1976 Progress Report . . .

Columbia Basin Agricultural Research

Special Report 459
June 1976

Agricultural Experiment Station,
Oregon State University, Corvallis
in cooperation with
Agricultural Research Service, USDA

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THE COLUMBIA BASIN AGRICULTURAL RESEARCH CENTER

COLUMBIA PLATEAU CONSERVATION RESEARCH CENTER

The Oregon Agricultural Experiment Station and the United States Department of Agriculture, Agricultural Research Service, Western and Northeastern Regions, are cooperating agencies of government that provide personnel and financing for various research projects.

The USDA and the OAES have a long history of cooperative research at the three branches of the center. The Sherman Station was established in 1910 on 235 acres of land provided by Sherman County under a long-term agreement between the Experiment Station and the federal Bureau of Plant Industry. This site has been the prime source of information on dry land crop production and soil management for eastern Oregon.

Also in 1910, the Umatilla Field Station was established by the USDA to aid farmers on the irrigated sands of the Columbia Basin. It was moved to its present site, just south of Hermiston, in 1932. This station consists of approximately 290 acres, with 190 acres available for irrigation studies. Experiments involve work on irrigated crops, livestock feeding studies and beef progeny tests.

The Pendleton Station was established in 1928 on land owned by Umatilla County as a cooperative project between the OAES and the USDA under the Division of Dryland Agriculture. Most of the research effort has been aimed toward varietal development and culture of dryland crops with emphasis on soil and water management, nutrition and erosion control.

In 1973, the three stations were combined administratively by the Oregon Agricultural Experiment Station and became the Columbia Basin Agricultural Research Center with administration at the Pendleton site.

The USDA has maintained a small but continuing support and staff at Pendleton for the conduct of cereal breeding and soil and water research; however, major expansion of the soil and water research was begun in 1966.

Planning and construction of a new research and office building were initiated by the Soil and Water Conservation Research Division, ARS. The structure was constructed in 1969 and named the Columbia Plateau Conservation Research Center. The building now serves both federal and state scientists at Pendleton.

In 1975, a major building and staffing program was initiated by ARS. Building additions of about $400,000, expected to be completed in 1976, equip Pendleton as one of the finest agricultural research centers in the Northwest. In 1976, there will be seven new USDA employees at the Center.

Total staff of the two centers consists of 12 project leaders and administrators and 13 support personnel including clerical, technicians and farm workers.

Research is conducted on station land at all three units of the Columbia Basin Agricultural Research Center, and also in many farmer's fields throughout the Columbia Basin and Plateau in eastern Oregon. Off-station experiments are increasing because of a growth in numbers of field experiments and the need to duplicate various climates and soil conditions of eastern Oregon.

Research projects of OSU and ARS are:

Project Number	Project Title
096	Develop Feed Grain Varieties with Superior Nutritional and Agronomic Qualities
170	Improvement of Agronomic Crop Production
200	Planning and Direction of Research
240	Improvement and Varietal Testing of Small Grains in Northeastern Oregon
242	Cultural, Chemical and Biological Weed Control in the Columbia Basin
243	Management Practices of Irrigated Crops in Northeastern Oregon
244	Tillage and Cultural Practices on Dry Farm Soils
248	Improvement of Horticultural Crop Production on the Irrigated Lands of Northeast Oregon
290	Pesticide Interactions on Weeds, Cereals and Other Crops in the Columbia Basin
553	Beef Cattle Feedlot
570	Lamb Feeding
670	Swine Feeding
WRU 15060-001	Tillage, Crop, and Residue Practices for Control of Erosion in the Northwest
WRU 12310-001	Dryland Grain Yield Prediction in the Northwest
WRU 12310-002	Water Relations and Growth of Non-Irrigated White Wheat as Affected by N and S Fertilization
WRU 15060-002	Planting Geometry for Wheat
WRU 15060-003	Residue and Tillage Effects on Infiltration

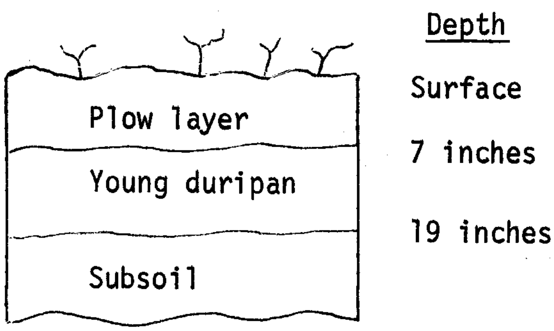
MORE INFILTRATION, LESS RUNOFF AND EVAPORATION

R. R. Allmaras, C. L. Douglas and Kathy Ward

During the recharge in the winter season there is a delicate balance between net soil water recharge as opposed to runoff and evaporation.

The balance between these opposing rates of precipitation is sensitive to infiltration coupled with internal soil drainage. Runoff and associated soil erosion seriously decrease soil productivity in the already shallow soils in the Columbia Plateau and adjacent areas; the water quality in our streams and rivers is also impaired. Poorer internal soil drainage contributes toward increased evaporation. Thus, increased infiltration and faster internal soil drainage are vital soil management objectives especially in dryland wheat.

In Walla Walla soils, a problem soil layer about 21 inches thick occurs just below the normal plowing depth.



This layer is best described as a young duripan. It transmits water 15 times slower than the subsoil underneath it. The untilled plow layer produced about the same water transmission rate. When the soil is wet, the young duripan is moderately resistant to a disrupting force but when it is dry it is extremely hard. Because the young duripan is not compact, its strength is derived from cementation. Possibly some substance was moved into this layer to coat the soil grains.

Chiseling to a depth of 17 inches increased the water transmission rate about 10 times, but still the plow layer and the young duripan transmitted water slower than the subsoil. Our measurements agree with many other studies indicating a better infiltration and internal soil drainage after chiseling but the net overwinter water conservation value is still being measured. Others have also shown that the increased internal water flow disappears after a season of tractor traffic.

Preliminary measurements show that a gypsum (about 1/4 to 1/2 ton/acre) application increases internal water drainage but the nature of the effect has not been determined. Extensive laboratory experiments are now directed at seeking the cause. Field experiments are in progress to test the possible value of combined chiseling and lime (or gypsum) application to preserve the increased internal water drainage rate for two or more seasons.

Water transmission characteristics and associated soil chemical and physical measurements are being studied at three sites: a wheat-pea recrop site, a wheat-summer fallow sequence and a site not tilled since about 1910. Comparisons among these sites indicate an intensification of the infiltration problem with intensive cultivation and a widespread occurrence of the problem in eastern Oregon.

A significant decline in soil pH of the plow layer is occurring because of the use of ammoniacal fertilizers. The young duripan below the plow layer has a higher pH, more like that of the virgin soil. The pH change in the plow layer prompts a suspicion that rainwaters are dissolving soil constituents in the plow layer and transporting them to the young duripan. Possibly this may explain the cementation and slow water transmission characteristic.

This project is now enlarged to give detailed evaluation of chemically related problems associated with the slow water transmission rate in Walla Walla soils.

MALTING BARLEY

Mary Boulger

In eastern Oregon, the thrust of the malting barley program is to develop a winter type malting barley which will compete economically with winter wheat in the areas between and around Pendleton and Moro.

The 20 advanced lines and introductions grown this year at the Sherman Station will be analyzed for yield and quality patterns. In this new program, the 20 lines represent only a small fraction of the total malting barley program. Most of the material is still in the early generation selection stages and will offer a greater number of cultivars for yield trials within the next two years.

SOME PHYSIOLOGICAL, AGRONOMIC, AND GENETIC FACTORS RELATED TO WHEAT STAND ESTABLISHMENT

Mohammad Vahabian

Experiments were conducted at Pendleton and Moro in 1974 and 1975 to study the effects of seed size, seed source, coleoptile length and crown depth on stand establishment. Inheritance of coleoptile length and crown depth were also investigated. Late experiments were conducted to determine the relationships of some biochemical properties of the seeds (mainly adenosine phosphates and energy charge) and agronomic characters. Results are being analyzed and will be available soon.

OREGON STRIPE RUST PROJECT

Crop Loss Investigations

R. G. Emge and D. Johnson

The Oregon stripe rust project was initiated in 1968 to study the increase and spread of stripe rust of wheat under various climatic conditions. Investigations are continuing with emphasis on chemical control of the disease. Future studies will encompass the economics of various chemical control methods.

This season's goal is to determine the effectiveness of two systemic fungicides at two concentrations when applied to wheat at three growth stages. Half-acre fields were established at the Pendleton Experiment Station at Weston and at the Reese Farm west of Pendleton. At the Reese Farm, irrigated and non-irrigated fields are being compared.

Each field is divided into 36 plots treated with various chemicals and include treated and untreated control plots. The fungicides used are BAS 317 and Plantvax; e.c., these are classified as systemics, which means that the compound requires only a single application. The chemical is absorbed by the plant, kills the fungus present and prevents further infection for a specified length of time.

The fungicides were all applied at the rate recommended by the manufacturer. Applications were made at the tiller, joint and boot stages. The plots were laid out so that each plot received no more than one application of the experimental fungicide. The treated control plots received a weekly application of the non-systemic fungicide Dithane M-45.

The effectiveness of the fungicides are determined from periodic readings of rust development and final yields.

These studies are to continue until reliable recommendations can be released. Residue information will be developed as the need arises.

CEREAL SEED TECHNOLOGY RESEARCH

Don F. Grabe, Felix Mathenge, Vinicius Assuncao and Benigno Rotta

We have several studies in progress to determine the effects of seed production practices on wheat seed quality, and the effects of seed quality components on the production of the wheat crop. Research plots are on the Sherman Station at Moro, on the Rugg Farm near Athena and on the Hyslop Farm near Corvallis.

The effect of the source of seed on wheat production is being studied in one experiment. Samples from 20 seed lots of Hyslop wheat were obtained from 20 locations around the state and placed in yield trials. In the previous two years, yield differences from seed source ranged up to 28 percent at Moro.

Following up these results, an attempt is being made to determine why seed lots of the same variety vary in yield potential. Seed of five varieties is being produced in several locations. Physiological and genetic differences in the harvested seed will be related to moisture stress, temperature, light intensity, soil fertility and other environmental factors.

In another study, the effect of seed size on crop yields is being evaluated. Twenty seed lots of Hyslop were sized into four size classes and placed in yield trials with unsized seed. In previous years, yields have been directly related to size, with the largest size (held on a 7/64 x 3/4 screen) yielding 3 to 5 bushel/acre more than unsized seed, depending on location and planting rate.

When seed of different sizes is planted in equal numbers, large seed usually outyield small seed. When planted in equal volume, small seed tend to nearly equal the yields produced by large seed. This is because a given volume contains up to twice as many small seed as large seed. To clarify this situation, a study is being carried out to determine optimum planting rates for seed of various sizes.

Previous work has shown that wheat seed with high protein outperforms seed with low protein, and that large seed are superior to small seed. Production practices for obtaining seed of large size and high protein are being evaluated. Variables in this experiment include two varieties, three nitrogen levels and four plant populations. The largest seed with highest protein is produced with the lowest plant populations and highest nitrogen levels. Thus, the most favorable practices for producing the highest seed quality may not be the same as required for producing maximum grain yields.

DEVELOPMENT OF HIGH YIELDING NUTRITIONALLY SUPERIOR FEED GRAINS

Mathias F. Kolding

Breeding and improvement of feed grains for Oregon are accomplished by a coordinated research team stationed at both Corvallis and Pendleton. The region served from the Columbia Basin Agricultural Research Center (CBARC) at Pendleton is the area east of the Cascades, excluding the Klamath Falls and Madras basins.

Though the ultimate goal of the feed grain project is to develop high yielding cereals with the most satisfactory balance of nutrients genetically available, the immediate mission is to find selections that will produce the most digestible energy in a given area. To achieve both the distant and immediate goal, the feed grain project at the Pendleton Station of CBARC utilizes the three major units at Pendleton, Moro and Hermiston; has yield trials at Helix, Rugg Farm and at Ontario; conducts a smut and snow mold trial at Flora; screens early generation barley and sorghum at Union; and plans to initiate extensive winter and spring screening trials near Burns.

PENDLETON STATION

The Pendleton Station is used for breeding and evaluating early generation seed sources and as a location to test the more promising advanced selections in replicated yield trials. This year, there are 5,600 early generation populations of wheat, barley, triticale, oats and sorghum growing for seed increase and evaluation. The following breakdown of the numbers of the various species in the yield trials shows proportional interest in each crop:

Wheat, 732	Barley, 465	Triticale, 102
Sorghum, 96	Oats, 27	

SHERMAN STATION

The Moro site which represents the major dryland cereal production area in Oregon is utilized almost in the same manner as the Pendleton unit except that only early generation populations suited to the dryland area are screened. In addition, this year there are 188 winter barleys in yield tests at the Moro Station selected from populations previously grown at Moro or from nearly identical sister selections.

HERMISTON STATION

This unit serves as a herbicide tolerance screening area as well as an irrigated site. The sandy soil at Hermiston helps accentuate herbicide damage and at times gives extreme results. Of 1,652 wheat selections thought to exhibit tolerance in 1975, only 25 to 50 selections remain after herbicide stresses applied last winter. There are approximately 3,600 barley populations at Hermiston and 108 barley lines selected for use under sprinkler irrigation in a replicated yield trial. This site should prove more interesting since this is the first breeding program in North-central Oregon designed to develop varieties for sands irrigated by overhead sprinklers.

HELIX

Tommy Thompson and Harry Schuening are providing a deep soil site at a moderate elevation in the 11- to 12-inch annual rainfall area. This site at Helix, common to much of the north-central Oregon dryland cereal area, should assist in verifying the adaptability of selections tested at Moro. There are 108 winter wheats and 108 winter barleys being tested at this site north and west of Helix.

RUGG FARM

Lack of land area at the Pendleton unit prevented the planting of all the feed grain trials so room was made available at the Rugg site by Dr. Warren Kronstad. There are 90 winter feed barleys and 108 winter feed wheats under test in replicated trials at this high yielding site.

FLORA

The Kenneth Wolfe Ranch near Flora offers a shallow soil and high elevation (4300 feet) where snowmold and dwarf bunt are serious problems. This year, there are 370 selections in an observation trial, 285 selected on site and 85 which showed promise at other locations.

ONTARIO

The experiment station at Ontario is in a flood irrigation site where 90 winter wheats and 90 winter barleys are growing in replicated yield trials.

UNION

This is a new site this year and is serving both as a spring barley selection site and one replication of the CYMMT Cool Temperature Tolerant Sorghum Trial.

BURNS

We plan to use this as a winter and spring area plus an area to observe frost tolerance during anthesis or filling stages of plant growth.

The feed grain program, now in its fifth year, is finally able to start testing and exploiting complex crosses that originated both at Pendleton and at Corvallis.

WINTER X SPRING WHEAT IMPROVEMENT PROGRAM

Willis L. McCuistion

An overall objective of the expanding winter X spring wheat program at OSU is to increase wheat production in winter rain-fed areas. More specific objectives are the creation of additional genetic variation for use in strengthening national cereal research programs in Oregon and the less developed countries.

Winter and spring wheats historically have been developed separately. For this reason, the crosses between the two groups provide highly variable germplasm. Crosses permit the transfer of desirable characters from winter to spring wheat and vice versa.

The dissemination of widely adapted germplasm from Oregon provides potential wheat varieties for cooperating countries and they return information for the Oregon nurseries as well as additional germplasm from their own nurseries. This results in improved lines of communication between wheat breeders around the world. The International Winter X Spring Wheat Screening Nursery from OSU is being distributed to 65 cooperators in 40 countries.

The climatic conditions in western Oregon provide natural crossing conditions between winter and spring wheat. The widely diverse climatic and physiological conditions in Corvallis, Moro, Pendleton and Madras permit selection of agronomically-suited, disease-resistant types adapted to the major winter wheat-growing areas of the world.

The original crosses are made at Hyslop Farm, Corvallis; however, the selection of all segregating populations from F_2 through F_6 are made at Hyslop, Pendleton and Moro locations with 1,000 (40"), 500 (20") and 250 (10") millimeters of precipitation respectively. By selecting the same segregating material across these 3 diverse sites each year, the resulting lines selected should show good general adaptation when grown internationally. All major market classes of wheat, except Durum Wheat, are resulting from the cross combinations in this program.

Winter X spring wheat nurseries being grown at Sherman Station, Moro and the Quinton Rugg Farm, Pendleton:

Nursery	No. of Populations
F_2 Segregating Populations	2,202
F_3 " "	1,721
F_4 " "	955
F_5 " "	723
F_6 " "	316
Miscellaneous Yield Trial	1,120
Screening Nursery Yield Trial	448

A SEARCH FOR RESISTANCE TO COMMON AND DWARF BUNT AND ITS INHERITANCE IN WHEAT HYBRIDS

R. J. Metzger and B. A. Silbaugh

As a group, most selections of wheats and related species are susceptible to one or more races of common and dwarf bunt. Resistance is the exception and must be sought among the many thousands of wheats contained in collections maintained by various public and private organizations throughout the world.

One of our goals is to identify wheats resistant to common bunt. Those that are resistant to all known races of common bunt or to new combinations of the prevailing races are tested for resistance to dwarf bunt at Logan, Utah, and Flora, Oregon. Finally, seeds of the lines that are resistant to both common and dwarf bunt are distributed to cereal breeders for use in their breeding programs.

In allied studies, the number of genes that govern resistance to bunt in a given wheat selection is determined. New genes or new combinations of genes are identified and the information is made available to our cereal breeders.

Because resistance to bunt is uncommon in wheat, we are consistently looking for resistance in species that are closely related to wheat. We have found resistance in einkorn, durum wheats, timopheevi, rye and triticale. Through hybridization we are attempting to incorporate resistance from those species into our commercial wheat varieties. A small section of the nursery is devoted to such crosses each year.

EPIDEMIOLOGY AND CONTROL OF FUNGUS-INDUCED DISEASE OF WHEAT

R. L. Powelson and M. L. Powelson

Disease work with cereal grains in eastern Oregon is comprehensive. Finalized data are not presented in this paper but a statement of objectives and present activity is outlined to reveal the scope of activity.

OBJECTIVES

(1) To determine the influence of irrigation, fertilizers, planting date and other cultural practices on the incidence of wheat diseases. (2) To develop bioassay procedures for the evaluation of disease resistance and assist in the search for new sources of disease resistance in cooperation with wheat breeding programs. (3) Maintain a testing program for evaluating chemicals that may give economic disease control. (4) To define epidemiological systems utilizing mathematical models and computer techniques. (5) Coordinate research with Washington and Idaho and disseminate results to promote adoption of effective control measures.

MAJOR ECONOMIC DISEASES RECEIVING EMPHASIS

Stripe rust (*Puccinia striiformis*), powdery mildew (*Erysiphe graminis*), foot rot (*Cercosporella herpotrichoides*), take-all (*Ophiobolus graminis*) and root rot (*Fusarium 'Culmorum'*).

1975-76 FIELD EXPERIMENTS

Stripe Rust--1. Race identification nurseries (IWWRN-WR, European, Powelson, Line). Locations: Pendleton Station, Sherman Station and Case Farm, LaGrande. 2. Quantitative evaluation of nonspecific resistance. Locations: Rugg Farm, Pendleton Station, Sherman Station and Case Farm, LaGrande. Cercosporella Foot Rot--1. Chemical control. Use of systemic fungicides and growth regulator compounds. Compatibility with herbicides. Location: Pendleton Station. 2. Evaluation of commercial applications of Benlate. Locations: Wasco, Sherman, Gilliam, Morrow, Umatilla and Union county wheat growers. 3. Varietal resistance screening nursery. Pendleton Station. Powdery Mildew--1. Chemical control. Relationship to yield reduction. Location: eastern Oregon farms. Common Smut--1. Chemical seed treatments. Compatibility with wireworm insecticides. Locations: Sherman Station, Pendleton Station and Case Farm, LaGrande.

CONSERVATION TILLAGE EFFECTS ON WATER STORAGE AND CROP YIELD IN WALLA WALLA AND RITZVILLE SOILS

Robert E. Ramig and Les G. Ekin

The influence of wheat stubble management and time of tillage on storage of winter rainfall in an alternate wheat-pea rotation has been studied since 1968 on a Walla Walla silt loam soil at the Center.

Four methods of tillage of wheat stubble were compared: (1) fall plow and spring tooth, (2) fall plow--left rough, (3) spring plow, and (4) no tillage--volunteer wheat and weeds killed with paraquat. Wheat was fertilized with 40 pounds of nitrogen per acre every fall after seeding and peas with 20 pounds of nitrogen and 23 pounds of sulfur every other pea crop.

For the 6-year period, 1968-73, standing stubble stored an average of 87 percent of the winter precipitation (11.55 inches) and controlled soil erosion. Fall-plowing the wheat stubble stored only 64 percent of the winter precipitation and left the field susceptible to severe soil erosion in winters when high rainfall and rapid snow melt occurred on frozen soil. The additional 2.5 inches of water stored by standing wheat stubble during the winter increased the yield of green peas grown for freezing from none to 1,300 pounds per acre in individual years but averaged 600 pounds per acre over the 6-year period 1968-73 when compared with fall-plowed stubble (an increase of 20 percent). Peas are shallow rooted and in some years did not use all the water stored during the winter in standing wheat stubble. Unused water left in the soil (an average of 0.7 inches) was available to the following wheat crop, and for the 6 years (1968-73) increased wheat grain yield an average of 2 bushels per acre.

Non-tilled plots produced the highest wheat grain yield during this period, while decreasing straw yield nearly 400 pounds per acre (10 percent). The surface residues kept the soil slightly cooler during the spring and summer than where residues were plowed under. This temperature difference resulted in slightly smaller wheat plants which used water more efficiently than where the stubble had been plowed.

In 1974-75, wintertime rainfall was 11.77 inches. Overwinter soil water storage efficiency was 70 percent with standing wheat stubble; 67 percent when chopped and incorporated by fall rototilling; 53 percent when covered by fall plowing; and only 32 percent irrespective of tillage after peas and seeded to winter wheat. Peas used 89 percent of their water from the upper 4 feet of the soil; wheat used 95 percent of its water from the upper 6 feet of soil.

Weed populations in the pea crop in 1975 were sensitive to methods of wheat stubble tillage with 6.0, 11.5, 20.0 and 0.3 lambsquarter plants per foot of row in fall rototilled, fall plowed, spring plowed and no tillage, respectively. Russian thistles were respectively 1.8, 2.0, 2.2 and 7.1 plants per foot of row.

Production of peas with no-tillage is not completely solved. Further work is needed to determine the proper time of stubble tillage in the spring, degree of residue incorporation, use of herbicides to control weeds and volunteer wheat in stubble and weed control in peas.

New work has been initiated on a Ritzville soil site to test tillage and surface residue managements for wintertime soil water storage. Subsequent benefits to wheat from increased water storage is being tested in a wheat-summerfallow system where the annual precipitation is 11 inches. In addition to tests of tillage and residue management for storing wintertime precipitation, new weed control methods are being evaluated through the use of selective herbicides in wheat, complete weed control by chemical summerfallow, or by a combination of these methods.

NITROGEN AND SULFUR FERTILIZATION EFFECTS ON WATER RELATIONS AND GROWTH OF NON-IRRIGATED WHITE WHEAT

Paul E. Rasmussen

Nitrogen (N) and sulfur (S) fertilization is again a critical factor in crop production because of increased fertilizer costs and fertilizer effects on plant-water relations.

Work with N fertilization is directed toward grain and straw yields consistent with the supply of soil water. S fertilization work is directed toward optimization of N response and improved plant-water relations. N and S fertilization effects on fertilizer-use-efficiency are being studied from measurements of nutrient movement and recovery, root development, nutrient uptake in relation to growth and levels of N and S in plant tissues. A major portion of this research is being conducted on off-station sites in wheat-fallow rotations near Condon, Ione and Dufur, Oregon.

In 1975, McDermid winter wheat at Dufur responded to both N and S fertilization. Optimum N application (70 to 80 pounds N/acre) increased grain yield approximately 16 bushel/acre when no S was applied and 22 bushel/acre when 12 pounds S/acre was included. Application of S without N did not increase yield. Sulfur responses were typical:

1. Wheat does not respond to S whenever N is deficient.
2. In the 40 to 65 bushel/acre yield range, the yield increase from S application is approximately 5 to 6 bushel/acre at optimum N fertilization.
3. Yield increases from S can be even higher (6 to 20 bushel/acre) whenever moisture is adequate for high grain yields (65 to 90 bushel/acre).

The interdependence of N and S on each other is likely related to the ratio of S to N required in plant proteins since each protein building block requires a certain quantity of each. Yield responses to several rates of N and S at Dufur are included in Table 1. The N-S experiment at Condon was not harvested in 1975 because of extensive hail damage. No experiment was conducted at Ione in 1975.

For evaluating soil testing as a method of recommending S fertilization, soil samples are being taken periodically from residual-S plots. Soil samples taken in the fall of 1975 show that extractable-S levels from 24 and 36 pound/acre applied in 1973 remain above suggested deficiency levels whereas levels from 6 and 12 pounds S/acre have declined to approximately the same as those where no S has been applied. (Soil test S levels are presented in Table 2.) All three sites are in winter wheat this year. Evaluations will be made to compare yield response and S uptake between residual S applied in 1973 and S applied prior to seeding (September, 1975).

Table 1. Winter wheat response to N and S fertilization (Clausen plots, Dufur, Oregon, 1975-75)

Nitrogen Applied (lb/A)	Grain Yield* -S	Grain Yield* +S (bu/A)	Grain Yield* Difference	Straw Yield* -S	Straw Yield* +S (cwt/A)	Straw Yield* Difference
0	44.5	43.2	-1.3	43.8	38.1	-5.7
24	51.3	53.4	+2.1	46.8	50.3	+3.5
48	57.0	60.3	+3.3	52.5	55.3	+2.8
72	58.8	64.8	+6.0	53.8	55.8	+2.0
96	59.2	66.1	+6.9	52.6	56.8	+4.2
120	65.9	68.2	+2.3	58.0	65.3	+7.3
144	56.7	66.2	+9.5	57.1	60.1	+3.0
168	64.6	74.4	+9.8	60.2	63.7	+3.5

*Yields calculated @ harvest moisture (7%)

Table 2. Effect of residual sulfur on soil test sulfur levels two years after sulfur application

Location	Depth (inches)	S Rate Applied in September, 1973 (lb/A) 0	6	12	24	36
		Soil Test Extractable Sulfate-Sulfur[1] (ppm) in 1975[2]				
Gilliam	0-24	1.5	1.2	1.2	3.1	2.9
Morrow	0-24	1.1	1.4	1.2	1.5	2.4
	24-48	15.1	14.6	15.1	---	16.0
Wasco	0-24	1.1		1.4	3.0	2.1
	24-28	1.4		1.6	1.3	2.8
	48-72	0.6		1.4	1.2	3.0

[1]Oregon State University Soil Test Laboratory Analytical Precedure

[2]Dates Sampled: Gilliam - September 15, 1975; Morrow - September 23, 1975; Wasco - December 11, 1975

ROOT GROWTH, WATER USE AND GRAIN PRODUCTION

R. W. Rickman

Water stress effects in dryland wheat depend on the interplay of at least three factors: the tendency of the air to remove water from the plant, the amount and distribution of water in the soil, and the plant rooting.

At last year's field day, a comparison of root growth in wheat varieties showed that plant rooting is a significant factor in the tolerance of dryland wheat to water stress. A better understanding of the plant climate, plant rooting and soil water distribution will help to tell what plant characteristics are needed to tolerate water stress in eastern Oregon.

In this project, many plant and environmental characteristics are being studied. These characteristics are measured frequently during the growing season:

1. Depth of root penetration and amount of roots at each depth.
2. Leaf area of crop canopy (surface from which water is lost by transpiration).
3. Evaporative demand (or drying ability of sun and wind) imposed on crop.
4. Total amount of water use and depths from which the plant removes water.
5. Ability of the plant to increase the concentration of soluble sugars and photosynthetic products within the leaves.
6. Water stress and wilting development in the plant.
7. Amount of dry matter and the yield of grain.

Rooting capability of four varieties (Hyslop, a new white club OR7147, a Turkish variety, and McDermid) were tested last year. The first three varieties have a more vigorous root growth that is well developed to five feet before mid-May. (Five feet is the effective bottom of the rooting zone at the plot site because of a hard layer that roots cannot penetrate. However, water does go through the layer readily.) McDermid did not have as extensive root growth below about 3 feet as did the other three in mid-May.

When measuring the concentration of soluble materials inside the leaves, McDermid again was different from the other three varieties. It consistently had higher concentrations of soluble materials in its leaves. It did not, however, show any symptoms of wilting or water stress that were not exhibited by the other varieties.

The analysis of the root samples, water use measurements, plant growth, and yield for the last half of the season revealed the following:

The three varieties with early extensive rooting to five feet extracted stored soil water to that depth before the middle of June. McDermid extended its root system to five feet during late May and early June and utilized the water there. However, it used the water about one week later in the season--during the critical grain-filling period of growth. Yield of grain was highest from McDermid (77 bushel/acre compared to 68, 75 and 68 from 1, 2 and 3 respectively).

It appears that some apparently minor differences in the growth characteristics of McDermid allowed it to make the most efficient use of the water supply. Its rooting system started early but did not extend as rapidly to below three feet as did the other varieties. By not having extensive roots at 4 to 5 feet early in the season, some of that water was not used early. While using less water, the plant had to create higher concentrations of soluble materials in its leaves to avoid water stress. When water could be most efficiently used--during grain filling--the roots had extended and fully utilized the water to the bottom of the rooting zone. The end result was a higher grain yield than the other varieties.

The timing of root growth and its consequences for distribution of water use during the growing season are little understood but, as illustrated by this example, can have significant consequences. The experiment is being repeated this year with Hyslop, McDermid, OR7147 (Faro), Wanser and Yamhill.

RECENTLY RELEASED VARIETIES OF WINTER AND SPRING WHEAT AND WINTER AND SPRING BARLEY

C. R. Rohde

WINTER WHEAT

Selection of the best small grain variety depends upon the problems most commonly encountered on individual farms. The occurrence of unusual problems may explain the unsatisfactory performance of varieties some years. Brief descriptions of recently released varieties are given in order to help determine the variety that will yield best under the diversity of climate, soil, and disease conditions that may occur in eastern Oregon.

HYSLOP

Short strawed, bearded, high yielding, soft, white variety. Moderately resistant to stripe rust and mildew. Resistant to leaf rust, smut and *Septoria*. Moderately susceptible to flag smut. Good milling and baking quality. Recommended as a replacement for Gaines and Nugaines. Developed at OSU by Warren Kronstad.

LUKE

Short strawed, bearded, high yielding, soft variety. Resistant to stripe rust, smut, dwarf smut, snow mold, and tolerant to *Cercosporella* foot rot. Moderately susceptible to flag smut. Good milling and baking quality. Recommended in dwarf smut areas. Developed at WSU by C. J. Peterson, USDA.

MCDERMID

Short strawed, bearded, high yielding, soft, white variety. Moderately resistant to stripe rust and mildew. Resistant to leaf rust, smut and *Septoria*. Moderately susceptible to flag smut. Slightly earlier than Hyslop. Good milling and baking quality. Recommended as a replacement for Gaines and Nugaines, especially where earliness is desired. Develop at OSU by Warren Kronstad.

PAHA

Soft, white, club wheat variety. Shorter in height and more resistant to lodging and shattering than Moro. Moderately susceptible to stripe rust. Resistant to smut and tolerant to *Cercosporella* foot rot. Susceptible to flag smut. Excellent milling and baking quality. Developed at WSU by R. E. Allen, USDA.

PECK

Medium height, bearded, soft variety. More winterhardy, emerges better and is more tolerant to troubles associated with wet soils than is Nugaines. Resistant to stripe rust and smut similar to Nugaines. Moderately susceptible to flag smut. Good milling and baking quality. Developed by W. K. Pope, University of Idaho, Moscow, Idaho.

REW

Medium height, bearded, soft variety. Resistant to smut. Moderately susceptible to stripe rust. Moderately susceptible to flag smut. Because of its taller plant height, it is best adapted in areas where the short height of Hyslop and Nugaines causes harvesting problems. Good milling and baking quality. Developed by C. R. Rohde, Columbia Basin Agriculture Research Center, Pendleton.

SPRAGUE

Short strawed, bearded, high yielding, soft variety. Resistant to snow mold, stripe rust and common smut, but susceptible to dwarf smut and <u>Cercosporella</u> foot rot. Moderately susceptible to flag smut. Recommended in areas where snow mold is a problem. Developed by Walt Nelson, M. Nagamitsu and G. W. Bruehl, WSU.

YAMHILL

Medium height, soft, white, beardless, high yielding variety. Resistant to stripe rust and mildew. Susceptible to smut. Moderately resistant to flag smut. Good milling and baking quality. Recommended for the Willamette Valley but not for eastern Oregon because of its susceptibility to smut. Developed by Warren Kronstad at OSU.

Hyslop, Luke, Sprague and McDermid are Gaines-type varieties and management practices being used for Gaines would also be satisfactory for these varieties. Paha, Peck and Rew are taller growing varieties; therefore, management practices commonly used for Moro and Omar also would be satisfactory for these varieties. However, all three are more resistant to lodging than Moro and Omar. Higher rates of N can be applied to these varieties without danger of lodging. Yamhill, although a taller growing variety, has very stiff straw and can use the same management practices as used on Gaines. Peck is especially suited for seeding in areas of wet soils. Rew is best suited in areas where taller plant heights are desired.

SPRING WHEAT

ANZA

Short strawed, hard, red variety. Resistant to stripe rust. Good milling quality but baking is sometimes questionable. Developed by the CIMMYT breeding program, but tested and released by the California Agricultural Experiment Station.

BORAH

Short strawed, hard, red, bearded, high yielding variety. Resistant to stripe and leaf rust. Satisfactory milling and baking quality. Best adapted for irrigation. Developed by D. W. Sunderman, USDA, Aberdeen, Idaho.

FIELDER

Short strawed, soft, white, bearded, high yielding variety. Resistant to stripe and leaf rust. Moderately resistant to mildew. Milling and baking quality similar to Twin. Best adapted for irrigation. Developed by D. W. Sunderman, USDA, Aberdeen, Idaho.

PROFIT 75

Short strawed, hard, red, bearded variety. Resistant to leaf and stripe rust. Good milling and baking quality. Developed by World Seeds, Inc.

PROSPUR

Short strawed, hard, red, bearded variety. Moderate resistance to stripe rust. Good milling and baking quality. Developed by Northrup, King and Co.

SPRINGFIELD

Short strawed, soft, white, beardless, high yielding variety. Moderately resistant to stripe rust. Susceptible to leaf rust. Adapted for growing under both dryland and irrigation. Developed by D. W. Sunderman, USDA, Aberdeen, Idaho.

TWIN

Short strawed, soft, white, beardless, high yielding variety. Moderately resistant to stripe rust. Susceptible to mildew and leaf rust. Adapted for growing under both dryland and irrigation. Developed by D. W. Sunderman, USDA, Aberdeen, Idaho.

URQUIE

Medium height, soft, white, bearded variety. Moderately resistant to stripe rust. Susceptible to leaf rust and moderately susceptible to mildew. Cold tolerance is superior to most spring wheat varieties. Adapted for mid-winter or very early spring re-seeding of white winter wheat fields. Good milling and baking quality. Developed jointly by WSU and USDA/ARS personnel.

WARED

Short strawed, hard, red, bearded variety. Resistant to mildew and stripe rust. Good milling and baking quality. Adapted for dryland and irrigation. Developed jointly by USDA/ARS personnel at Minnesota and WSU personnel at Pullman, WA.

WS-1

Short strawed, soft, white, bearded variety. Moderate resistance to stripe rust, leaf rust, and mildew. Milling and baking quality is variable. Good cold tolerance. Developed by World Seeds, Inc.

WS-6

Short strawed, hard, red, bearded variety. Resistant to leaf rust. Fair milling and baking quality. Developed by World Seeds, Inc.

WINTER BARLEY

BOYER

Mid tall, medium maturing, 6-row variety. Best for the areas where Luther is adapted. Developed by R. A. Nilan and co-workers, WSU.

KAMIAK

Mid tall, early maturing, 6-row variety. Probably will replace Hudson and Ione. Developed by R. A. Nilan and co-workers, WSU.

SPRING BARLEY

BLAZER

Six-row, stiff strawed, malting variety. Maturity about the same as Unitan. Plant height is slightly taller than Unitan. Developed by R. A. Nilan and C. E. Muir, WSU.

BUTTE

Two-row, moderately stiff-strawed feed barley. Has not yielded as high as Steptoe, Gem or Harlan in eastern Oregon. Developed at the Branch Experiment Station, Aberdeen, Idaho.

KLAGES

Two-row, moderately stiff-strawed, malting variety. Developed at the Branch Experiment Station, Aberdeen, Idaho.

LUD

Short strawed, medium maturing, 2-row variety. Best adapted for irrigation. Distributed by North American Plant Breeders.

STEPTOE

Six-row, medium tall variety that is moderately resistant to lodging. Adapted for both dryland and irrigation. Developed by R. A. Nilan and C. E. Muir, WSU.

VANGUARD

Two-row, medium height variety with very high test weight. It is moderately resistant to lodging. This variety was developed by R. A. Nilan and C. E. Muir, WSU.

Tables 1 through 8 give summaries of the yield data obtained from test plots at various locations in northeastern Oregon.

Table 1. Yield data of winter wheat varieties tested at the lower yielding locations in eastern Oregon, 1971-1975

Variety	Moro	Pilot Rock	Rew Farm	Holdman	Arlington[2/]	Heppner	Condon[3/]	Avg.
				(bushels per acre)				
McDermid	33.1	35.1	33.0	36.1	35.6	27.6	22.8	31.9
Hyslop	35.4	33.8	32.3	39.8	34.2	26.1	21.4	31.9
Rew	35.9	32.3	32.4	36.8	32.8	26.0	25.1	31.6
Luke	33.2	30.9	32.2	36.8	34.6	25.7	22.2	30.8
Sprague[1/]	34.0	33.1	32.7	36.0	31.6	25.7	22.1	30.7
Nugaines	34.9	29.0	32.2	36.1	35.3	25.9	20.3	30.5
Paha	32.7	32.1	30.3	35.1	34.2	25.9	20.7	30.1
Yamhill	34.4	32.5	30.1	33.8	33.0	23.6	20.2	29.7
Moro	28.6	31.7	28.6	31.5	31.3	24.4	17.6	29.1
Wanser	28.9	32.8	31.2	30.1	31.9	25.1	22.4	28.9
Peck[3/]	27.1	27.5	28.5	34.0	27.3	21.7	20.1	26.6

1/ Tested for the 1973-1975 period
2/ No test in 1973
3/ Tested in 1975 only

Table 2. Yield data of winter wheat varieties tested at the higher yielding locations in eastern Oregon, 1971-1975

Variety	Pendleton	Weston	LaGrande	Enterprise	Baker[3/]	Avg.
			(bushels per acre)			
McDermid	79.8	69.4	62.0	64.3	66.5	68.4
Luke	77.2	67.2	66.3	61.4	68.4	68.1
Hyslop	80.1	68.7	62.4	62.3	64.9	67.7
Rew	73.5	66.5	67.4	64.0	62.1	66.7
Nugaines	78.2	67.1	62.9	59.9	62.4	66.1
Yamhill	71.8	69.0	59.1	50.4	64.9	63.0
Paha	71.6	62.7	67.0	60.5	51.7	62.7
Sprague[1/]	76.3	62.7	54.4	60.9	41.2	59.1
Peck[2/]	70.2	63.4	63.1	62.6		
Wanser	59.8	62.6	60.7	53.6	57.6	58.9
Moro	61.4	59.7	59.2	58.0	56.1	58.9

1/ Tested for the 1973-1975 period
2/ Tested in 1975 only
3/ No test in 1975

IRRIGATED TRIALS

	Pendleton	Summerville[2/]	Avg.
		(bushels per acre)	
Hyslop	110.1	86.1	98.1
Nugaines	101.3	86.6	93.9
McDermid	105.6	78.0	91.8
Luke	101.1	73.9	87.5
Yamhill	88.0	75.4	81.7
Paha	73.6	74.2	73.9
Rew	70.2	76.5	73.4
Peck[1/]	66.3	72.1	69.2

1/ Tested in 1975 only
2/ No test in 1972

Table 3. Summary of yield data of spring wheat varieties tested in the lower yielding areas of eastern Oregon, 1972-1975

Variety	Pendleton	Rew Farm	Moro	Heppner	Arlington	Condon	Avg.
				(bushels per acre)			
Anza 1/	45.7	24.5	28.1	18.1	25.2	25.2	27.8
Twin	45.4	23.8	27.1	14.6	23.7	21.8	26.1
Fielder 1/	44.9	24.2	24.6	15.7	20.5	23.9	25.6
Borah 1/	44.2	22.0	25.3	17.1	21.7	23.4	25.6
Springfield 1/	45.2	23.6	24.2	15.1	21.7	22.0	25.3
Urquie 2/	41.7	19.9	25.2	15.2	21.6	23.2	24.5
WS-1 2/	41.2	21.5	33.8	16.9	17.5		
Profit 2/	30.2	21.5		18.8	18.9		
Wared 3/	40.4		23.7				

1/ Tested in 1974 and 1975 only
2/ Tested in 1975 only
3/ Not tested in 1975

Table 4. Summary of yield data of spring wheat varieties tested in the higher yielding areas of eastern Oregon, 1972-1975

Variety	Pendleton 3/	Hermiston 3/	Weston	LaGrande	Joseph	Baker	Avg.
			(bushels per acre)				
Anza 1/	77.7	57.4	46.6	27.9	35.7	53.5	49.8
Fielder 1/	74.4	46.1	47.9	28.3	42.4	58.3	49.6
WS-1 2/	67.9	41.1	43.5	40.0	40.0		
Twin	71.6	33.3	44.0	35.5	44.0	61.9	48.4
Urquie 2/	72.4	14.9	39.2	39.3	49.8	69.5	47.5
Springfield 2/	70.5	29.9	43.3	29.6	44.0	54.9	45.4
Profit 75 2/	63.1	32.4	43.9	38.7	33.8		
Prospur 2/	59.6						

1/ Tested in 1974 and 1975 only
2/ Tested in 1975 only
3/ Irrigated

Table 5. Summary of yield data of winter barley varieties tested in the lower yielding areas of eastern Oregon, 1972-1975

Variety or Cross	Moro[1]	Pilot Rock	Rew Farm	Arlington[2]	Heppner	Condon[3]	Avg.
			(pounds per acre)				
Kamiak	1601	2119	2444	1784	1354	1620	1820
Hudson	1596	2214	2339	1779	1612	1061	1767
Schuyler	1424	1917	2285	2013	1351	1529	1753
Boyer	1360	2041	2428	1569	1296	1686	1730
Ione	1572	2273	2370	1173	1269	1618	1712

[1]Not tested in 1972
[2]Not tested in 1973
[3]Tested only in 1975

Table 6. Summary of yield data of winter barley varieties tested in the higher yielding locations of eastern Oregon, 1972-1975

Variety or Cross	Pendleton	Holdman	Weston	LaGrande	Summerville	Enterprise	Baker[1]	Avg.
				(pounds per acre)				
Schuyler	5083	2248	4327	5172	3493	3531	2570	3775
Boyer	4596	2120	4514	4882	3484	3481	2556	3662
Kamiak	5157	2157	3610	4760	3429	3219	2647	3568
Luther	4174	2040	4239	4297	3033	3296	2489	3367
Hudson	4398	2048	3776	4115	2926	2694	2487	3206

[1]No test in 1975

yielding areas of eastern Oregon, 1972-1975

Variety	Pendleton	Rew Farm	Moro	Heppner	Arlington	Condon	Avg.
				(pounds per acre)			
Steptoe	4108	2160	1697	1210	1528	1930	2106
Gem	3673	2358	1696	1160	1573	1717	2030
Unitan	3732	2232	1653	1148	1415	1784	1994
Flynn 37	3364	2230	1579	1156	1487	1731	1924
Piroline	3595	2116	1634	956	1359	1760	1903
Vanguard 2/	3342	1883	1563	1043	1492	1778	1850
Butte 1/	3493	1966	1471	982	1307	1512	1788
Zephyr 1/	3533	1768	1412	919	1171	1328	1688
Triticale 3/	2032	1295	1023	683	834	938	1134

1/ Not tested in 1972
2/ Not tested in 1975
3/ Tested in 1974 and 1975 only

Table 8. Summary of yield data of spring barley varieties tested in the higher yielding areas of eastern Oregon, 1972-1975

Variety	Pendleton 3/	Hermiston 3/4/	Weston	LaGrande	Joseph 3/	Baker 3/	Avg.
			(pounds per acre)				
Steptoe	5135	3605	3926	3320	3387	5018	4065
Zephyr	4642	2504	3417	2756	3537	5034	3648
Butte	4050	2168	3304	2904	3273	5125	3471
Unitan	4117	2351	3334	2766	3128	4371	3344
Vanguard 1/	3862	2755	2819	2841	2705	4946	3321
Vale 70	4244	2450	3123	2886	2551	4485	3290
Piroline	4257	2170	3099	2638	2955	4486	3268
Vale	4197	2556	3332	2447	2782	4252	3261
Klages	3933	1785	2837	2584	2990	4997	3188
Triticale 2/	3895	910	3521	1958	2072		

1/ Tested in 1972 and 1973 only
2/ Tested in 1974 and 1975 only
3/ Irrigated
4/ No test in 1973

WHEAT BREEDING PROGRAM

Charles R. Rohde and Wesley B. Locke

The wheat breeding program at Pendleton has the primary objective of developing high yielding, soft, white, winter wheat varieties for the lower yielding areas of eastern Oregon. Varieties best suited for the lower yielding areas often are taller growing than semi-dwarf varieties such as Hyslop and Nugaines. Varieties commonly grown in these areas include club wheat varieties such as Moro and Paha.

Desired characteristics in varieties for the lower yielding areas are: (1) high yields of grain with excellent milling and baking quality; (2) resistance to smut, stripe rust and foot and root rots; (3) ability to emerge when seeded deep or when the amount of moisture in the soil is rather low; (4) resistance to shattering; (5) medium height of straw; and (6) moderate winterhardiness.

PLANNED RELEASES

Charles R. Rohde and Warren E. Kronstad

SUWON 92/3*OMAR//MORO,OR7147

This strain of soft, white, winter club wheat is being prepared for release in the fall of 1976. It has brown chaff and is beardless. It is equal to Moro in test weight and is similar to Paha in growth habit, winter hardiness and seedling emergence. OR7147 is superior in lodging resistance to Moro and equal to Paha. It is resistant to stripe rust and moderately resistant to smut. It is slightly shorter than Paha and 4 to 7 inches shorter than Moro.

This variety is exceptionally well adapted to the lower rainfall areas of eastern Oregon where the club wheats are commonly grown, producing the highest yields of all varieties tested in that area (Table 1) and exceeding Paha by over 2 bushels/acre in the Regional Nursery (Table 2).

The proposed name for this variety is Faro. Breeders seed of OR7147 is being grown on 13 acres by the Foundation Seed Project and it is estimated that 39,000 pounds of seed will be available for seed growers this fall.

OR 65-116

A new, soft, white winter wheat, OR 65-116 is being proposed for release as a new variety. It has resulted from a cross between Nord Desprez and Pullman Selection 101. These are the same parents which provided the varieties Hyslop and McDermid.

Selection OR 65-116 is a semi-dwarf wheat; however, unlike previous semi-dwarf varieties the heads are quite distinct being coarse in appearance with the awns tending to be flared.

Selection OR 65-116 has good resistance to the major diseases observed in the Pacific Northwest including stripe rust, leaf rust, and common bunt and appears to have some tolerance to Cercosporella foot rot. There is, however, some question as to the level of this tolerance.

Selection OR 65-116 has good emergence and appears similar to Hyslop in terms of winterhardiness. It is also much like Hyslop in maturity.

Selection OR 65-116 has been identified by the Wheat Quality Laboratory at Washington State University as having particularly promising overall milling and baking characteristics.

Selection OR 65-116 has a very outstanding yield record. In the Western Uniform Regional White Winter Wheat Nursery, it has ranked No. 1 for yield during the last three years when averaged across all locations (Table 2). (Table 3 gives a summary of the yield data of OR 65-116 in comparison to other varieties commonly grown in eastern Oregon.) This suggests that Selection OR 65-116 has very wide adaptation being superior across environmentally diverse locations and over several years.

Stephens is the proposed name for OR 65-116 in honor of the late D. E. Stephens, who made a significant contribution to agriculture as a result of his work at the Sherman Branch Experiment Station. Landmark varieties such as Federation and Golden were the products of his research efforts.

Four acres of Breeders seed is being increased for possible release as Foundation seed in the fall of 1976.

Table 1. Yield data comparing OR7147 with other varieties grown in eastern Oregon, 1973-1975

LOWER YIELDING LOCATIONS

Variety	Moro	Pilot Rock	Rew Farm	Holdman	Heppner	Arlington	Condon	Avg.
				(bushels per acre)				
OR7147(Faro)	44.9	36.5	33.9	30.5	23.5	35.4	21.8	32.4
Hyslop	39.4	36.9	32.5	37.1	24.1	33.4	21.4	32.1
McDermid	35.1	36.8	33.6	32.6	26.8	32.6	22.8	31.5
Rew	37.0	33.9	32.0	34.5	23.5	32.8	25.1	31.3
Luke	36.3	31.7	32.9	34.7	23.8	31.8	22.2	30.5
Nugaines	39.4	29.5	32.6	33.1	23.9	33.8	20.3	30.4
Paha	34.9	32.8	30.4	33.6	23.5	32.6	20.7	29.8
Wanser	29.7	33.3	31.0	28.2	23.2	30.1	22.4	28.3
Moro	28.9	32.3	28.4	31.2	23.3	28.4	17.6	27.2
Rank of OR7147	1	3	1	8	5	1	5	1
No. years tested	3	3	3	3	3	2	1	18

HIGHER YIELDING LOCATIONS

Variety	Pendleton	Weston	LaGrande	Enterprise	Baker	Avg.
			(bushels per acre)			
OR7147(Faro)	77.0	64.3	63.2	55.6	48.2	61.7
Hyslop	79.5	63.9	59.9	58.9	78.6	68.2
Luke	77.1	61.3	62.7	57.6	82.2	68.2
McDermid	78.2	58.4	56.2	59.4	83.2	67.1
Nugaines	76.9	61.3	62.9	55.5	73.2	66.0
Rew	72.0	61.6	66.6	61.1	64.2	65.1
Paha	70.7	60.6	64.7	56.3	51.0	60.7
Wanser	56.0	59.8	54.9	53.3	65.0	57.8
Moro	59.4	55.2	54.7	51.7	53.2	54.8
Rank of OR7147	4	1	3	6	9	6
No. years tested	3	3	3	3	2	14

Table 2. Average Yields from the Western Uniform Regional White Winter Wheat Nursery for OR 65-116, OR 67205 in Comparison with Promising Selections and Commercial Varieties from 1973-1975

	1973	1974	1975	Avg.
COMMON				
Selection OR 65-116 (Stephens)	79.5	76.6	78.0	78.0
Hyslop	75.9	75.2	78.0	76.4
McDermid	77.2	71.7	74.5	74.5
Nugaines	72.6	68.3	70.6	70.5
Luke	70.6	----	----	70.6
Selection WA 6099 (Daws)	----	74.0	72.8	73.4
CLUBS				
Paha	70.6	63.8	67.2	67.2
Selection OR 71147 (Faro)		65.8	69.8	67.8
Number of Locations	16	18	18	

Table 3. Yield data comparing OR65116 with other varieties grown in eastern Oregon, 1973-197

LOWER YIELDING LOCATIONS

Variety	Moro	Pilot Rock	Rew Farm	Holdman	Heppner	Arlington	Condon	Avg.
				(bushels per acre)				
OR65116(Stephens)	43.4	41.8	25.3	27.4	26.3	29.5	26.2	31.4
Hyslop	38.1	38.8	26.6	30.0	24.3	31.2	21.4	30.1
Rew	28.8	39.7	24.9	31.3	26.4	29.5	25.1	29.4
Nugaines	37.1	36.1	26.1	28.7	25.3	31.2	20.3	29.3
McDermid	31.2	40.3	29.8	28.2	26.0	27.4	22.8	29.4
Luke	35.7	34.6	25.1	28.9	24.6	27.8	22.2	28.4
Paha	33.8	37.8	22.6	30.9	24.6	26.5	20.7	28.1
Wanser	24.0	34.8	23.8	25.0	24.0	28.1	22.4	26.0
Moro	26.8	35.8	18.3	29.1	22.4	23.5	17.6	24.8
Rank of OR65116	1	1	4	8	2	3	1	1
No. years tested	3	1	1	1	1	1	1	9

HIGHER YIELDING LOCATIONS

Variety	Pendleton	Weston	LaGrande	Enterprise	Avg.
			(bushels per acre)		
OR65116(Stephens)	82.9	61.5	53.3	59.3	64.2
Luke	81.2	61.1	55.2	60.8	64.6
Hyslop	83.6	65.7	46.3	54.3	62.5
Nugaines	80.9	66.2	53.8	50.9	63.0
McDermid	82.4	62.6	41.8	62.2	62.2
Paha	74.2	59.9	----	59.7	----
Rew	72.0	60.6	48.1	58.8	59.9
Moro	62.4	52.0	38.6	56.5	52.4
Wanser	56.0	59.1	37.9	53.0	51.5
Rank of OR65116	2	4	3	4	2
No. years tested	3	1	1	1	6

WEED CONTROL RESEARCH

D. J. Rydrych

Research in eastern Oregon and on the Pendleton, Umatilla, and Sherman Stations has shown that many broadleaf weeds are controlled by one or more registered herbicides. Herbicide mixtures have proven far superior on weeds than one chemical. We have four herbicide combinations with state and federal registrations and other combinations are being investigated. The four herbicide combinations are: bromoxynil - MCPA, bromoxynil - linuron, bromoxynil - diuron, and bromoxynil - dicamba. The weed grasses have been more difficult to control in cereals and other crops but new herbicide systems have been developed at Pendleton which will influence agriculture in eastern Oregon. Controls developed for cheatgrass and wild oats in cereal grains enable conservation farming such as stubble mulch and no-till.

SELECTIVE CHEATGRASS CONTROL IN CEREALS

Improved cheatgrass control has been made possible by the use of metribuzin (Lexone or Sencor) as a post-emergence selective herbicide in wheat or barley. Metribuzin is not registered for use in wheat or barley but petitions have been submitted for this use. Metribuzin is more effective when combined with bromoxynil or dicamba. Applications are made in early spring when the cereals have 2 to 3 tillers and crown root development is complete. Metribuzin is also effective on most broadleaf weeds particularly when combined with other herbicides.

Another new compound made by the Hoechst Company (Hoe 23408) proved effective on downy brome when incorporated as a pre-plant treatment. Cereals are fairly tolerant to this compound.

Trifluralin (Elanco Company) is the only registered herbicide for the selective control of cheatgrass in winter wheat. This compound must be soil incorporated for effective use. Trifluralin is useful in areas where cheatgrass, bulbous bluegrass or goatgrass are a problem but it is not effective on the mustards.

CEREAL RESISTANCE TO HERBICIDES

In 1975, a new project (Project 290) was initiated to search for cereal varieties with superior tolerance to presently used herbicides. Wheat and barley varieties differ in their ability to metabolize herbicides at the cellular level. Cultivars are being selected that have resistance to metribuzin so the crop safety factor can be increased from a 2X to 4X level (biochemical selectivity). Cereal tolerance to herbicides is influenced by several factors such as (1) placement selectivity, (2) biochemical selectivity, (3) soil absorption, (4) location of growing point, and (5) physical selectivity. Biochemical selectivity is the ability of plants (both weeds and crops) to detoxify chemicals at the cellular level either by enzymes or metabolites which degrade the substance to a harmless form. Biochemical resistance is a genetic trait that can be used to distinguish the superiority of one variety over another. Weed populations have been known to develop resistance to a particular chemical, particularly when exposed to the same chemical for several generations. The escape mechanism in weed populations can be a serious problem when a control program is involved. This resistance can increase the tolerance of crop cultivars to herbicides. Hopefully, the expanded use of biochemical selectivity can be used to develop more resistant varieties and thereby increase crop safety.

CHEMICAL FALLOW

The cancellation of amino triazole for use in cropland by EPA seriously affected our chemical fallow program. However, new registrations have been obtained for Bladex, paraquat and glyphosate for use in chemical fallow. Atrazine has been registered for this use for many years. The use of glyphosate, Bladex, atrazine and paraquat, alone or in combination with other herbicides is being evaluated. Research results show that mixtures are far more effective than an application of one chemical. Research is being conducted on both the residual and non-residual phase of chemical fallow. Some areas are not suited for long term residual herbicides; therefore, non-residual types such as glyphosate, paraquat and IPC are more desirable.

NO-TILL IN CEREALS

No-till, which has been practiced experimentally in the Columbia Basin since 1968, has shown some promise and wheat and barley are well adapted to this practice. Good chemical seedbed preparation is essential in the fallow year followed by selective weed control in the crop year.

A comprehensive screening program for cheatgrass and annual weed control in no-till culture was established in 1975. Research has shown that several herbicide mixtures containing metribuzin can control cheatgrass and broadleaf weeds in a no-till seedbed. In 1975, no-till wheat yields at the Research Center were 820 pounds more than conventional tillage (Table 1). At the Sherman Station (Moro) winter wheat yielded 410 pounds more using no-till than wheat grown on plowed seedbeds.

The incidence of foot rot in 1975 was much less in no-till winter wheat plots than in either plow or stubble mulch culture (Pendleton). The 820-pound increase in the no-till plots may have been the result of reduced foot rot infection. These data were taken from fields which had excellent cheatgrass and broadleaf weed control.

Table 1. Winter Wheat Yields Produced Under Various Tillage Treatments at Pendleton and Moro, 1975

	Pendleton lb/A McDermid Wheat		Moro lb/A Moro Wheat	
	Control	Chemical	Control	Chemical
Plow	2810	3490	2040	2420
Roto-till	2600	3500	----	----
Stubble mulch	2140	3470	1760	2740
No-till	2630	4310	2340	2830

RYE CONTROL IN CEREALS

Volunteer rye continues as a major problem in grain throughout the Pacific Northwest. An expanded program for cereal rye control was initiated at Pendleton in 1975 but selective control of rye in winter wheat has proven difficult. However, preliminary research has shown that some new herbicides may be effective. Chemical seedbed preparation has been effective using non-selective herbicides post-emergence on volunteer rye before the wheat emerged. Chemical methods that remove the rye from the wheat are being investigated. Gramoxone (1:1 - Dimethyl-4-4-Biphyridinum dichloride) selectively removed rye from wheat in the seedling stage; however, 10 to 30 percent reductions in cereal yield were recorded. Gramoxone is not registered for this use in cereals. Research has shown that chemical control is possible and efforts are being made to limit crop injury by the use of antidotes.

WILD OAT RESEARCH

Wild oat research has been conducted throughout Oregon for several years. Several promising wild oat herbicides are being field tested in Umatilla County this year. Companies that have wild oat compounds that are being considered for registration include: American Hoechst, Ansul and American Cyanamid. These compounds are effective when applied post-emergence on wild oats and the American Hoechst compound has also been effective on wild oats when applied pre-emergence or by soil incorporation.