

***Proposal for 2008-2009
Northwest Columbia Plateau PM₁₀ Project***

Objective #5: Wind Erosion and PM₁₀ Emission Control Methods

Title: Agronomic Comparison of Pacific Northwest Winter Wheat Varieties and Advanced Breeding Lines in Early Planted Tilled Fallow Versus Late-Planted Chemical Fallow

**Personnel: Principal investigator: Dr. Stephen Jones, WSU;
Co-investigators: Dr. Kevin Murphy, Dr. William Schillinger, Steve Lyon, Kerry Balow, Margaret Gollnick, and Bruce Sauer, WSU;
Farmer collaborators: Jim Moore and Joe Roach.**

Project Objectives

The objective of this study is to evaluate the performance of current winter wheat varieties direct seeded late (after mid-October rain) into chemical fallow as compared to the standard practice of early deep-furrow seeding (end of August) into conventional summer fallow.

Recent Accomplishments

This is a new project.

Planned Research

Background

Sixty percent of Washington's winter wheat production area receives only 150 to 300 mm annual precipitation (Hasslen and McCall, 1995). In this 3.7 million acre dryland area, stand establishment is the most important single factor affecting grain yield (Bolton, 1983). Through the practice of summer fallow, growers can generally achieve adequate stands of winter wheat (*Triticum aestivum* L.) by sowing in late August or early September into soil moisture accumulated from the previous winter. However, early stand establishment is strongly influenced by many processes. These include agronomic factors (Loeppky et al., 1989), genetic factors (Rebetzke, et al., 2007; Allan et al., 1962; Sunderman, 1964; Allan, 1980), interaction between seeds and environmental conditions (Chastain et al., 1995), soil water potential (Lafond and Fowler, 1989), soil temperature (Burleigh et al., 1965), soil water and soil temperature interactions (Lindstrom et al., 1976), planting depth (Schillinger et al., 1998), and seed size (Evans et al., 1977). In dry years, when the seed-zone water content is less than the local minimum requirement for emergence of winter wheat from deep sowing depths (11mm³ mm⁻³) (Schillinger and Papendick, 1997), growers must make a decision of whether to delay planting and wait for precipitation and risk losing grain yield (Donaldson et al., 2001; Schillinger et al., 1998) or plant early and risk having to replant due to insufficient seedling emergence.

Justification

It is generally not possible to plant winter wheat into carryover soil moisture in chemical fallow whereas early (late August) planting is possible with tilled fallow. Late-planted (mid

October or later) winter wheat, on average, yields 30% less than early-planted winter wheat. There is interest in chemical fallow because it provides year-round protection from wind erosion. It is common knowledge that winter wheat varieties perform differently based on their planting date, but no data exists for our current varieties to aid growers in their varietal selection for late planting.

Objective

Our objective is to evaluate a number of winter wheat varieties and advanced breeding lines to identify winter wheats that do better from late planting compared to others, thus providing farmers the best variety options for planting into chemical fallow as well as in years when it is too dry for early planting even in tilled fallow.

Procedures

The experiment will consist of a split plot randomized complete block (RCB) design with tillage method as the main plots and varieties/advanced breeding lines as the subplots. It will be conducted in two dryland wheat fields representing the low-precipitation zones (<250mm annually) of eastern Washington (Lind and Kahlotus), replicated four times with the tillage and chemical fallow strips randomly assigned within each rep, and planted on two dates (late August for the tilled fallow and after mid-October rain for the chemical fallow). This design will allow for great statistical power by allowing us to look for grain yield interactions not only among planting dates, but also across locations. The varieties will consist of ten soft white winter (SWW) and ten hard red winter (HRW) wheat varieties or advanced breeding lines and the same varieties/breeding lines will be evaluated at both locations for all three years.

The WSU Winter Wheat Breeding Program has all the necessary equipment to conduct this field experiment (deep furrow and no-till plot drills, plot combine, etc) and we also have access to all the winter wheat germplasm that will be tested.

Fertility, tillage and weed control will be managed by the cooperator with nitrogen and sulfur rates held constant for both fallow systems. If soil tests indicate the need for phosphorus, we will add it to the late-planted chemical fallow, as research has demonstrated that late-planted winter wheat responds to phosphorus whereas early-planted winter wheat does not (Schillinger, personal communication). The wheat varieties will be evaluated for stand establishment, plant height, heading date, grain yield, grain volume weight and grain protein content.

Review

After three years, results will be published in a refereed journal article as well as popular publications such as 'Wheat Life'. The results will also be reported to growers during the year at field days, farm tours, Wheat Research Review, Crop Improvement meetings, breakfast talks and wheat grower meetings.

Expected Results

The data generated from this study will: (1) assist growers in varietal selection should they be forced into planting winter wheat late due to poor seed-zone soil moisture and (2) help in

narrowing the large yield gap that exists between early- and late- planted winter wheat in the summer fallow region.

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