  - Vegetable Brassica

- Using genetic diversity to identify genes linked to resistance for key biotic and abiotic traits

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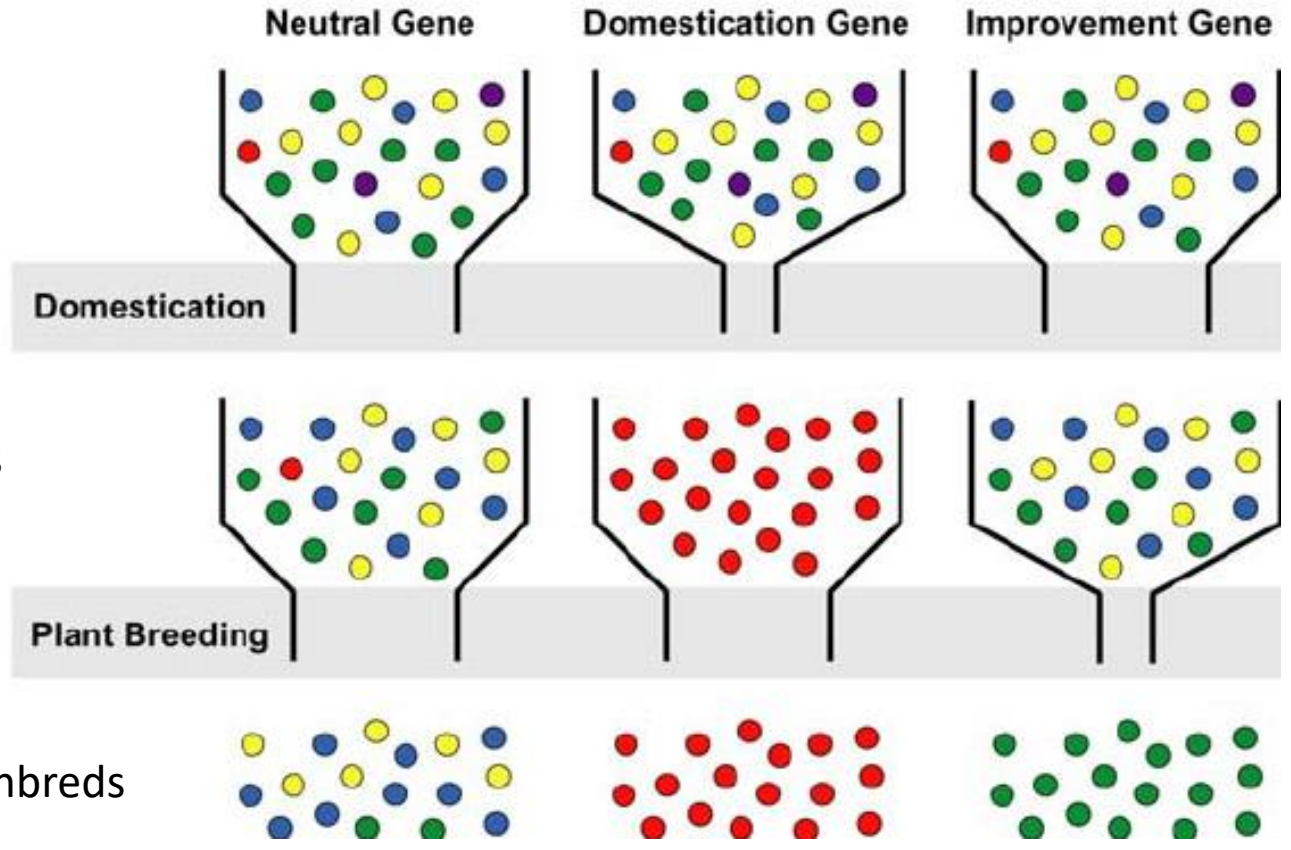
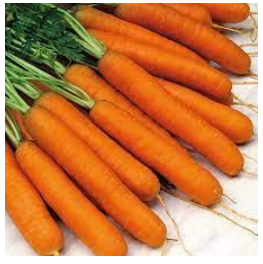
Harper Adams University

Department for Environment Food & Rural Affairs

Importance of genetic diversity





UK Vegetable Genebank

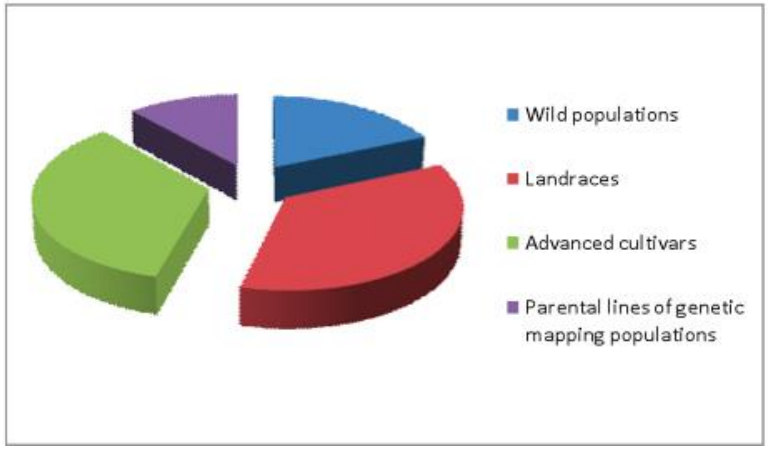
Conserving and using vegetable crop diversity

- 14,000 seed samples
- 520 million seeds
- 47 vegetable and herb crops
- Seed originating from 108 countries

Total number of Accessions	**14022**
Brassica (cabbage and related crops)	5273
Allium (onions, leeks)	1754
Daucus (carrot)	**1481**
Lactuca (lettuce)	1483
Raphanus (radish)	803

Carrot Diversity Set

- The VeGIN Carrot Diversity Set (CDS) is a subset of the carrot accessions held by Warwick Vegetable Genetic Resource Unit (GRU)
- These 77 lines capture the genetic and morphological variation present in the core collection including:
  - Root shape and colour
  - Geographic origin
  - Foliage characteristics



16 wild Daucus
31 landraces / traditional varieties
30 advanced varieties




Cavity spot

- Cavity spot is one of the biggest problems for carrot growers in the UK; estimated losses at least £5M per annum
- In the UK principally caused by the oomycete *P. violae* and to a lesser extent *P. sulcatum* – incidence of each species was unknown
- Other *Pythium* species associated with cavity spot include *P. intermedium* and *P. sylvaticum*
- Other fungi may cause similar root lesions or invade cavities e.g. *Cylindrocarpon destructans* and *Mycocentrospora acerina*

The problems

- **Interaction between components of the cavity spot complex unknown**
  - Relative importance of *P. violae*, *P. sulcatum*, *P. intermedium*

- **The disease is unpredictable**
  - Lack of understanding of key abiotic and biotic factors that enhance disease
  - Lack of understanding of biology of *P. violae* and timing of infection

- **Metalaxyl issues / lack of new actives**
  - Microbial degradation of metalaxyl / future withdrawal
  - Field trials to identify new control products / approaches challenging – lack of adequate disease levels
  - Lack of artificial inoculation approaches

- **Commercial carrot varieties lack good resistance**
  - Cv. Nairobi most widely grown – low-intermediate resistance

Developing techniques for research and control

1) **Identification of *Pythium* isolates** associated with cavity spot

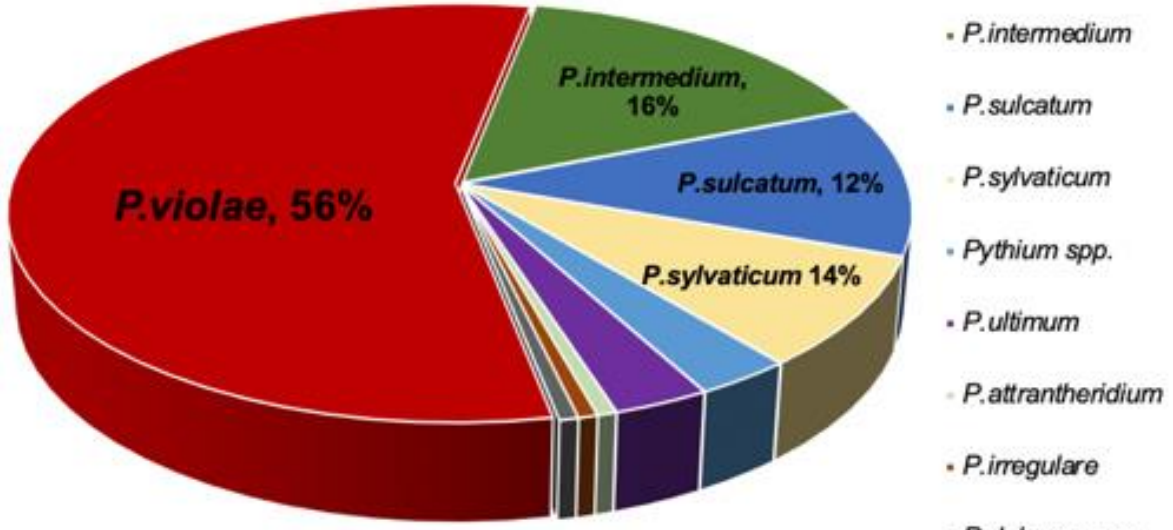
   Determine frequency of different *Pythium* spp. associated with cavity spot

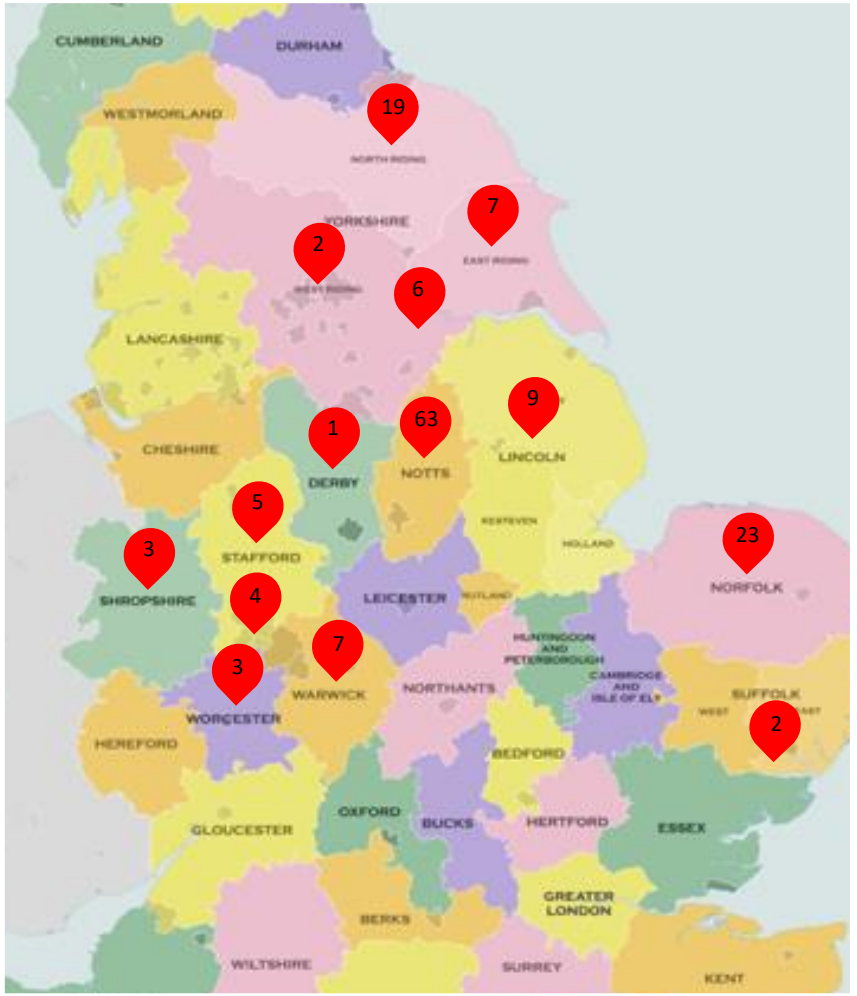
1) **Develop artificial inoculation systems** to induce cavity spot disease to enable:

   Identification of new crop protection products

   Identification of new sources of plant resistance

P. violae is the major cavity spot pathogen in the UK

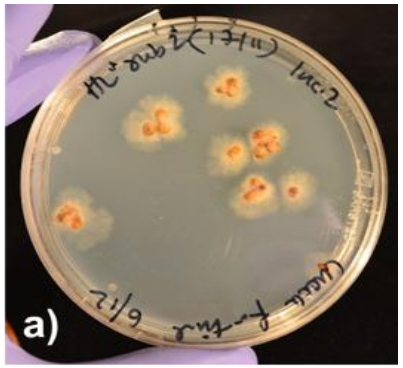




Cavity spot lesion size: *P. violae* > *P. sulcatum* > *P. intermedium*

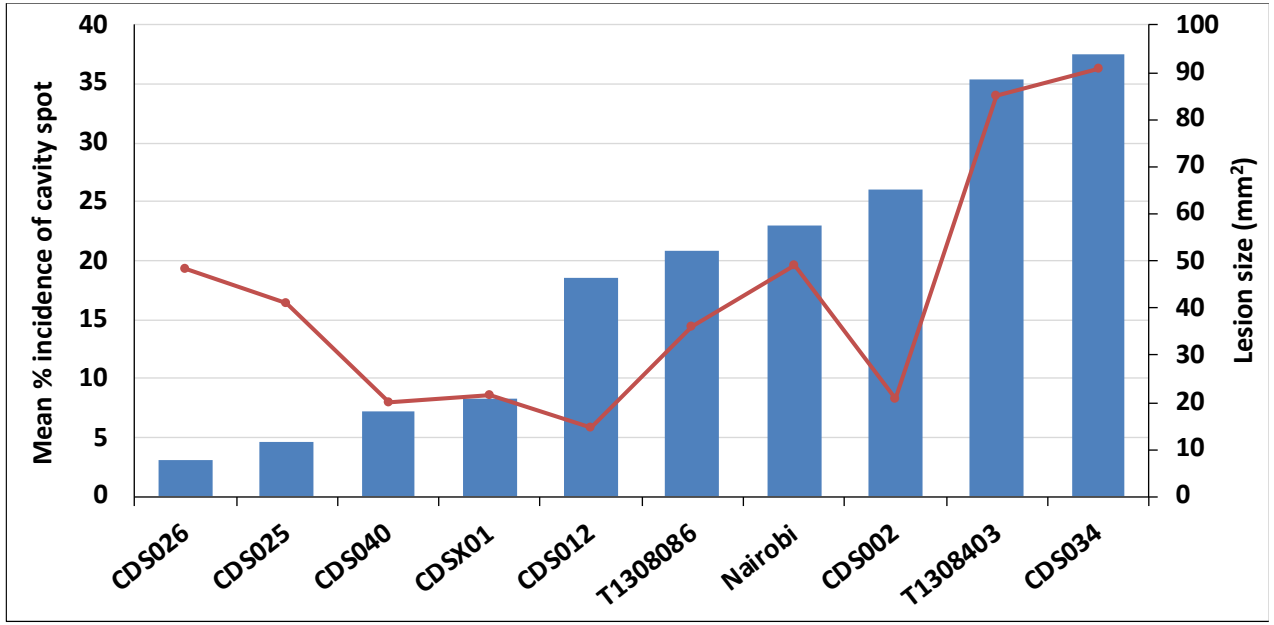
Inoculation of pot grown carrots with *P. violae* mycelium

- Millet grain inoculum used which is quicker to produce than oospores and resulted in:
  - Seedling damping off at higher levels
  - Reduction in carrot foliage
  - Production of stubby carrots
  - Reduction in root weight
  - Cavity spot incidence of 50%
  - Low cavity spot severity (mean 2-3 lesions / root)



Carrot resistance to cavity spot

- <u>Glasshouse pot test:</u> millet inoculum
- Differences between different carrot accessions
- Some relationship with *P. violae* agar plug test

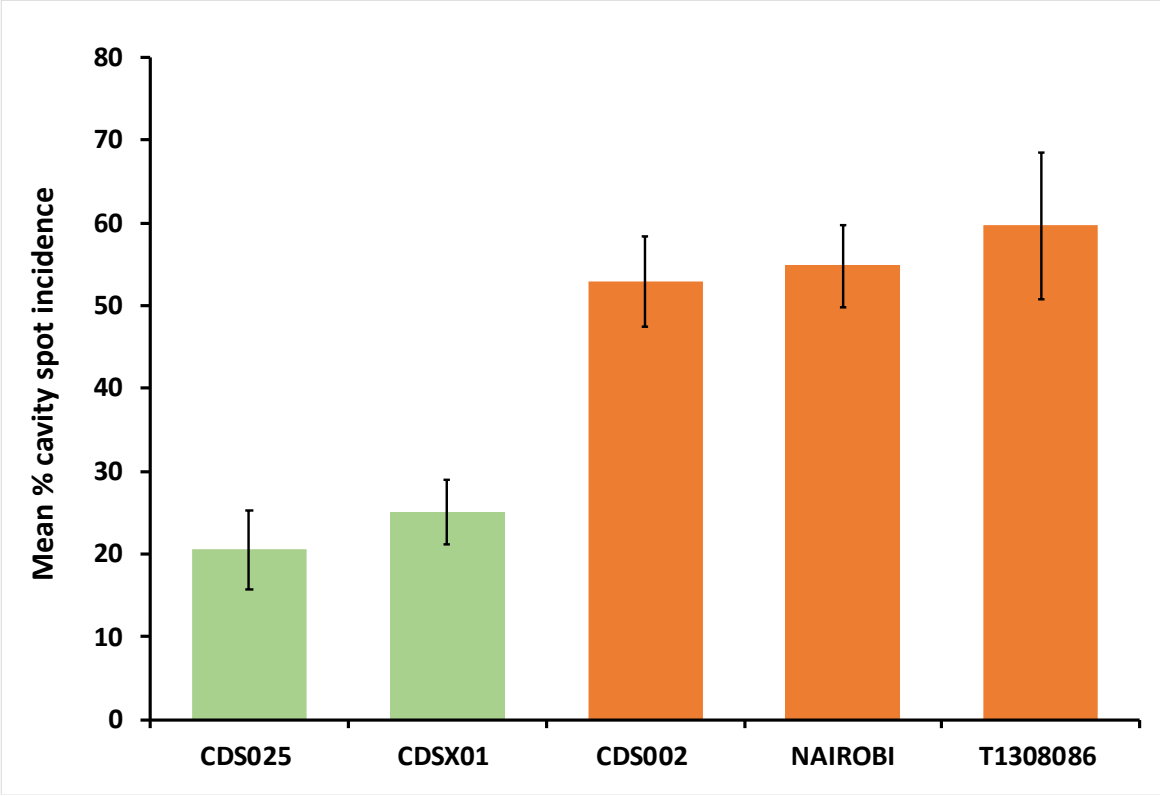


Artificial inoculation of ‘macrocosms’

- P. violae oospores produced in sand/oat substrate
- Consistently high cavity spot incidence – up to 40% cavity spot incidence, severity of 6 lesions / carrot
- Normal growth of carrots

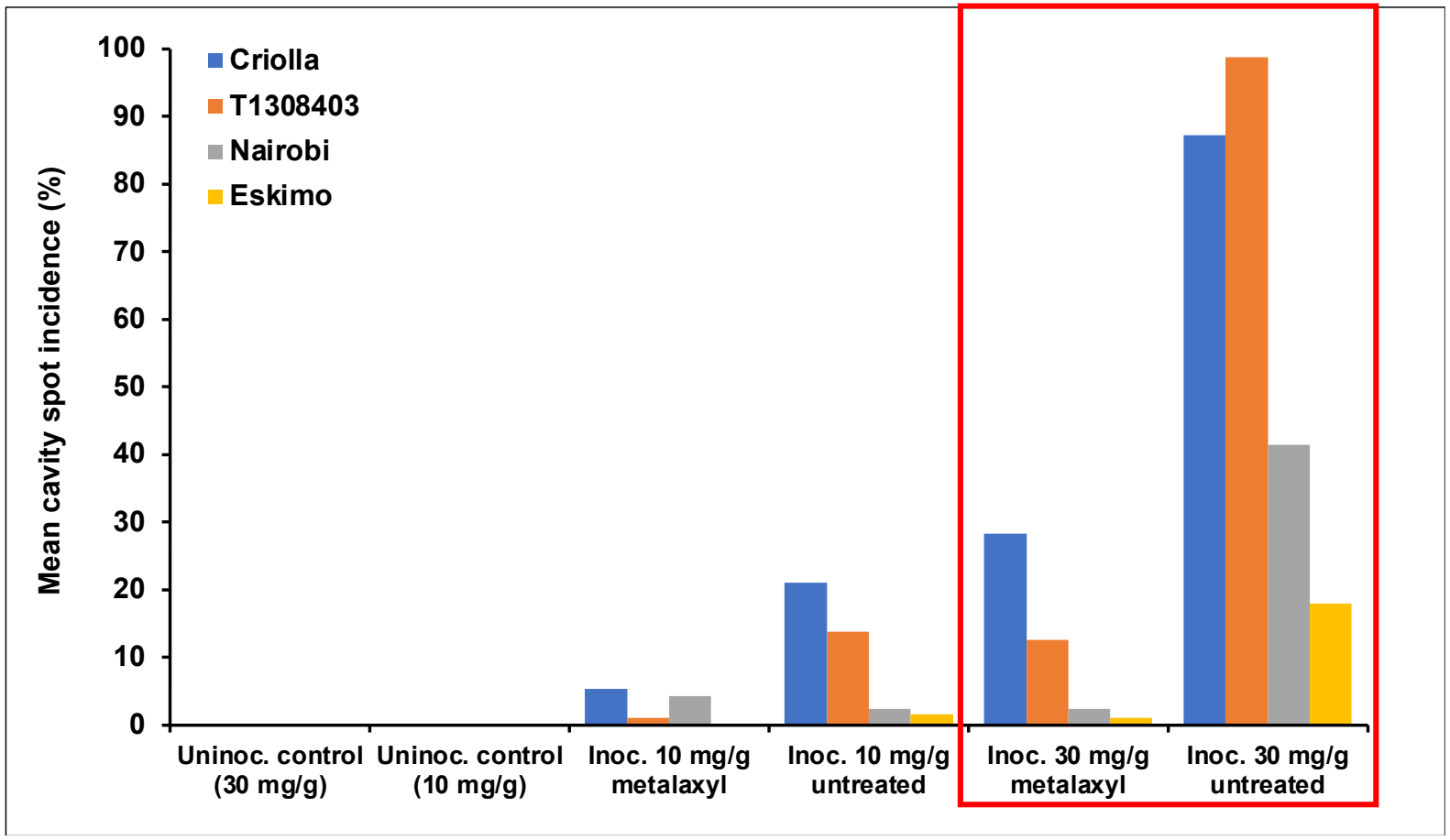
Carrot resistance to cavity spot

- <u>Macrocosms field test:</u>
  oospore inoculum
- Differences in resistance observed between carrot accessions
- Similar results to glasshouse pot test



Metalaxyl and carrot variety reduces cavity spot in pot tests

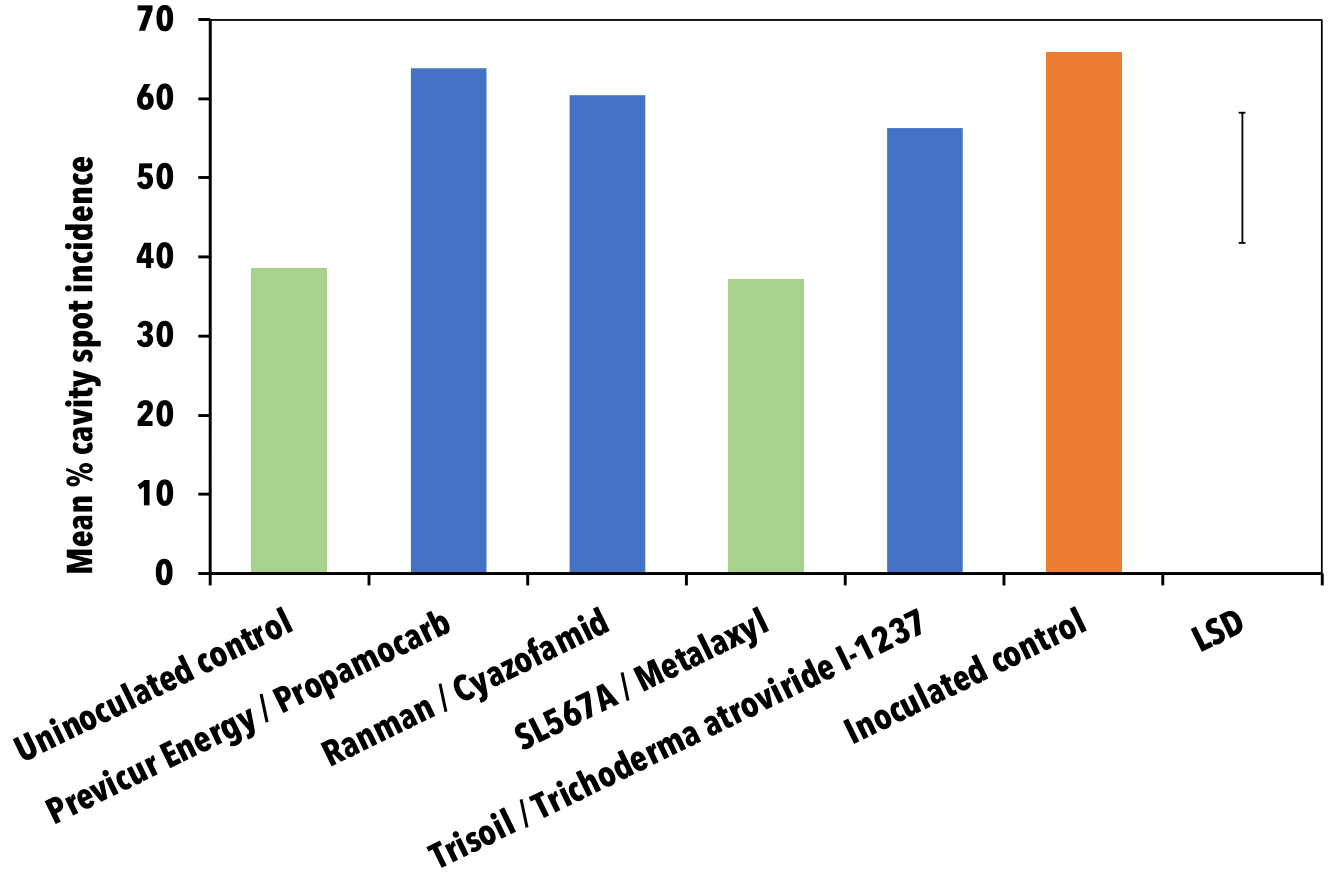
- Inoculum at 10mg/g and 30mg/g
- Differences in resistance observed between carrot accessions
- Metalaxyl reduces cavities



Fungicide trial in macrocosms

- Highly susceptible carrot cv. Criolla used
- Treatments:
  - SL567a (metalaxyl)
  - Previcur Energy (propamocarb and fosetyl Al)
  - Trisoil (*Trichoderma atroviride* I-1237)
  - Ranman (cyazofamid)

Only metalaxyl reduces cavity spot



Summary

- Cavity spot is the primary soilborne disease affecting UK carrots
- We have developed an artificial inoculation system for both pot-based experiments and field ‘macrocosms’
- Control of cavity spot is reliant on the use of the fungicide metalaxyl
- Resistance to cavity spot have been identified in carrot

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Any Questions……