Proposal for 2010-2011
Northwest Columbia Plateau PM_{10} Project

Objective #5: **Wind Erosion and PM_{10} 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***

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Collaborator: **Kerry Balow, Margaret Gollnick, Bruce Sauer, WSU; Jim Moore and Joe Roach, growers.**

Project Objective
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
The nurseries were prepared and planted as outlined in the procedures. Thirty cultivars and advanced breeding lines were planted with a deep-furrow drill into summer-fallow on August 21, 2009 at Kahlotus, WA and August 25, 2009 at Lind, WA. The same cultivars and breeding lines were then planted again using a cross-slot no-till drill into chemical fallow at both locations on November 5, 2008. Agronomic notes will be taken during the growing season and on the harvested grain. End-use quality of grain samples also will be analyzed.

Planned Research
Background
Sixty percent of Washington's winter wheat (*Triticum aestivum* L.) production area receives only 150 to 300 mm annual precipitation (Hasslen and McCall, 1995). In this 3.7 million acre rain fed 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 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, but are not limited to, 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 ($11mm^3\ mm^{-3}$) (Schillinger and Papendick, 1997), growers must make a difficult decision. Delaying planting and waiting for precipitation comes at the risk of grain yield reductions (Donaldson et al., 2001; Schillinger et al., 1998) whereas planting early introduces risks of replanting due to insufficient

seedling emergence because of low moisture. If cultivars could be identified which perform well under late planted chemical fallow conditions, wind erosion would decrease significantly as fields could stay under chemical fallow conditions and be planted into after fall rains.

Justification
An interest in chemical fallow in a winter wheat- fallow rotation exists because it provides year-round protection from erosion. There is generally not enough carryover soil moisture to plant winter wheat early (late August) in chemical fallow whereas early planting is possible with tilled fallow. Late-planted (mid October or later) winter wheat, on average, yields 30% less than early-planted winter wheat. 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 wheat that does better in late planting conditions 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 and fallow systems, but also across locations. Twelve soft white winter common (SWW), four soft white winter club (SWW club), ten hard red winter (HRW) and four hard white winter (HWW) wheat cultivars or advanced breeding lines will be planted at both locations and the same cultivars/breeding lines will be evaluated for all three years. Data will be collected on emergence and stand establishment, winter survival, heading date, plant heights, test weight, protein content, and end-use quality. ANOVA will be used to identify significant differences between genotypes, locations, replicates, tillage systems, and all interactions. The student's t-test will be used to rank genotypes for each trait.

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).

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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