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Use of 15N in the study of inter- and intra-species competition for applied nitrogen

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Competition between species (crop and weeds) and within rows of the crop may be affected by the distribution pattern of the applied nutrient source. Direct injection of nitrogen (N), either applied as mineral N or slurry N, may improve the competitiveness of a cereal crop in relation to weeds compared with uniform distribution of the applied N in the soil volume. Three experiments has been conducted with the objective to examine the inter-species (crop:weed) and the intra-species (between crop rows) competition for applied N as affected by the distribution pattern.

A 15N-labelled nitrogen source was applied in field experiments (56 degrees 30' N, 9 degrees 35' E) for determination of recovery of the applied nitrogen in crop and weeds. Weekly recordings of 15N recovery in crop and weeds were fitted to a sigmoid growth model, and an interpretation of the estimated and derived parameters was made. In two experiments pig slurry was applied, and the spring cereals competed with the natural weed population of 1800 plants/m2 (Petersen, 2003, 2005a). In a third experiment a solution of ammonium nitrate was injected in bands at tillering of spring wheat grown in weed free conditions for investigation of inter-row competition (Petersen, 2005b).

In Exp. I two rows of spring barley were grown with 12 cm inter-row distance, and the slurry bands injected before sowing were located in the middle between the rows. In Exp. II the two slurry distribution patterns were combined with either spring barley density (one or two rows for the incorporated slurry), or distance between the slurry band and crop row (one row seeded either in 2 or 12 cm distance from the slurry band) (Petersen, 2005a). In Exp. III two rows of spring wheat were sown with 12 cm inter-row distance, and after emergence mineral N was injected in bands dividing the inter-row space in either 2-10, 4-8 or 6-6 cm sections, giving five combination of crop row to fertilizer band distances (Petersen, 2005b).

Weed maximum recovery were 12% (Petersen, 2003) and 26% (Petersen, 2005b) of the applied N, making weeds a significant competitor for the applied N. Management factors, such as the positioning of band-applied nitrogen close to the crop row decreasing the weed recovery caused a corresponding increase in crop recovery (Petersen, 2005a). Similarly, the band position affected the recovered N between two competing crop rows in weed-free conditions (Petersen, 2005b).

Increased horizontal distance between crop row and nitrogen band decreased recovery by 2.2 - 5.1%-point/cm (Petersen, 2005a, 2005b), and the crop recovery course was delayed by 0.5 day per cm increased horizontal distance. Thus, the use of 15N indicates that methods for precise N application may be part of a well-balanced weed control strategy.

References

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