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

Objective 07: **Evaluating the Profitability and Social Benefits of Alternative Farming Systems for Air Quality Control**

Title: ***Economics of Wind Erosion Control***

Personnel: Principal Investigator: **Douglas Young, WSU;**
Cooperator: **William Schillinger, WSU; Harry Schafer, Project Manager, Washington Association of Wheat Growers (WAWG) PNW Undercutter Project; Stephen Machado and Steven Petrie, Oregon State University.**

Project Objectives

1. To conduct a survey in 2013 to determine the increase or decline in undercutter fallow among WAWG undercutter project participants and among a random sample of other wheat-fallow farmers in the participating counties.
2. To assess the causes of changes in undercutter use and the consequences for equipment design and for conservation incentive programs.
3. To complete an average profitability and basic economic risk analysis of the performance of seven cropping systems in a six-year agronomic experiment in Sherman County, Oregon.
4. To disseminate results to scientists, growers and others through published materials and popular presentations.

Recent Accomplishments

Accomplishments during 2008-2009 funded by the Northwest Columbia Plateau PM_{10} Project have been previously reported in the P.I.'s annual report.

Justification for Research

Objectives 1 and 2: Modeling has shown undercutter fallow to reduce wind erosion by 54% compared to conventional fallow during high wind events, so it is a clear environmental success. USDA/NRCS paid $720,042 from taxpayer funds for cost sharing to 47 participating Oregon and Washington wheat growers in the 2006-2010 undercutter project. Administrative overhead absorbed additional cost. Eligibility was restricted to farms receiving less than 12 inches average annual ppt/yr. This study will attempt to determine if the project increased adoption of the undercutter fallow system by the year 2013. The study will also attempt to answer the following questions: (1) What reasons do farmers offer as causes of changes in undercutter use from 2010 to 2013? (2) What are the equipment design and policy implications of the study's results?

Background for Objectives 1 and 2: A brief review of research under a previously funded 2008-2010 PM_{10} project follows to provide background for the current proposal. The 47 farmers from Oregon and Washington participating in the WAWG undercutter project had received 50% cost sharing for the implement. These farmers were surveyed to compare the agronomic and economic performance of conventional versus undercutter fallow. In 2008, 11 of the 47 participating farmers had completed a complete summer fallow-winter wheat (SF-WW) cycle using both undercutter and traditional fallow. In 2009 and 2010 all 47 farmers have or will have completed full SF-WW cycles with both systems. These farmers have been or will be surveyed to obtain similar information. Farmers' average subjective evaluation by autumn 2009 was that the undercutter system would increase long term profitability compared to the conventional system. There were no statistically significant differences in crop yields or number of rodweedings between the two systems in 2008 and 2009. Farmers' comments indicated that low precipitation during these two years influenced the results. A complete objective economic comparison of the 2008-2010 results is planned for the fall and early winter of 2010.

Justification for Objective 3: Farmers in north central Oregon and similar low rainfall regions in eastern Washington have used the WW-conventional summer fallow (Conven. SF) farming system for over a century. Past research has shown that this system is both profitable and less risky compared to competing systems. This has made the system attractive to both growers and their bankers. However, the WW-Conven. SF system is highly susceptible to wind erosion. Wind erosion inflicts both on-site productivity damage and harms air quality for urban and rural residents. The Sherman County long term experiment examined in this study compares six less erosive cropping systems to the traditional WW-Conven. SF system. In order to promote promising alternative systems to the region's growers, it is essential to examine their profitability and economic riskiness relative to the traditional system. This economic analysis can also determine the cost sharing incentives necessary to cause the soil conserving systems to break even in profitability with the traditional system. Such cost sharing might be justified based on the non-monetary air quality benefits.

Methods of Proposed Research

Objectives 1 and 2

In the autumn-early winter of 2013, a mail questionnaire will be sent to the 47 participants in the Undercutter Project. Names, addresses, phone numbers, and oftentimes email addresses are already available for this group. At the same time, a similar questionnaire will be sent to a random sample of non-project farmers in the leading participating counties. The questionnaire will be similar to that used by Schafer and Young during 2008-2010 for Project participants. The questionnaire will target SF-WW cropland on the sampled farms. It will elicit acreages of undercutter (or equivalent) fallow and conventional fallow on each farm, yields following both fallow systems, number of rodweedings on each system, other tillage operations, and weed control practices for each system. The survey will also elicit growers' perceived problems and benefits with the undercutter system as well as their subjective evaluation of the undercutter system on long term profitability.

Non-project growers will be randomly sampled in participating counties proportional to the estimated number of SF-WW farms in each county. Statisticians will be consulted to determine the sample size to provide reasonable accuracy given budget constraints. Table 1 reports the number of undercutter participants in each county and the size distribution of farms based on the 2007 Agricultural Census. Table 2 describes cropland acres in each county by irrigation status. Nonirrigated cropland acres and wheat acres in Table 2 are computed as differences between totals and irrigated acres. The data in Tables 1 and 2 are important because the farms of interest in this study are commercial-scale SF-WW farms. These farms are generally 2000 acres or larger. Obviously there are many farms in every county that do not qualify as commercial WW-SF farms. This is especially true in counties with a sizeable proportion of irrigated land like

Adams, Benton, Franklin, Umatilla, Walla Walla, and Yakima. Partly this reflects the definition of a Census farm as one "that produces $1,000 of crops and livestock per year, or normally would produce that value within a year." Many "Census farms" are rural residences with most land devoted to forages for livestock or horses. Also, in irrigated areas many farms contain small orchards, vegetable plots, or alfalfa plantings. The majority of family income from these small "farms" comes from off-farm earnings.

Table 1. Number of Farms by County and by size, 2007 Ag Census

	Project Farms	**>2,000 acres**	**Total Farms**	**Total Farm Acres**
Washington				
Adams	14	152	782	1,098,487
Benton	9	71	1630	632,636
Douglas	2	130	955	883,094
Franklin	3	74	891	749,452
Walla Walla	1	113	929	682,350
Yakima	1	52	3540	1,649,281
Oregon				
Gilliam	5	86	164	733,387
Murrow	5	140	421	1,104,250
Umatilla	6	191	1586	1,447,321
Wasco	1	78	649	949,462

In this study we will obtain names and addresses of all farms that participate in USDA's wheat, barley, and corn direct and countercyclical payments (DCP) program. These lists, which are available through the Freedom of Information Act (FOIA) from USDA's Farm Services Agency, will provide the sampling frame from which to draw random samples of non-project grain farmers. FOIA precludes providing the acres of crops grown. However, the DCP list has the advantage of screening out rural residents with only forages and/or livestock, orchards, and other non-grain crops. We still expect to pick up several small part time grain growers, but we can weight our sample results by SF-WW acreage during analysis. We will exclude responses from irrigated wheat land and from farms in micro-climates that permit annual cropping. To increase the response rate to the mail survey, we will use the modified Dillman method which utilizes some postcard and telephone follow-ups. We will solicit WAWG and Oregon Wheat Growers League (OWGL) ex officio co-sponsorship of the 2013 survey. If the Associations' names appear on survey cover letters, this might improve the response rate.

To keep survey costs affordable, we will exclude counties which include relatively little wheat land, including Franklin and Yakima Counties. Franklin and Yakima Counties also have a fairly high number of irrigated wheat acres. This exclusion will permit higher and more statistically valid sampling rates in the remaining counties.

Table 2. Irrigation Characteristics of Cropland by County, 2007 Ag. Census

			Harvested Cropland Acres			Wheat Acres		
	Total Farms	**Total Farm Acres**	**Total Acres**	**Irrigated Land**	**Non Irrigated**	**Total Acres**	**Irrigated**	**Non Irrigated**
Washington								
Adams	782	1,098,487	368,235	120,873	247,362	262,101	25,702	236,399
Benton	1630	632,636	251,332	170,308	81,024	94,268	14,678	79,590
Douglas	955	883,094	183,242	18,496	164,746	157,898	595	157,303
Franklin	891	749,452	N/A	211,331	N/A	76,863	16,009	60,854
Lincoln	798	1,090,178	386,081	30,503	355,578	313,441	14,549	298,892
Walla Walla	929	682,350	282,092	87,162	194,930	190,973	14,842	176,131
Yakima	3540	1,649,281	251,114	238,850	12,264	20,427	11,350	9,077
	9525							
Oregon								
Gilliam	164	733,387	116,354	5,878	110,476	97,710	540	97,170
Murrow	421	1,104,250	245,489	78,252	167,237	170,060	8,044	162,016
Sherman	208	514,004	127,084	1,370	125,714	115,237	186	115,051
Umitilla	1586	1,447,321	439,881	125,833	314,048	303,203	21,788	281,415
Wasco	649	949,462	80,585	20,555	60,030	56,091	2,157	53,934

N/A = Not Available

We will statistically compare, as possible, the proportion of acres in undercutter fallow among project participants during 2013 versus 2010. We will also compare the adoption rate among non-project farmers in 2013 to Undercutter Project farmers in 2013. We hypothesize that counties with more Project participants--such as Adams, Benton, Gilliam, and Murrow--will have greater undercutter adoption among non participants, due to greater opportunities for farmer-to-farmer communication. We will use the responses to qualitative questions to determine why farmer use of the undercutter changed from 2010 to 2013. These qualitative responses will also guide implications for equipment design and future conservation incentive programs.

Objective 3

Standard enterprise budgeting techniques will be used to assess the profitability and riskiness of seven farming systems in Sherman County, Oregon. These systems have been compared in a six-year field experiment conducted by Cooperator Stephen Machado. These systems include (1) Winter Wheat (WW)-Conventional Fallow, (2) WW-Chemical Fallow (CF), (3) Continuous WW: Direct Seeding (DS), (4) Continuous Spring Wheat: DS, (5) Continuous Spring Barley (SB): DS, (6) WW-SB-CF: DS, and (7) Winter Wheat-Spring Pea: DS. An eighth system, flex-cropping, will be omitted from the analysis because it varied greatly over the six years. No standardized decision rule was employed to determine annual flex-cropping decisions.

The P.I. will use the University of Idaho's standardized MACHINE COST and CROP ENTERPRISE BUDGETING spreadsheets. These spreadsheets comply with the guidelines from the American Agricultural Economics Association Crop Production Costs Task Force. To ensure comparability with other production cost estimates in the literature, total variable costs and total fixed costs, including cash and noncash costs, will be calculated for each cropping system. These costs include a fair market return for the land, machinery, labor and other resources used to produce crops whether the farmer uses his own resources or custom hires labor and machinery or rents land. Under such total cost budgeting, a "fair or normal profit" would be zero because all resources are receiving their fair market return.

Variable costs increase with the number of acres farmed. These include fuel, lube, repairs, materials (seeds, fertilizer, herbicides, diesel, etc.), maintenance, and labor. These are capsulated by the mnemonic, the "FLRMML Six." An exception is that maintenance for machine sheds and other buildings is a fixed cost because buildings deteriorate whether they are occupied or not. Fertilizer, herbicide, seed and other input rates are averages for each crop in each system in the Sherman County experiment. Cooperator Steve Petrie has already assembled this information electronically for several years of the experiment. Interest on variable costs will also be included in variable costs because it represents the income foregone while money is tied up in these costs before the harvest.

Fixed costs for machinery, land, and buildings accrue regardless of the acres in production. Machinery costs are based on the actual sequence of operations conducted on the research plots, but assume typical farm-scale machinery for the region. Machinery fixed costs include depreciation, interest, taxes, housing, and insurance ("DITHI Five"). For buildings, repairs are substituted for housing. The P.I. and cooperators will interview about 10 representative farmers in Sherman County to determine the machinery complements on farms of the size and technologies assumed in the budgets. The information collected will include the sizes of machines, purchased new or used, purchase and salvage values, annual hours use, expected life, fuel consumption, and annual repairs by use. Questionnaires are available for this purpose. The research team will also collect information on typical Sherman County property tax rates for land and machinery, umbrella insurance rates by (non-land) asset value, and crop insurance rates. For an owner-operator, the fixed cost of land is the net income he/she foregoes from not renting the land out. This is calculated as the typical share rent based on average yields, prices, and input cost sharing net of property taxes. Although one could argue that land cost is variable for a tenant farmer, it is placed in the fixed cost column by convention. It makes no difference in the bottom line since both fixed and variable costs are subtracted from gross revenues using economic total cost budgeting.

Gross revenues are calculated by multiplying average grain yields by cropping system in the experiment times local average crop prices. Steven Petrie and Stephen Machado's technician, L. Pritchett, have already assembled considerable multi-year information on input and crop prices in Sherman County. Grain yields are those measured for each crop in each cropping system in the experiment. Because every crop in every system was grown each year, these are six-year averages. All total cost and gross revenue figures are presented on a rotational acre basis. For example, a rotational acre of system 6, WW-SB-CF, will contain 1/3 acre of winter wheat, 1/3 acre of spring barley, and 1/3 acre of chem fallow. To determine mean profitability by cropping system over the six-year experiment, yields and input and crop prices are averaged over the experiment era. For a "basic risk analysis" measuring the economic *production risk*, we will report the six-year standard deviations and coefficients of net returns for each cropping system. This *basic economic production risk* typically appears in most agronomic-economic summary articles in the scientific and extension literature. Government payments and insurance indemnities are usually excluded in these basic economic/agronomic analyses because they require farmer-specific crop history assumptions, because they vary over time with farm programs, and because some previous Pacific Northwest studies show that they do not change cropping system economic rankings.

More advanced economic risk studies beyond the scope of Objective 3 (budgeted for only $7,500) will be conducted only if time is available. Possible modest extensions include computing net returns over variable costs when key input prices, crop prices, and crop yields are varied over reasonable ranges for the intermediate term. One can calculate break- even winter wheat yields and prices, when one is held constant. Break-even yields or prices cause gross revenue to exactly equal total costs. Further extensions of risk analysis include combining market price risk with production risk, incorporating government programs, and assessing different marketing strategies. It is the P.I.'s experience that more extensive economic risk analysis are not well received by scientific article reviewers when included in a basic agronomic-economic system comparison article. They are better received in a separate article with a primarily economics focus.

Objective 4

The P.I. and Cooperators will submit a scientific journal article and an extension bulletin from research conducted under Objectives 1 and 2. The P.I. and Cooperators will also submit a scientific journal article and extension bulletin from research conducted under Objective 3. The

P.I. and Cooperators will present results to growers and others at local field days in the appropriate regions. The research team will also present results at PM_{10} project annual meetings. If invited, the P.I. and/or Cooperators will present results at the annual Pacific Northwest Direct Seed Association meetings.

Time Line for Proposed Research

Objectives 1 & 2

Time Line	Activity	Funding
Aug.-Sept. 2010	H. Schafer completes survey after 3'rd Undercutter Project harvest	Previous PM_{10}
Sept. –Dec. 2010	D. Young completes econ. analysis of 2008-2010 Undercutter Project	Previous PM_{10}
Nov. 2013-Jan. 2014	D. Young completes survey of 47 Project participants & random sample of non-project participants	2009-2014[1] PM_{10}
Feb.-April 2014	D. Young completes analysis & reporting	2009-2014 PM_{10}
As appropriate	Outreach/extension activities	2009-2014 PM_{10}

Objective 3

Time Line	Activity
Sept. 2009-July 2010	S. Petrie completes input summary of 2009-2010 and other crop years
July 2010	S. Machado completes 6'th harvest of 6-yr experiment
Aug. 2010-Jan. 2011	D. Young completes economic profitability and basic risk analysis.
Aug. 2010-May 2011	Research team completes research and extension publications
Jan.-Dec. 2011	Extension presentations by research team

[1] If PM_{10}funding duration precludes extending project through 2014, the P.I. will take allowed salary before the required deadline. Or possibly a special extension could be requested. Because the project design requires a 3-yr waiting period before the second survey, the time-line is necessarily long.