

NITROGEN MINERALIZATION AND UPTAKE IN SNAP BEAN AND SWEET CORN

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Wisconsin is one of the leading producers of vegetable crops for processing in the United States. Wisconsin ranks third nationally in potato production, first in snap bean production, and third in sweet corn production, and result in \$304 million in gate receipts for Wisconsin framers. Proper nitrogen supply is critical to all crop growth, but is particularly important in high input vegetable systems due to a shortened season for snap bean and sweet corn and a lower rate of return on investment relative to potatoes. Nitrogen is also a problem in much of the vegetable production areas due to its susceptibility to leaching rains resulting in groundwater contamination by nitrates. The price of nitrogen has been extremely volatile in recent years and producers have searched for alternative management strategies to reduce their reliance on fertilizer nitrogen.

Annual and perennial cover crops have shown the potential to provide alternative sources of nitrogen to vegetable crops. In 2006 and 2007, perennial cover crops supplied between 50 and 100% of the required nitrogen for a sweet corn crop at Hancock. The management practices required to implement these cover crops into existing vegetable rotations is currently being addressed in several cover crop studies. One of the management needs of this system is determining how much nitrogen is available for vegetable crop plant uptake that is provided by the cover crops.

Cover crops have the potential to increase the nutrient use efficiency of the vegetable crops of the rotation through improvement of various soil quality parameters. Cover crops have been shown to increase soil organic matter, soil water holding capacity, cation exchange capacity, and soil structure all of which can contribute to better plant nitrogen uptake and efficiency.

Nutrient use efficiency can be calculated by four different methods to determine nitrogen uptake and utilization of the fertilizer nitrogen.

- 1) Nitrogen use efficiency $NUE = (TN_{Full} - TN_{Zero}) / (NA_{Full} - NA_{Zero})$
- 2) Agronomic use efficiency $AUE = (TDM_{Full} - TDM_{Zero}) / (NA_{Full} - NA_{Zero})$
- 3) Agronomic efficiency $AE = (Y_{Full} - Y_{Zero}) / (NA_{Full} - NA_{Zero})$
- 4) Nitrogen harvest index $NHI = (Fruit\ N_{Full} - Fruit\ N_{Zero}) / (TN_{Full} - TN_{Zero})$

Deviations in these measurements within a cover crop system versus no cover crops would indicate the influence of the cover crop on nutrient use efficiency. Annual cover crops did not improve nutrient use efficiency versus the no cover crop control. There was no

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conclusive evidence that annual cover crops could serve as an alternative source of fertilizer nitrogen for a vegetable crop rotation. Sweet corn produced yields that were 50 to 100% of the no cover crop control and it is believed that this was primarily due to nitrogen provided by decomposing cover crop residue and nitrogen released from the growing legume cover crop species. There was evidence in the perennial cover crop system that cover crops changed the nutrient use efficiency values compared to where no cover crops were present. A perennial cover crop system holds immediate potential as a production system, while annual cover crop benefits may only be realized under a long term rotation.