Nutrient placement

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Factsheet about integrated weed management

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Introduction

The strategic placement and timing of nutrients (fertilization) can be a strategy in managing weeds in combination with many tillage types. Plants compete for the resources that they share during different stages of their life cycle[1]. In general, weeds have a high nutrient requirement and will absorb as much or even more than crops. The response of weed species to changes in nutrient availability is often different from the response of the crop plants and this knowledge can be used to optimize the growing conditions for the crop, while rendering them less suitable for the main weed species through the targeting of resources in time and space.

Applicability

Strategic nutrient placement can be applied in any situation by optimizing the placement and timing of fertilizers. In general, banded application rather than broadcast application of fertilizers is more efficient while it provides the crop a more competitive position compared to weeds. Banding refers to placing the nutrients close to the crop, either below, aside, above or on both sides of the seed or seedling.

Fertilizer bands should be placed close to the seed or seedling so that they are more available to the crops than to weeds, but to prevent damage a certain distance from the seeds or seedling must be respected. Weeds close to banded fertilizer need to be controlled.

Different nutrients as well as fertilizer formulations require different treatment, e.g. because of their solubility in water, mobility and function during different growth stages of the crop.

Efficacy

Most annual weeds germinate in the few millimetres in the top of the soil[2], by nutrient placement below that level, the crop is given a better competitive position than weeds.

Effective fertilizer placement enables crops to become more competitive against weeds as a result of improved growth[3,4,5,6].

Smart nutrient placement promotes crops' resilience to mechanical weeding.

Higher yields are a result of increased crop growth and reduced yield losses due to crop-weed competition.

Costs

The nutrient use efficiency is higher, thus costs of fertilizers are reduced. Eventually extra costs are involved if the required machinery (band spreader and/or slurry injector) is not available and needs to be purchased. Alternatively it can be outsourced to a contractor.

Equipment

To apply fertilizer bands a band spreader is required that can be attached to the sowing machine for direct application during sowing. For application of slurry under the soil surface an injector is needed.

1| Holst, N., Rasmussen, I. A., & Bastiaans, L. (2007). Field weed population dynamics : a review of model approaches and applications. Weed Research, 47(1), 1–14.

2| Lampkin, N. 1997. Weed management. Pages 161–213 in N. Lampkin, ed. Organic Farming. Ipswich, U.K.

3| Blackshaw, R.E., Semach, G., Janzen, H.H., 2002. Fertilizer application method affects nitrogen uptake in weeds and wheat. Weed Sci. 50, 634–641.

4| Légère, A., Shirtliffe, S.J., Vanasse, A., Gulden, R.H., 2013. Extreme grain-based cropping systems: when herbicide-free weed management meets conservation tillage in northern climates. Weed Technol. 27, 204–211.

5| Melander, B., Rasmussen, I.A., Bàrberi, P., 2005. Integrating physical and cultural methods of weed control—examples from European research. Weed Sci. 53, 369–381.

6| Petersen, J., 2005. Competition between weeds and spring wheat for 15N-labelled nitrogen applied in pig slurry. Weed Res. 45, 103–113.

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Core results

- Weed species often respond differently to changes in nutrient availability than crops, such as Chenopodium album and Polygonum lapathifolium in maize[7].
- A significant interaction between fertilizer placement method and rate of application on weed biomass within the maize row at 5 weeks after emergence was reported. The weed density was consistently higher in the broadcast applied fertilizer treatment compared to the band and spot placement[8].
- Subsurface-banded fertilizer of N was often better than surface-broadcast fertilizer off N in terms of N uptake by wheat vs. weeds, weed biomass production and the yield of wheat[9,10].
- Weed emergence was significantly reduced when nitrogen availability near soil surface was reduced[9,11]

The following results come from European research[12] on placement of nutrients in relation to weed control:

- *Nitrogen placement at 10 to 50 mm from the crop row and 50 mm deep may result in an initial competitive advantage of the crop over weeds thanks to an improved early nitrogen uptake and crop growth. The effect of this competitive advantage may reach a 50% reduction in weed biomass.*
- *Crop competitiveness and yield of spring-sown cereals as well as the effectiveness of weed harrowing can be improved by injection or placement of slurry into the soil at the time of sowing.*
- *In winter rye and winter barley, fertilizer applied in spring at approximately 60 mm soil depth and approximately 70 mm away from the crop row improves the crops' competitiveness with weeds compared to application on top of the soil. This is a consequence of improved early crop growth more than that of weeds. In winter wheat this only applies to shallow-rooted weeds, e.g. chickweed, while the growth of tap-rooted weeds was enhanced.*
- *The weeding effect of interrow hoeing in combination with weed harrowing was improved by fertilizer placement in winter cereals, especially when crop density was increased as well.*

Extra information

See *https://iwmpraise.eu/publications/* for all crop diversification strategies and their definitions.

7| *Krahmer, H. (2016). Can we associate weeds with specific environmental conditions? Chapter 20 from Atlas of Weed Mapping. Wiley Blackwell. ISBN 978111870721.*

8| *Mashingaidze, AB., Lotz, L.A.P., van der Werf, W., Chipomho, J., Kropff, M.J. and Nabwami, J. (2010). The influence of fertilizer placement on maize yield and growth of weeds. Proceedings of 2010 JKUAT Scientific Technological and Industrialization Conference, pp. 786-800.*

9| *Sammi Reddy, K., Gopinath, K.A., Visha Kumari, V., Ramesh, K. (2018) Weed-Nutrient Interactions in Agricultural Systems. Indian Journal of Fertilisers, Vol. 14 (2), pp.50-58 (9 pages).*

10| *Blackshaw, R.E. 2005. Nitrogen fertilizer, manure, and compost effects on weed growth and competition with spring wheat. Agronomy Journal 97, 1612-1621.*

11| *Sweeney, AE., Renner, KA Laboski C and Davis AS. (2008). Effect of early spring fertilizer nitrogen on weed emergence and growth. Weed Science 56,714-721.*

12| *Melander, B., Rasmussen, I., & Bàrberi, P. (2005). Integrating physical and cultural methods of weed control—examples from European research. Weed Science, 53(3), 369-381. doi:10.1614/WS-04-136R*

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