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Nitrogen Management of Winter Triticale

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Abstract
Triticale (trit-ah-kay-lee) is a close relative of wheat. When durum wheat is pollinated with rye pollen, the cross is used in a breeding program to produce stable, self-replicating varieties. Triticale yield, stress tolerance, and disease resistance are typically greater than similar traits found in wheat. Triticale does not currently possess the grain traits of bread wheat, so its greatest market potential is as animal feed.

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Introduction

Triticale (trit-ah-kay-lee) is a close relative of wheat. When durum wheat is pollinated with rye pollen, the cross is used in a breeding program to produce stable, self-replicating varieties. Triticale yield, stress tolerance, and disease resistance are typically greater than similar traits found in wheat. Triticale does not currently possess the grain traits of bread wheat, so its greatest market potential is as animal feed.

Ongoing research at Iowa State University and past research in Florida, Canada, Europe, and Australia have indicated that triticale is a high-quality feed for swine because of its superior lysine content and relatively high feed value compared with other cereal grains. Swine on triticale-based diets have rates of gain similar to those of pigs fed corn-based diets. Besides its use as a feed grain, triticale can be used as a forage crop for ruminants and as a cover crop.

When added to a rotation, triticale may increase yields of other crops in the rotation, reduce costs, improve distribution of labor and equipment use, provide better cash flow, and reduce weather risk. Additionally, production of triticale may provide environmental benefits, such as erosion control and improved nutrient cycling. Triticale appears to be an ideal crop for producers using sustainable agriculture practices and organic farming techniques. It requires 2.5 times less energy to produce a bushel of triticale than a bushel of corn. Efficiency of nitrogen (N) uptake favors triticale when compared with other grains. Phosphorus excretion from pigs fed triticale was as much as 29% less than from pigs fed corn.

This study was conducted over two years to determine optimum N management for winter triticale following either corn silage or soybean. The objectives of the study were to 1) identify optimum N fertilizer rates for winter triticale and 2) quantify triticale's ability to capture N and limit nitrate-N loss from the soil.

Materials and Methods

Previous crops (corn and soybean) were planted in alternating strips, eight rows wide, in the spring preceding planting of winter triticale. Winter triticale (DANKO Presto in 2003 and NE426GT in 2004) was no-till planted on the harvested corn and soybean strips in late September. The seeding rate was 330 seeds/m^2 and the row spacing was 8 in. N was applied as ammonium nitrate at green up in the spring (late March). N rate treatments were 0, 30, 60, and 90 lb/acre.

Nitrate-N in the top 4 ft of soil was measured before triticale planting and after triticale grain harvest. Above-ground plant N was measured at physiological maturity. Grain was harvested with a combine equipped with an on-board electronic weighing system. The harvested area was 15 ft wide and 70 ft long. Final grain yields were adjusted to 13.5% moisture and 56 lb/bushel test weight.

Results and Discussion

The four nitrogen rates produced similar triticale grain yields in both years indicating addition of nitrogen fertilizer was not needed to maximize yield in this system at this site. Triticale grain yield was 49 bushels/acre in 2003–2004 and 61 bushels/acre in 2004–2005. The lower yields in 2003–2004 resulted from extremely wet conditions during kernel development and filling, which reduced final kernel size. Average grain yields for the two years were 50 bushels/acre following corn silage and 59 bushels/acre following soybean regardless of nitrogen application.

Considerable amounts of residual soil nitrate-N were left after the previous crops (Tables 1 and 2). Soil nitrate-N levels after triticale planting were considerably lower than levels before planting. They were also similar across years and treatments even though nitrate-N levels before triticale planting were about twice as great in 2003–2004 as 2004–2005. The triticale was able to capture excess nitrogen beyond that needed to maximize grain yield and continued to capture nitrogen as the N rate was increased from 0 to 60 lb/acre (Table 2). N capture was similar for 60 and 90 lb N/acre.

These results indicate that winter triticale production could capture residual nitrate after corn and soybean, thus limiting nitrate-N loss from Iowa cropping systems. Winter triticale performed considerably better after soybeans than after corn silage regardless of residual nitrate levels or N application rate.

In a similar study conducted at Ames, 30 lb N/acre was required to maximize winter triticale grain yield in 2003–2004 and 2004–2005. Combined results from Lewis and Ames suggested that up to 60 lb N/acre could be applied to winter triticale without increasing residual soil nitrate-N above levels from no addition of N.

Table 1. Influence of year, previous crop, and winter triticale production on soil nitrate-N status and nitrogen capture within aboveground biomass.

Year	Previous crop	Soil nitrate-N before triticale planting	Soil nitrate-N after triticale harvest	Nitrogen capture by above-ground biomass
		lb/acre	lb/acre	lb/acre
2003–04	Corn silage	96	32	137
2003–04	Soybean	82	24	101
2004–05	Corn silage	38	21	96
2004–05	Soybean	56	24	131
	SE	5	2	7

Table 2. Influence of nitrogen application to winter triticale on soil nitrate-N status and nitrogen capture within above-ground biomass.

Nitrogen rate	Soil nitrate-N before triticale planting	Soil nitrate-N after triticale harvest	Nitrogen capture by above-ground biomass
(lb/acre)	(lb/acre)	(lb/acre)	(lb/acre)
0	67	21	81
30	62	21	110
60	73	31	135
90	70	27	138
SE	5	3	8