# Minnesota Department of Agriculture
# Pesticide & Fertilizer Management
## FINAL REPORT
## FOR THE GRANT ENDING: MARCH 31, 2012

PROJECT NUMBER: B54752 (Project J)

PROJECT DESCRIPTION: Wheat Yield, Quality and Plant Health Parameters from Starter Applications of MicroEssentials in Northwest Minnesota

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**Background:** Spring wheat is a major crop for farmers in northwest Minnesota. Perennial ryegrass is a relatively new grass seed crop raised in northwest Minnesota. Production estimates indicate over 16,000 acres of perennial ryegrass will be harvested in 2011. The primary method of establishing perennial ryegrass is to under seed it with spring wheat. Seeding perennial ryegrass under wheat protects the plants during the winter by catching snow with the wheat stubble. However, perennial ryegrass seed yields in the subsequent year following wheat may be negatively impacted due to excessive plant growth and crop residue from the wheat crop. This project will evaluate spring wheat growth and development, yield, and seed quality parameters from in-furrow fertilizer treatments using new fertilizer technologies to improve profitability.

New formulations of phosphate fertilizers that increase phosphorous uptake by roots up to 30% have been developed (MicroEssentials - The Mosaic Company). An increase in phosphate uptake by wheat is theorized to improve plant growth and development which may lead to increased wheat yields, improved quality, and ultimately profitability. A new formulation of nitrogen called ESN is a time released coated urea product (Agrium Company). ESN can be applied broadcast or in furrow only at nitrogen rates up to three times the current safe rate of urea. The polymer coated, time released formulation supplies nitrogen to the crop throughout the entire growing season and reduces nitrogen loss through volatilization, denitrification, and leaching.

Producers were interested in obtaining unbiased data on the use of MicroEssentials and ESN in spring wheat and perennial ryegrass seed production systems under northern Minnesota's environmental conditions. This research is part of a larger research program investigating fertility requirements for grass seed cropping systems that integrate spring wheat into the production system. The rationale for this research was to compare MicroEssentials alone and with ESN compared to a standard phosphorus fertilizer starter program in spring wheat. In addition to phosphorus, the MicroEssentails products contain sulfur and zinc which have been reported to be involved in protein synthesis and may increase protein levels in wheat. A coated urea product may offer the potential to improve wheat yield and quality (protein), especially if the product is not released into the soil solution until later in the plant developmental stages of the spring wheat. The combination of this coated urea and MicroEssentials offer the potential to improve both wheat yields and seed quality.

**Goals and Objectives:**

1. To compare MicroEssentials with a standard phosphorus fertilizer applied as a starter fertility treatment when seeding spring wheat.

2. To evaluate spring wheat yield and quality from MicroEssentials, MicroEssentials plus ESN coated nitrogen, and

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the standard recommended fertility treatments.

**Procedures:** This fertility research integrated small plot replicated trials with large, replicated on-farm trials. The small plot replicated trials was conducted at the Magnusson Research Farm. The experimental design was a randomized complete block with 4 replications. Wheat and perennial ryegrass will be seeded with and without a starter fertilizer. This starter fertilizer will be applied down the tube with the seed. These small plots will be managed similar to area wheat production fields and harvested for yield with a small plot combine. Sub-samples will be taken from each plot for wheat seed quality assessments.

The small plot fertility trial consisted of treatments including the three MicroEssential products: MES10 (12-40-0-10S), MES15 (13-33-0-15S) and MESZN (12-40-0-10S-1ZN). The standard rate of $P_2O_5$ and $K_2O$ was 30 units; two treatments will have double the standard rate of $P_2O_5$ and $K_2O$; MAP fertilizer was compared to MES 10, MES15 and MESZN with a 2X rate of MES10 and $K_2O$ all applied in-furrow; a single broadcast soil incorporated MES10 treatment; and MES10 plus ESN at 20 and 40 units applied in-furrow to compare $P_2O_5$ treatments alone (Table 1).

The on-farm trial was conducted in Lake of the Woods county in a randomized complete block design replicated three times. The three starter treatments were: 1) the current starter fertilizer program [control of standard monoammonium phosphate (MAP)]; 2) MicroEssentials starter fertilizer; and 3) MicroEssentials starter fertilizer plus ESN. The applied ESN nitrogen was in addition to the nitrogen applied for meet the producer's specific yield goal for wheat. Plot size was 85 feet wide by 500 feet long to accommodate the production practices and the farmer cooperators equipment.

There were trends towards higher wheat yields in the in furrow application of fertilizers resulting in an average increase of 8.6%. Few differences were observed for grain protein. There was a small but consistent phosphorus and sulfur response observed in the tissue analysis for all treatments except the control which received only nitrogen fertilizer.

Table 1. 2011 Spring Wheat Small Plot Trial

| | Total fertilizer | Fertilizer applied | **Grain yield** | | Tissue samples*** | | |
|---|---|---|---|---|---|---|---|
| Treatment | Applied | in furrow | **Bu./ac.**** | % protein | %P | %K | %S |
| MES10 | 90+30+30+7s | 9+30+30+7s | **86.2** | 13.6 | 0.24 | 1.2 | 0.32 |
| MES10+30#ESN | 90+30+30+7s | 39+30+30+7s | **89.3** | 13.6 | 0.24 | 1.2 | 0.32 |
| MES10 (2x)+K20(2x) | 90+60+60+14s | 18+60+60+14s | **89.2** | 13.7 | 0.25 | 1.1 | 0.35 |
| MES15 | 90+30+30+14s | 9+30+30+14s | **88.1** | 13.4 | 0.23 | 1.2 | 0.32 |
| MESZ | 90+30+30+14s+1z | 9+30+30+7s+1z | **89.0** | 13.3 | 0.23 | 1.2 | 0.31 |
| MAP | 90+30+30 | 7+30+30 | **88.6** | 13.8 | 0.24 | 1.2 | 0.33 |
| No treatment | 90+0+0 | None | **82.3** | 13.5 | 0.22 | 1.3 | 0.30 |
| MES10 surface applied | 90+30+30+7s | None | **86.1** | 13.6 | 0.24 | 1.2 | 0.34 |
| MES10+30#ESN | 120+30+30+7s | 39+30+30+7s | **89.5** | 13.9 | 0.25 | 1.2 | 0.35 |
| MES10+60#ESN | 90+30+30+7s | 69+30+30+7s | **90.4** | 13.9 | 0.24 | 1.2 | 0.33 |
| 30# ESN only | 90+0+0 | 30+0+0 | **84.5** | 13.9 | 0.22 | 1.1 | 0.30 |
| MES10+Foliar** | 90+30+30+7s | 9+30+30+7s | **84.5** | 14.0 | 0.24 | 1.2 | 0.31 |
| LSD @10% level | | | **4.9** | 0.4 | | | |

* Yields corrected to 12% moisture
** 30 lbs of N (28% N) applied as foliar spray at anathesis
*** Flag leaf tissue samples taken at anthesis

Pre-Plant Soil test results:

55 lbs/acre $NO_3$-N from 1 – 24 inch depth
14 lbs/acre $P_2O_5$
pH = 7.8
K = 185 lbs/acre $K_2O$
S = 15 lbs/acre $SO_4$

Table 2. 2011 Spring Wheat Data from Large Plot On Farm Trial:

| | | Grain yield | Test | Protein | Tissue samples* | |
|---|---|---|---|---|---|---|
| Treatment | In furrow fertilizer | Bu./ac.** | weight | % | % P | % K |
| MES10 | 12+30+20+7.5s | **66.4** | 63.2 | 13.8 | 0.22 | 1.17 |
| MAP+AMS | 9+30+20+7.5s | **68.6** | 62.7 | 13.8 | 0.22 | 1.20 |
| MES10+ESN | 39+30+20+7.5s | **64.5** | 64.0 | 13.7 | 0.23 | 1.20 |
| LSD @10% level | | **4.6(NS)** | 1.1 | 0.5(NS) | 0.1 | 0.09 |

All plots received a total of 140 N + 30 P + 20K + 7.5S
Experimental Design: Randomized Complete Block with 3 replications
Plot size= 79' x 500' grower harvest

* Tissue samples- flag leaf samples taken at anthesis (7/6/2011)
** Yields corrected to 12% moisture

Pre-Plant Soil Test Results:

14 lbs/acre $P_2O_5$
pH = 7.9
K = 210 lbs/acre $K_2O$
S = 9 lbs/acre $SO_4$