

Project Title: Agronomic evaluations of winter and spring wheat in Oregon

Funding Agency: Agricultural Research Foundation  
Oregon Wheat Commission

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Organization: Department of Crop and Soil Science  
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Corvallis, OR 97331

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Commission Grant Fund

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**Title:** Agronomic evaluations of winter and spring wheat in Oregon

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**Funding History:** 2008 – 2009 - \$20,000  
2009 – 2010 - \$32,000  
2009 – 2010 - \$50,000  
2010 – 2011 - \$30,000 requested

**Abstract:**

Agronomic studies provide growers with critical information regarding variety selection and management. The OSU cereal extension program is proposing a series of agronomic studies in winter and spring wheat. Study objectives include the development/refinement of varietal recommendations for early and late planted wheat, the evaluation of agronomic management practices for no-till/direct seed systems, and the development of nitrogen management guidelines for spring wheat in western Oregon. Trial sites will be located throughout Oregon and will represent a range of environments. Study sites may also be used in field days and demonstrations to increase grower awareness of new varieties and management practices. These research studies are designed to compliment much of the on-going research at OSU and will be a collaborative effort with the OSU Wheat Breeding Program, OSU Wheat Quality Improvement Program, Oregon's agricultural experiment stations, and local extension personnel. This research will provide growers with important new information and management recommendations for winter and spring wheat in conventional and no-till/direct seed cropping systems.

**Objectives:**

- 1) To develop/refine varietal recommendations for early and late plantings across a range of environments in Oregon.
- 2) To evaluate agronomic management practices for no-till/direct seed systems in dryland cropping systems.
- 3) To develop N management guidelines for spring wheat in Western Oregon.

**Procedure:**

**Objective 1.**

Three study sites will be located on research stations near Corvallis, Moro, and Pendleton, Oregon to represent a range of environments in the wheat growing region of Oregon. At each site a randomized complete block design with three replications will be used.

Treatments will consist of winter and spring wheat varieties seeded at five planting dates. Planting dates will be September, October, November, and March/April. Wheat varieties will consist of new and commonly grown varieties as well as OSU elite lines of soft white winter, hard red winter, soft white spring, and hard red spring wheat. Winter wheat varieties will be sown in September, October, and November. Spring wheat varieties will be sown in November and March/April. Seed will be sown using a small plot drill. Management at each site will reflect local management practices. At maturity, plots will be harvested using a small plot combine and measurements of grain yield, test weight, and grain protein will be obtained. Data will be analyzed using SAS software and means separated.

Study results will be reported through the cereal extension website, grower meetings, field days, extension publications, and peer reviewed publications. The expected outcome of this study is improved variety recommendations for early and late plantings.

### **Objective 2.**

Study sites will be located in the low and intermediate rainfall zones of Oregon to capture a range of environmental and crop residue conditions. At each site a series of experiments will be established that address basic management practices in no-till/direct seed systems. Experiments will include a seeding rate study, a starter fertilizer study, and a N fertility study. All studies will use a randomized complete block design with four replications.

Seeding rate treatments will consist of five seeding rates (15, 20, 25, 30, and 35 seeds per square foot). Starter fertilizer treatments will consist of a control (0), a starter fertilizer treatment with 50 pounds per acre of 16-20-00, and a starter fertilizer treatment of 50 pounds per acre of 16-20-00 with the total N rate equal to the control. All starter fertilizer treatments will be applied across five winter wheat varieties. Nitrogen fertilizer treatments will vary depending yield potential at each site. For the low rainfall site N rates will be 0, 25, 50, 75 and 100 pounds per acre. For the intermediate rainfall site, N rates will be 0, 50, 100, 150, and 200 pounds per acre. Each N fertilizer treatment will be applied across five winter wheat varieties.

Seed and fertilizer will be sown using a newly fabricated no-till/direct seed small plot grain drill. Management at each site will reflect local management practices. At maturity, plots will be harvested using a small plot combine and measurements of grain yield, test weight, and grain protein will be obtained. Data will be analyzed using SAS software and means separated.

Study results will be reported through the cereal extension website, grower meetings, field days, extension publications, and peer reviewed publications. The expected outcome of this study is improved management and variety recommendations for no-till/direct seed systems in the low and intermediate rainfall zones of Oregon.

**Objective 3.**

A non-irrigated study site will be established at the Hyslop Field Research Laboratory near Corvallis, Oregon. A randomized complete block design with four replications, two spring wheat varieties and 8 N treatments will be used. Table 2 outlines the 8 N treatments that will be evaluated. Please note that the N mineralization test is the currently recommended method for determining the proper N fertilizer rate for soft white winter wheat in Western Oregon.

**Table 2.** Spring wheat N treatments.

N Fertilizer Rate (lbs N / acre)							
0	30	60	90	120	150	N Mineralization Test	0.5 N Mineralization Test

Nitrogen treatments will be established at growth stage 5 by surface applying granular urea (46-0-0) using a drop spreader. The site will be monitored during the growing season and common agronomic characteristics will be measured. Samples from each site will be made available for further quality testing through the OSU Wheat Quality Improvement Program and/or the ARS Western Wheat Quality Lab. Data will analyzed and results reported through the cereal extension website, grower meetings, field days, extension publications, and peer reviewed publications. The expected outcome of this study is the development of N management guidelines for spring wheat in Western Oregon.

**Timeline:****Objective 1.**

In the summer of 2010, winter and spring wheat varieties for the planting date study will be identified and sourced. Plots will be established starting in September in cooperation with the OSU Wheat Breeding Program and the personnel at the Columbia Basin Agricultural Center. At maturity plots will be harvested using a small plot combine in cooperation with the OSU Wheat Breeding Program. Grain samples will be analyzed for yield, test weight, moisture, and protein. Data analysis will start after harvest is completed. Preliminary results will be reported through the cereal extension website, grower meetings, and extension publications when applicable. Preliminary results may also be presented at regional and national meetings. Yearly progress reports will be presented to the Oregon Wheat Commission.

**Objective 2.**

In the fall of 2010, plots will be established at a minimum of two locations in cooperation with the OSU Wheat Breeding Program and the personnel at the Columbia Basin Agricultural Center. At maturity plots will be harvested using a small plot combine in cooperation with the OSU Wheat Breeding Program. Grain samples will be analyzed for yield, test weight, moisture, and protein. Data analysis will start after harvest is completed. Preliminary results will be reported through the cereal extension website, grower meetings, and extension publications when applicable. Preliminary results may also be presented at regional and national meetings. Yearly progress reports will be presented to the Oregon Wheat Commission.

**Objective 3.**

In the spring of 2011, plots will be established at the Hyslop Field Research Laboratory in cooperation with the OSU Wheat Breeding Program. Nitrogen fertilizer will be surface applied at growth stage 5 using a drop spreader. At maturity plots will be harvested using a small plot combine in cooperation with the OSU Wheat Breeding Program. Grain samples will be analyzed for yield, test weight, moisture, and protein. Data analysis will start after harvest is completed. Preliminary results will be reported through the cereal extension website, grower meetings, and extension publications when applicable. Preliminary results may also be presented at regional and national meetings. Yearly progress reports will be presented to the Oregon Wheat Commission.

**Justification:****Objective 1.**

Variety selection is one of the most important agronomic decisions a grower makes. Selecting an appropriate variety minimizes the risk from crop diseases and stresses while maximizing yield potential. Statewide variety trials, extension trials, and private company variety trials are commonly used by growers and crop consultants to choose adapted and high yielding varieties. However, these trials are limited in that they only compare varieties in a single common setting. In practice, growers may find that varieties perform quite differently in their individual production systems, given differences in equipment and planting date.

Research over the last three years has shown that some newer varieties perform better than older common varieties under the more stressful conditions of early or late planting. For example, Goetze averaged 5, 14, and 14 bushels per acre more than Stephens in late plantings at Pendleton during 2006, 2007, and 2008, respectively. Clearly, information on the performance of varieties under early and late plantings would benefit growers in determining how best to use these varieties within their individual production system.

However to date, research has only been conducted on a small set of new varieties. Thus, an expanded study that examines the many new varieties from the PNW breeding programs is required. In addition, studies such as this should be considered for continuous funding since new varieties are always being developed.

**Objective 2.**

Currently there are few studies that address basic agronomic management in no-till/direct seed systems across a range of environments and residue conditions in Oregon. To address these needs my program recently worked with the OSU wheat breeding program and the researchers at the Columbia Basin Agricultural Research Center to develop an easily portable no-till/direct seed small plot drill that can handle a range of residue conditions. Due to the portability of this new grain drill, no-till/direct seed studies can now be established at a larger number of locations and across more varied environments. Given this new ability, research should be initiated to answer common questions from growers such as variety selection, seeding rate, and the need for starter fertilizer.

**Objective 3.**

Wheat production in western Oregon has increased over the last two years. While most of this production is winter wheat, acreage of spring wheat has also increased. Currently, there are no nitrogen management guidelines for spring wheat in western Oregon. Thus, nitrogen fertilizer recommendations are based on the experience and past history of growers and fieldmen. However, many growers and fieldmen have not dealt with wheat in quite awhile. Therefore, research is required to develop nitrogen management guidelines for spring wheat in this region of Oregon.

**Relationship to Other Research:**

This project will complement current research efforts and be conducted through collaboration with the OSU Wheat Breeding Program, the OSU Wheat Quality Improvement Program, Oregon's agricultural experiment stations, and local extension faculty.

**Budget:** Funds are requested for labor, travel, supplies, and land rent. The increase in requested funds for land rent and travel are due to decreased state support for extension and research activities.

<b>Item</b>	<b>Amount</b>
<b>Salaries</b>	
Student Labor (1 Corvallis, 1 Pendleton)	10,000.00
Student OPE (8%)	800.00
<b>Services / Supplies</b>	
Objective 1 – Site Establishment and Maintenance	4,000.00
Objective 2 – Site Establishment and Maintenance	3,200.00
Objective 3 – Site Establishment and Maintenance	500.00
Site Establishment and Maintenance Costs Include – Land, Seed, Fertilizer, Flags, Sample Bags, etc.	
<b>Travel</b>	
Site Visits/Field Day/Grower Meetings	10,000.00
PNW Grains Conference	750.00
Western Wheat Workers Conference	750.00
<b>Total</b>	<b>30,000.00</b>

### Current and Pending Support

Name	Supporting Agency	Total Amount (\$)	Effective Dates	% of Time Committed	Project Title
Current					
Flowers, M.D.	Oregon Wheat Commission	50,000	7/1/09 – 6/30/10	20	Agronomic evaluations in winter and spring wheat
Flowers, M.D.	Agricultural Research Foundation	12,500	7/1/09 - 6/30/10	10	Evaluating a remote sensing technique for predicting in-season nitrogen application rates on perennial ryegrass for seed production
Flowers, M.D.	Helena Chemical Company	4,500	10/1/09 - 9/30/10	5	Evaluation of CoRoN in winter wheat
Flowers, M.D.	J.R. Simplot	5,000	10/1/09 - 9/30/10	5	Evaluation of NSN in winter wheat
Pending					
Flowers, M.D. and A. Hulting	Agricultural Research Foundation	12,500	1/1/10 - 2/30/11	5	Alternative winter cereal crops for western Oregon
Flowers, M.D.	Oregon Wheat Commission	30,000	7/1/10 – 6/30/11	20	Agronomic evaluations in winter and spring wheat

## Report of Accomplishments:

### N Management in Hard Red Winter Wheat

Study sites in Lexington and Pendleton, were established in the fall of 2006, 2007, and 2008. Additional sites were established at Helix in 2006 and 2007 and Arlington in 2008. Varieties included in the study were Paladin (HRW), Boundary (HRW), Norwest 553 (HRW), OR2052046H (HWW), and Stephens (SWW). Fall N treatments were incorporated into the soil prior to seeding. The N source for all N treatments was granular urea (46-0-0). All treatments received 15 lbs per acre sulfur (K mag; Potassium magnesium sulfate) to eliminate any potential sulfur deficiency.

### Study Results

- Fertilizer N increased grain protein in all site-years. However, the degree of response varied by both year and location, underscoring the difficulty of managing N for protein enhancement in these environments (Figure 1).
- In contrast to the popular belief that high stress, lower yield environments are better suited for HRW production, results indicate that modest yield at low rainfall sites does not necessarily confer a grain protein advantage.
- Fertilizer use efficiency was modest at Pendleton, and exceedingly poor at low rainfall locations. In the years of this study, applying high rates of N fertilizer was not an efficient protein enhancement strategy.
- Higher fertilizer use efficiency and more stable protein response at the intermediate rainfall location suggest such environments may be suitable for HRW production.
- Current N recommendations for HRW are inadequate (Table 1). The range of N necessary to achieve target protein is wider than recommendations at all locations, especially within the low rainfall zone.
- Varieties Norwest 553 and AgriPro Paladin appear to have improved protein performance over Boundary. Improved protein of AgriPro Paladin may partially owe to slightly lower yield potential (Figure 2).

**Table 1. Current N recommendations vs. experimentally derived values.**

Protein Goal	Current Recommendations: lbs N / bushel	Intermediate Rainfall: Pendleton		Low Rainfall: Lexington			Low Rainfall: Arlington
		2008	2009	2007	2008	2009	2009
11.5%	2.2 - 2.6	2.4	2.7		3.4	4.2	1.7
12.0%	2.4 - 2.9	2.7	3.3		3.9	5.3	2.7
12.5%	2.6 -3.2	3.0	3.8	2.4	4.5	6.2	3.9

Figure 1. Grain yield and protein at Lexington in 2007, 2008, and 2009 averaged across three HRW varieties.

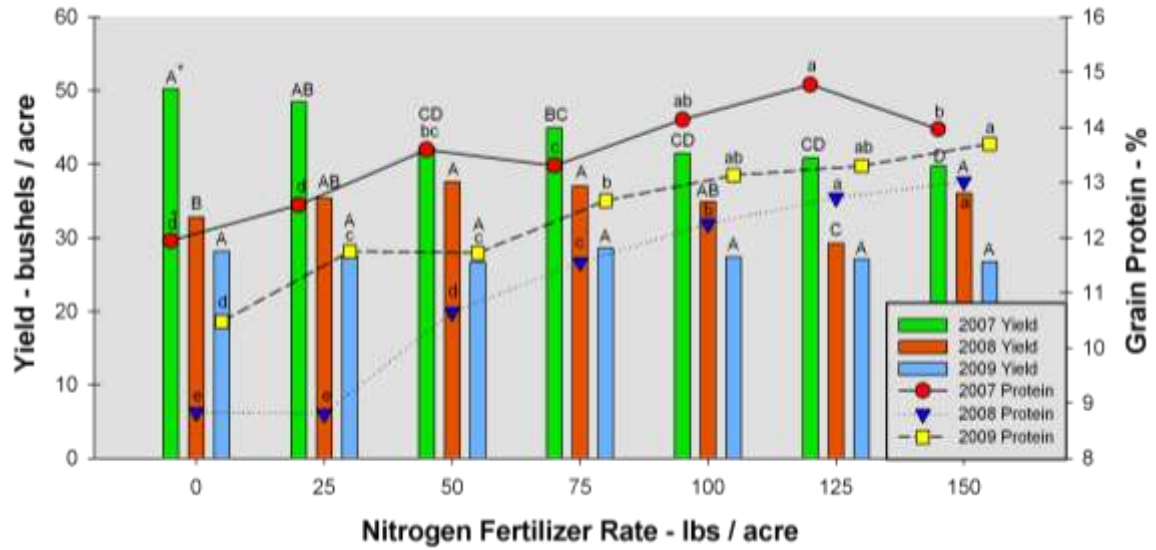


Figure 2. Relative yield and grain protein of three HRW varieties at Lexington in 2007, 2008, and 2009.

