

# Corn Productivity and Nitrate Accumulations in Stalks following Alfalfa in the Rotation

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Alfalfa-corn is the predominant cropping rotation on most dairy farms in the Northeast. Sustainable cropping systems to be developed will take N cycling into accounting to minimize nitrate leaching into groundwater. The crops succeeding legumes will usually require less N fertilizer. In this study, corn was planted following alfalfa which had been treated as follows: unfertilized (zero N), low manure-N (5,000 gal/ac), high manure-N (15,000 gal/ac), and low and high fertilizer N (100 and 300 lbs N/ac as Ammonium Nitrate). Treatments were applied to alfalfa for 3 consecutive years. The alfalfa was harvested 3 times a year.

At the Sunderland site, the rotation practiced was two years of alfalfa followed by two years of corn. Alfalfa was plowed under prior to planting corn. Treatments for corn following alfalfa consisted of application of low manure-N (5,000 gal/ac) and low fertilizer N (100 lbs N /ac from ammonium nitrate); and the residual effects of previously imposed treatments to alfalfa. Liquid manure was applied on the surface and disked in immediately prior to planting corn. At the Deerfield site, manuring experiments with alfalfa continued for a third consecutive year to study long-term effects. Corn was harvested at maturity and total silage yield and earcorn yields were determined. After each harvesting, ear leaves and the bottom portion of stalks (internode) were collected from five random plants in each plot and analyzed for total N and nitrate-N, respectively.

## Silage and Earcorn Productivity

Corn planted following two years of alfalfa in the rotation did not significantly ( $P 0.05$ ) respond to application of manure or N fertilizer as silage yield was not affected (Fig. 1). However, a significant increase in silage yield was observed in the second year of corn following

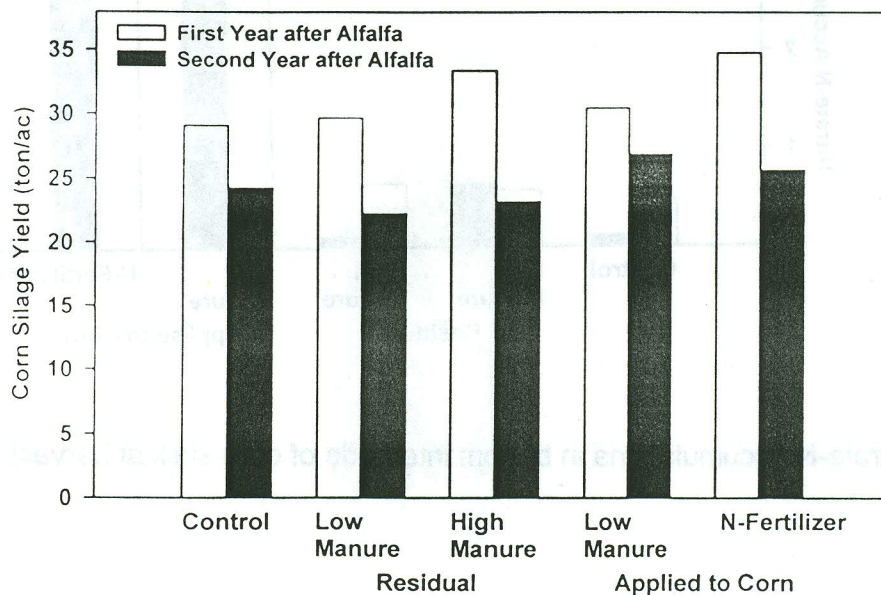


Figure 1. Corn silage yield following alfalfa in the rotation.

incorporation of alfalfa. The application of manure (5,000 gal/ac) or  $\text{NH}_4\text{NO}_3$  (100 lbs N/ac) to corn increased silage yield compared to corn raised on residual effects of low (5,000 gal/ac) and high (15,000 gal/ac) rates of manure previously applied to alfalfa in the rotation.

Significant treatment differences in earcorn yield occurred in both the years. During the first year after incorporation of alfalfa, application of ammonium nitrate to corn resulted in significant increase in earcorn productivity compared to corn receiving manure or corn grown on residual effects of zero N fertilizer or low rates of manure. However, no significant differences were observed between the treatments of ammonium nitrate and residual effects of high manure rates. No significant yield differences in earcorn were observed among zero N, residual effects of low manure rates, and application of manure to corn. During the second year following alfalfa, corn raised on residual effects of low manure rates showed significantly lower yields than plots receiving manure or  $\text{NH}_4\text{NO}_3$ .

### Nitrate Accumulations in Corn Stalk

Nitrate accumulations in corn stalks were significantly affected by nitrogen/manure management. Application of manure or N fertilizer to corn following alfalfa in rotation significantly increased nitrate concentrations in corn stalks by 600% (Fig. 2). This trend was observed in both the years. Hence, excess nitrogen applications, that is more than the crop needs either in the form of N-fertilizer or manure will only result in nitrate accumulations rather than an increase in corn yields.

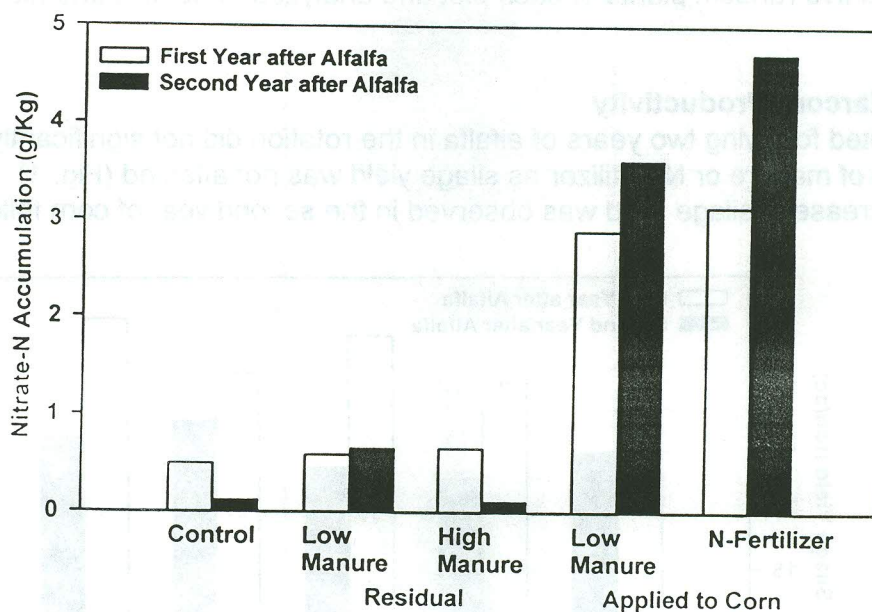


Figure 2. Nitrate-N accumulations in bottom internode of corn stalk at harvest.