Project number: 6498
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Date: July, 2018
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Maize nitrogen use

Key external stakeholders:

Tillage/dairy/beef farmers, agricultural merchants and maize input providers, agricultural advisors and consultants, policy makers

Practical implications for stakeholders:

- Inorganic nitrogen (N) is one of the key nutrient inputs required when producing forage maize and is currently the largest variable input cost in that process in Ireland.
- Soils that have a particular cropping history and management which result in a high soil nutrient status may benefit from reduced fertiliser N application and subsequently reduced costs of production, improved N use efficiency and increased response rate to fertiliser N application.
- Continued adoption of new and existing degradable film types at farm level will yield benefits for growers in terms of increased whole crop yield, grain yield, nutritive value and N use efficiency.

Main results:

- There was an increase in whole-crop yield with increasing fertiliser N application but at a relatively low response rate of 8.2 kg dry matter (DM)/kg fertiliser N applied in a high soil mineral N site. However, when examined on a continuous small grain cropping site there was a yield response of 23.9 kg DM/kg fertiliser N applied.
- Applying fertilizer N in a split application programme conferred no benefit in terms of whole crop, grain or cob yield but there was a quality benefit due to a lower proportion of stover in the whole crop. In addition there was an increase in N use efficiency by applying a split fertiliser N application programme at a low soil mineral N site.
- The retention of degradable film for longer in the growing season resulted in a greater yield of whole-crop DM, grain DM and whole-crop N, and N use efficiency.

Opportunity / Benefit:

Forage maize production offers the potential to increase the provision of forage to a rapidly increasing livestock sector. There is potential to improve N use efficiency in a degradable film system. However, amendments to current agronomic practices in both fertiliser N application rate and application strategy are site specific.

Collaborating Institutions:

UCD, AFBI

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External collaborators: Bridget Lynch, University College Dublin
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1. Project background:

Inorganic N is one of the key nutrient inputs required when producing forage maize and is currently the largest variable input cost in that process in Ireland. The current fertiliser N input strategy is typically to apply all fertiliser N shortly before planting accompanied by light cultivation into the seedbed. However, such application practices allow for exposure of the high levels of fertiliser N to losses through immobilisation, leaching, denitrification and clay fixation, potentially resulting in poor synchrony between soil N supply and crop demand. Improvement of current N fertiliser application strategies is required to enhance N use efficiency and whole-crop yield of forage maize whilst also curtailing N losses.

2. Questions addressed by the project:

- What is the response to increasing fertiliser N rate on two contrasting soil types in terms of forage maize yield and nutritive value?
- Is there potential to increase N use efficiency in the production of forage maize by employing a split N application strategy?
- Will a foliar form of fertiliser N improve the ultilisation of fertiliser N applied post emergence compared to a granular form in a degradable film production system?
- Can current agronomic practises (sowing date, seeding rate, use of degradable film) be altered to increase nitrogen use efficiency

3. The experimental studies:

- Replicated field plots of forage maize provided the ability to investigate the effect of N application rate, N application strategy, form of N fertiliser, degradable film type, seeding rate, sowing dates and use of slurry on yield and composition variables.
- Three field experiments were each undertaken during two consecutive growing seasons and a fourth experiment was undertaken during a single growing season.
- Laboratory silos were used to assess the ensilage characteristics of forage maize from selected field plot treatments.
- Nitrogen sensor technology was used to map the N status of forage maize in the experimental plots during the growing season.

4. Main results:

- There was an increase in whole-crop yield with increasing fertiliser N application (0 kg N to 150 kg N/ha), but a relatively low response rate of 8.2 kg DM/kg fertiliser N applied in a high soil mineral site. However, when examined on a continuous small grain cropping site there was a yield response of 23.9 kg DM/kg fertiliser N applied from 50 kg N/ha to 150 kg N/ha.
- Applying fertilizer N in a split application programme conferred no benefit in terms of whole crop, grain or cob yield but there was a quality benefit due to a lower proportion of stover in the whole crop. In addition there was an increase in N use efficiency by applying a split application programme at a low soil mineral N site.
- Both granular CAN and foliar sources of N for the second application of fertilizer N caused leaf damage and scorch respectively. However, there was no effect either on any yield or feeding value parameters at harvest or on ensilability.
- The retention of degradable film for longer in the growing season resulted in a greater yield of whole-crop DM, grain DM and whole-crop N harvested, and N use efficiency.

5. Opportunity/Benefit:

Forage maize production offers the potential to increase the provision of forage to a rapidly increasing livestock sector. There is potential to improve N use efficiency in a degradable film system. However, amendments to current agronomic practices in both fertiliser N application rate and application strategy are site specific.

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6. Dissemination:

Main conference publications:

Corcoran, E.M., O'Kiely, P., Gilliland, T.J., Brennan, E., Burke, J.I. and Lynch, M.B. (2018) 'Effects of rate and form of fertiliser nitrogen applied on the yield, nutritive value and ensilage characteristics of forage maize grown under degradable film' *Proceedings of the Annual General Meeting of IPSAM*, University College Dublin, Ireland, 10th June.

Corcoran, E.M., O'Kiely, P., Gilliland, T.J., Kelly, A.K., Burke, J.I. and Lynch, M.B. (2017) 'Response of forage maize to strategies of inorganic N use and degradable film' *Proceedings of the Annual Walsh Fellowship Seminar*, 9th November, RDS, Dublin, Ireland, p5.

Corcoran, E.M., O'Kiely, P., Gilliland, T.J., Burke, J.I. and Lynch, M.B. (2016) 'Nitrogen fertiliser rate and timing, and mulch type, effects on forage yield and composition' *Proceedings of the 26th General Meeting of the European Grassland Federation*, Trondheim, Norway, 4th September, Grassland Science in Europe, Volume 21, p445.

Popular publications:

Lynch, M.B. and Corcoran, E.M. (2015) 'Forage maize research update - UCD Lyons Research Farm' *The Irish Farmers Journal,* 2nd April.

Lynch, M.B. and Corcoran, E.M. (2018) 'Forage maize 2018 – is there a case for more nitrogen?' *The Irish Farmers Journal,* 9th June.

7. Compiled by: Bridget Lynch and Padraig O'Kiely

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