

Nitrogen Fluids Improve Yield and Quality of Wheat

Soil-applied and foliar N applications show positive responses in UK winter wheat studies.

Summary: Fluids containing N applied at lowest rates increased yields in six of nine winter wheat experiments carried out between 1989 and 1991. Grain protein content increased in all nine experiments.

Late foliar applications of urea solutions increased yield in six of the experiments and grain protein in eight. Where yield responses to foliar urea occurred, these generally were not as great as would have occurred from the same rate of additional soil-applied N. For grain protein, foliar urea generally was more effective than the equivalent rate of soil-applied N.

For yield, an optimal N rate could be identified in several experiments. However, protein generally continued increasing to the highest rate of N applied.

Though results spanning three years of our study will be addressed in this discussion, initial focus will be on the final year of our study.

Objective of this FFF-sponsored study was to investigate nitrogen management for breadmaking quality in winter wheat. Different rates of soil-applied UAN in the spring, with or without a single timing of late foliar urea, were evaluated for effects on yield and grain protein at two sites in the UK in 1991.

Some details of site, crop husbandry and experimental design are shown in Table 1. Crop at both sites received overall applications of fungicides to control diseases and a growth regulator to reduce lodging. Plot size was 6.5 x 33.0 feet, but this varied slightly between sites.

Responses favorable

Yield. As Figure 1 shows, there was no optimum yield response to spring soil-applied N at our Harper Adams site in 1991. There also was no significant influence between the Avalon and Mercia varieties. Foliar urea increased yield, but more so at the lower N rates. At our Eyeworth site (Figure 2), yield responses were similar, except that the effect of soil-

applied N was much less marked at high rates.

Protein. Though the Avalon hybrid had a higher protein content than the Mercia variety, responses to soil-applied and foliar N were similar for both varieties at Harper Adams in 1991. Protein content increased with more N applied without showing an optimum, but the response was more marked at higher N rates (Figure 1). Foliar urea increased protein by about the same amount at all N rates. At Eyeworth (Figure 2), responses of protein to soil-applied UAN and foliar urea were similar to those at Harper Adams.

Overview

Procedure. Nine experiments were conducted between 1989 and 1991 to study the effects of soil-applied N in the spring and late-applied foliar N on yield and grain quality of winter wheat.

UAN was soil applied in March and April through stream jets at varying pressures, according to N rate. The foliar urea was applied in June as a spray through hollow cone nozzles at 21.4 gals/A. Plots were combine harvested.

Yield. Only two of the nine experiments did not show a yield response to N. In only one experiment was yield reduced by N, and this was closely associated with early lodging. Six experiments showed a yield response to UAN, and in two of these the response was significantly greater at lower N rates.

Foliar urea gave a greater increase in yield than the same quantity of additional N in the spring at low N rates in one experiment and at all rates in another. In all other urea-responsive experiments, soil-applied N in the spring was more effective at increasing yield of winter wheat.

Protein. All nine experiments gave a grain protein response to soil-applied N in the

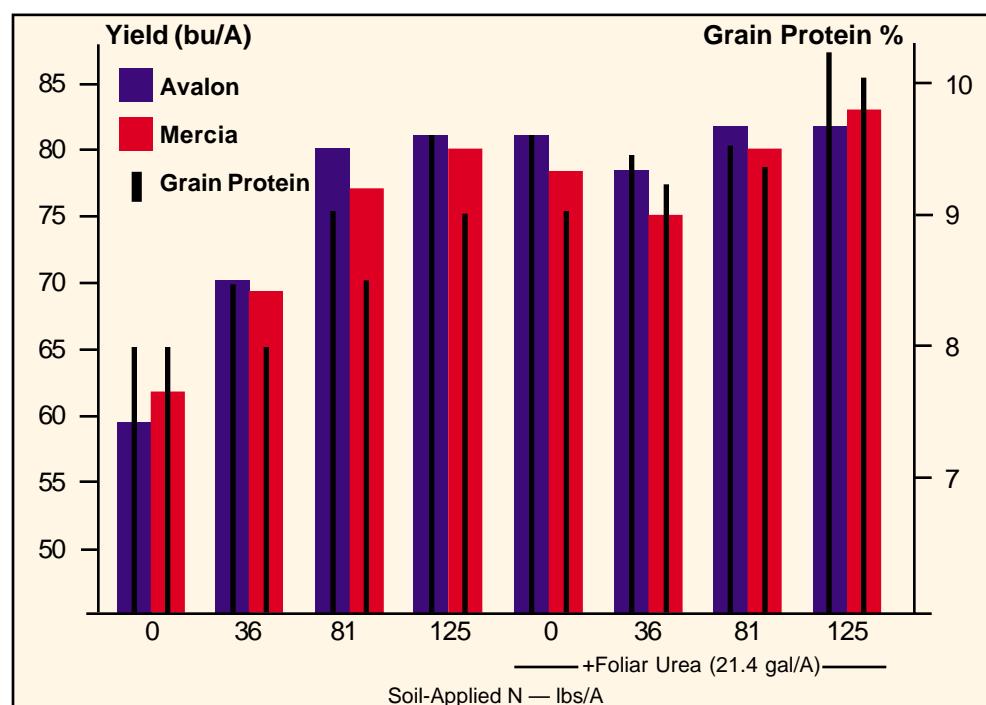


Figure 1. Effects of soil-applied UAN in spring and late applied foliar urea on yield and grain quality of winter wheat, using two varieties at Harper Adams, Kettlewell, et al. UK.

spring. All but one showed greater protein content from late foliar application. There was a significant nitrogen by urea interaction for grain protein (giving a smaller response to urea at high N) in only one experiment. There were indications in other experiments, however, that a lesser response to foliar urea at high N might occur, especially at Harper Adams in 1990. This type of interaction also has been found by other researchers from earlier foliar urea applications during tiller development of spring wheat.

A late foliar spray of urea (36 lbs N/A) gave a greater increase in grain protein content than the same amount of additional N soil-applied in the spring at all levels of N tested and at all sites except Harper Adams in 1990. Thus, for protein content it was better to apply a late spray irrespective of how much N had been applied in the spring, rather than applying additional N in the spring.

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Table 1. Site details and experimental design, N management study, Kettlewell, et al., Harper Adams Agricultural College, UK.

Site	Soil texture	Soil organic matter	Soil mineral N to 35 inches	Previous crop	Varieties	Sowing date	Design
Harper Adams	Sandy loam	2.0	108	Potatoes	Mercia & Avalon	10/18/90	Three randomized blocks, split-pot with variety main plots
Eyeworth	Clay loam	2.6	108	Spring beans	Mercia	10/9/90	Three randomized blocks

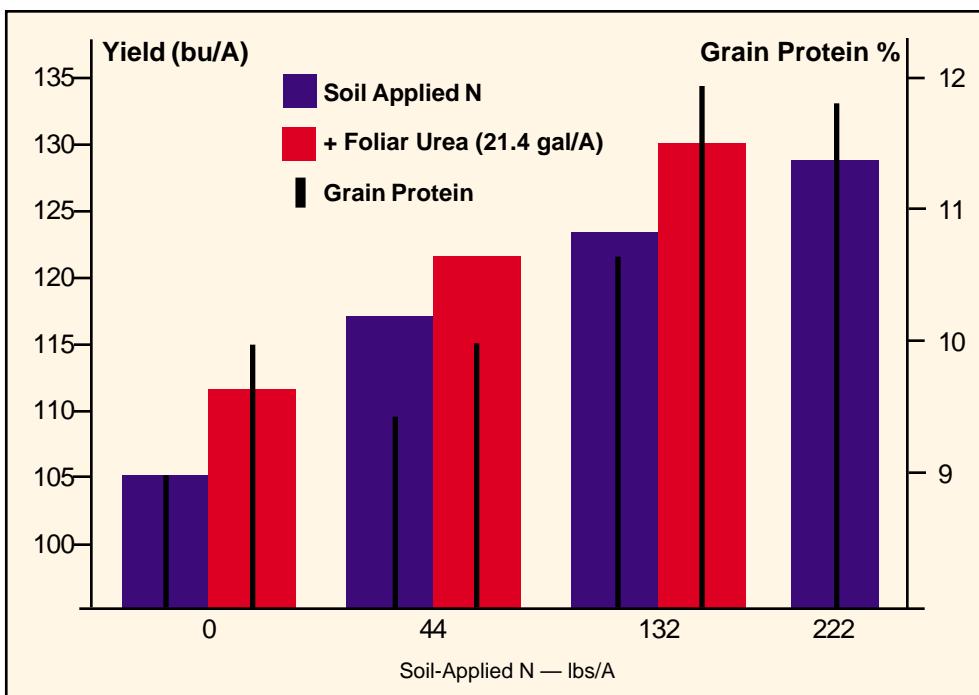


Figure 2. Effects of soil-applied UAN in spring and late applied foliar urea on yield and grain quality of winter wheat at Eyeworth, Kettlewell, et al., UK.