Oregon State University

Crop Science Report
RESEARCH/EXTENSION

# 1986 INFIELD HARD RED SPRING WHEAT FERTILIZATION TRIALS

by Russell S. Karow[1]

Small plot, experiment station studies have shown that boot-to-head applied nitrogen can effectively increase the protein content of hard red wheats. The purpose of these studies was to carry this research knowledge into actual field situations. County agents flagged plots in grower fields and applied fertilizer treatments. Grain was then harvested from the treated areas and analyzed for protein.

Table 1 gives a summary of results from the hard red spring (HRS) wheat infield fertilization trials conducted last summer. In all, eight growers participated in the trial. Eleven sites were utilized--seven irrigated and four non-irrigated. I have broken the experimental analysis into two sections based on the use of irrigation. My interpretation of results is as follows.

## IRRIGATED SITES

Irrigated sites were located in Jefferson, Wasco, Morrow, and Marion Counties. Yields covered a fairly narrow range--75 to 98 bu/A with an 83 bu/A average. Applied nitrogen ranged from 60 to 214 lb/A with sulfur applied in all but one instance at a 5:1 or 6:1 ratio. In the experimental analysis, fields were treated as replications.

In all but one instance, there was increased protein due to boot-to-head applied nitrogen. Averaged over all irrigated plots, the only statistically significant increase was due to the 30 lb nitrogen treatment; however, for individual growers (GC-WB906R and RBF) there was a larger increase in protein at the 40 lb rate. The conclusion from this data would be that 30-40 lbs nitrogen per acre applied boot-to-heading can significantly increase grain protein content.

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From an economic standpoint, the protein increase from 13.5 to 14.3 (0 to 30 lb N) was cost-effective as is shown in Figure 1. The 30 lb of additional nitrogen resulted in a net return of more than $19.00 per acre.

The BJ sight was the exception to the general trend of increased protein with added nitrogen. In this instance, protein content was essentially unchanged by added nitrogen. One explanation would be that residual and preplant nitrogen was sufficient to meet the yield production needs of the crop and that excess nitrogen was available to set a protein level as well. Some dryland growers are successfully using this approach of applying excess nitrogen preplant to grow high-protein hard red wheat crops.

DRYLAND SITES

Dryland sites were located in Yamhill, Umatilla and Morrow counties. Yields covered a range from 23 to 50 bu/A with an average of 34 bushels. Applied nitrogen ranged from 90 to 121 lb/A with sulfur applied in all but one case in approximately a 3:1 ratio.

Data on boot-to-head applied nitrogen and sulfur was quite variable. The only site showing consistent protein increase with increasing nitrogen was DW-L. At this site, a 30 lb nitrogen application resulted in a 1.6% increase in protein. Sulfur appeared also to be beneficial at this site.

At all other dryland sites results are inconclusive. The differences between treatments do not show a consistent pattern and are likely to be due to random variation. In general, we can say that this data shows that in dryland situations boot-to-head applied nitrogen was not effective in increasing protein.

This result is not unexpected as neither rainfall nor soil surface moisture was available at all sites to move fertilizer material to the root zone.

From an economic standpoint, using the dryland average values, boot-to-head fertilizer application would not be cost-effective.

The KT sight demonstrates another approach to dryland production of hard red spring wheat that has been effective. This approach is to apply excess nitrogen and sulfur at planting. In this approach, you need to be able to accurately predict expected yield, to fertilize for that yield, and then add additional nitrogen to increase protein. This approach can work in a dryland area as yield prediction is possible and leaching losses of nitrogen from the soil are minimal.

GENERAL CONCLUSIONS

This study and others conducted in Central Oregon on hard red spring wheat and at the Hermiston Experiment Station on hard red winter wheat all support the concept of boot-to-head nitrogen application for increasing protein content of hard red wheats under irrigated production. A cost-effective application rate would appear to be 30-40 lb N/A.

My recommendation to growers not already using this practice would be to try additional nitrogen applications on a small acreage. This practice may or may not work for you depending on your preplant fertility program, your rotation, and your rainfall/irrigation situation.

For additional information on hard red spring wheat production practices, contact your local office of the OSU Extension Service.

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Table 1. 1986 Hard Red Spring Wheat Infield Fertilization Trials

| | | | | | | Boot-to-Head Top Dress | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROWER | VARIETY | TOTAL N/S | N TOP DRESS | 1985 CROP | YIELD Bu/A | 0 | 30 | 40 | 50 | 50/5 | 50/10 | PLSD(5%) |
| IRRIGATED PRODUCTION | | | | | | | | | | | | |
| GC | YEC ROJO | 100/21 | 30N/SOL32 | STEPHENS | 75 | 12.8 | 14.5 | 14.2 | 14.3 | 14.6 | 14.5 | |
| GC | WB906R | 100/21 | 30N/SOL32 | STEPHENS | 80 | 12.5 | 12.9 | 13.6 | 13.6 | 13.5 | 13.0 | |
| JC | YEC ROJO | 175/30 | NONE | POTATOES | 75 | 14.3 | 15.7 | 15.5 | 15.5 | 15.4 | 14.7 | |
| BJ | YEC ROJO | 214/64 | NONE | OATS | 95 | 15.1 | 15.0 | 15.3 | 14.7 | 14.9 | 14.9 | |
| KT | WB906R | 185/34 | 75N/UREA SOL+AmS | WHEAT | 80 | 13.1 | 14.5 | 14.1 | 14.3 | 14.0 | 14.5 | |
| KT | KODIAK | 185/34 | 75N/UREA SOL+AmS | WHEAT | 80 | 12.2 | 13.0 | 12.5 | 13.7 | 14.0 | 13.7 | |
| RBF | YEC ROJO | 60/0 | 28N/SOL32 | YAMHILL | 98 | 14.3 | 14.5 | 15.9 | 15.3 | 15.6 | 15.3 | |
| IRRIGATED AVERAGE | | | | | 83 | 13.5 | 14.3 | 14.4 | 14.5 | 14.6 | 14.4 | 0.5 |
| DRYLAND PRODUCTION | | | | | | | | | | | | |
| CS | KODIAK | 76/0 | FOLIAR N/S | SPRG OATS | 50 | 11.5 | 12.1 | 11.8 | 12.4 | 11.9 | 12.1 | |
| KT | WB906R | 121/57 | 41N/DRY | FALLOW | 34 | 15.5 | 14.9 | 15.2 | 14.7 | 15.3 | 14.7 | |
| DW-U | PERF SEED | 50/15 | NONE | FALLOW | 23 | 15.1 | 14.8 | 14.0 | 13.7 | 13.2 | 14.8 | |
| DW-L | PERF SEED | 50/15 | NONE | FALLOW | 30 | 12.6 | 14.2 | 14.4 | 15.4 | 15.1 | 13.4 | |
| DRYLAND AVERAGE | | | | | 34 | 13.7 | 14.0 | 13.9 | 14.1 | 13.9 | 13.8 | 1.2 |
| OVERALL AVERAGE | | | | | 65 | 13.6 | 14.2 | 14.2 | 14.3 | 14.3 | 14.2 | 0.5 |

NOTE: Protein percentages for untreated (0 level) areas may differ from the value growers received from the Federal Grain Inspection Service. The values we obtain tend to be consistently lower than those obtained by FGIS. Our values in relation to one another (ie comparing proteins over the various nitrogen levels) are accurate.

Figure 1. Economic return from 30 lb of boot-to-head applied nitrogen under irrigated HRS wheat production conditions

A. Costs

| | | |
|---|---|---|
| 30 lb N @ .24/lb | = | 7.20 |
| Aerial application | = | 5.00 |
| Total | = | 12.20 |

B. Gross Return

| | | | |
|---|---|---|---|
| 13.47% protein DNS | = | 3.13 | ($3.43, 14% DNS; Portland, April 15, 1987) |
| 14.30% protein DNS | = | 3.51 | |
| Difference | = | .38 | |
| .38 x 83 Bu/A | = | 31.54 | |

C. Net Return

| | | |
|---|---|---|
| $31.54 - 12.20 | = | $19.34 |