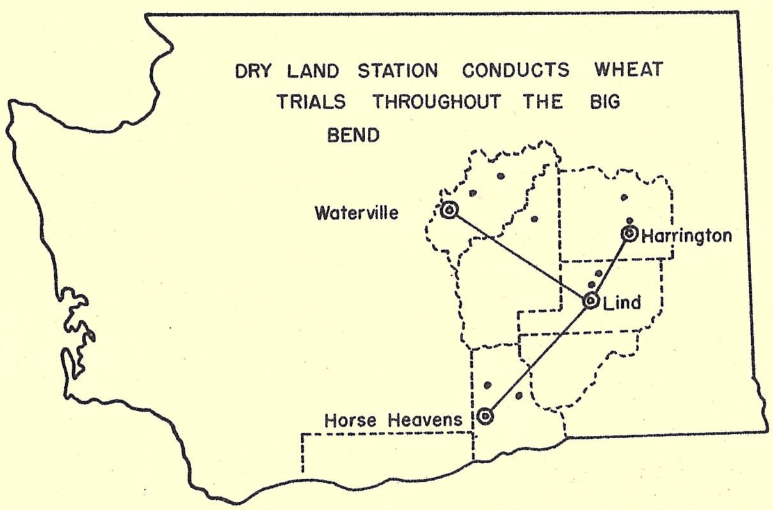
43d Annual

FIELD DAY

Dry Land Experiment Station



Lind, Washington June 24, 1959

Washington Agricultural Experiment Stations Institute of Agricultural Sciences
State College of Washington

INTRODUCTION

The Dry Land Experiment Station, formerly the Adams Branch Experiment Station, was established in 1910 near Ritzville, when a 10-acre plot of land was leased and experiments with cereals, forage crops, and certain phases of soils work commenced. Largely through the efforts of Spokane businessmen, the Milwaukee Railroad, and Adams County, a site was leased from Adams County approximately 3 miles northeast of Lind. Buildings were erected, and the Station moved to its present location in 1915.

Originally, the Station was operated with county, USDA, and state funds. At present it is supported entirely by state funds. The farm consists of 320 acres of land, of which approximately 260 acres are devoted to crop production experiments. The remainder consists of grass and rough land.

Early in 1949, Adams County deeded 2.06 acres to the Board of Regents of the State College of Washington. There the new state-financed office and greenhouse buildings were constructed. Under the leadership of the Washington Agricultural Experiment Stations, the Dry Land Experiment Station has carried out a continuous program of research since its establishment.

Experiments are planned and conducted cooperatively with the different departments of the Main Experiment Station at Pullman; Soil Conservation Service and Bureau of Plant Industry, USDA; and with the U.S. Weather Bureau, Department of Commerce.

The Field Day is an annual affair held in June to acquaint farmers, ranchers, and townspeople of central Washington with the nature of the work being conducted and to furnish information collected from the experiments in progress. The public is especially invited to attend these field days, although visitors are welcome at all times.

Walter L. Nelson, Superintendent

Table 1. Annual rainfall near Lind, Washington, 1897-1958

Data Obtained by Dan Krehbiel		Data Obtained by O. W. Goodenough		Data Obtained by the Dry Land Experiment Station			
1897-98	6.34	1909-10	8.74	1916-17	7.60	1937-38	11.89
1898-99	8.76	1910-11	8.10	1917-18	6.64	1938-39	5.32
1899-00	12.00	1911-12	10.33	1918-19	8.10	1939-40	13.01
1900-01	15.34	1912-13	8.24	1919-20	6.56	1940-41	18.00
1901-02	12.33	1913-14	10.50	1920-21	7.01	1941-42	12.29
1902-03	13.67	1914-15	10.54	1921-22	6.97	1942-43	11.65
1903-04	15.03	1915-16	13.59	1922-23	10.90	1943-44	8.60
1904-05	11.34			1923-24	6.62	1944-45	10.65
1905-06	12.01			1924-25	8.32	1945-46	11.82
				1925-26	6.65	1946-47	8.02
				1926-27	12.65	1947-48	22.71
				1927-28	10.83	1948-49	7.00
				1928-29	5.77	1949-50	9.89
				1929-30	4.80	1950-51	9.85
				1930-31	6.91	1951-52	8.11
				1931-32	9.78	1952-53	7.71
				1932-33	8.39	1953-54	7.98
				1933-34	9.79	1954-55	7.40
				1934-35	7.48	1955-56	11.50
				1935-36	8.09	1956-57	7.73
				1936-37	8.93	1957-58	10.10
Average	11.87		10.01				9.29

Average for 58 years 9.78

Rainfall September 1, 1958 to June 1, 1959 9.24

CLIMATIC INFORMATION

Table 1 gives the annual rainfall near Lind for the past 55 years. The data collected for the last 35 years at the Station show that 6 inches of rain fell between October 1 and March 31, 2.5 inches from April 1 through June 30 and 1 inch from July 1 to September 30. Approximately 90 per cent of the rainfall is between October 1 and June 30, which coincides almost exactly with normal winter wheat growing season.

Climatic measurements are made daily. They consist of readings made with such standard U.S. Weather Bureau instruments as maximum and minimum thermometers, a manual precipitation gauge, sling psychrometer, and evaporation instruments. In addition, a continuous record of soil and air temperatures, relative humidity, and precipitation is kept by means of automatic recording instruments.

RESEARCH ON CEREAL CROPS

In 1950, the Dry Land Experiment Station enlarged the cereal breeding and testing program. The object of this program is to produce new varieties of cereals adapted to the Big Bend area, where annual rainfall is from 9 to 13 inches. This program includes the testing of new varieties and selections developed at other experiment stations throughout the Midwest and Pacific Northwest, and breeding of new varieties. Actual breeding and selection are done on the station, with final testing at locations listed below.

Three testing sites were set up in 1950 to more adequately check cereal varietal response throughout the Big Bend. These sites are presently located on the Bill Schmidtman farm, Waterville; Leonard Schultz farm, Harrington; and Vollmer & Bayne, Prosser. All experimental work at the outlying locations is conducted by the same methods as the work at the Station. Fifty to sixty varieties and new selections from breeding nurseries are tested at these locations. Smaller test plots are located on the Jim Teel farm, Davenport; and the Phil Wainscott farm, Waterville, where twenty-five to thirty varieties are tested. Farmers in these areas are urged to visit the plots on county tours or at any other time. The results of these trials and the trials at the Station will determine the value of any new selection for the Big Bend area.

To facilitate harvest of experimental cereal plots, a plot combine was developed at this station. The combine was engineered and built to specifications by Carl Beckley, Benge, Washington. The combine was financed by a grant of $6, 000 from the Hay and Grain Fund of the Washington State Department of Agriculture, and by donations of $545 from County Wheat Associations and other donations. This combine will harvest forty to fifty plots an hour with a crew of two. By hand labor, a crew of six men were required for harvest at an equivalent rate.

WINTER WHEAT

The winter wheat breeding and testing program is pointed towards varieties of good quality adapted to early deep seeding. Selections from this breeding program are several years away from extensive testing for yield. High quality selections are in the preliminary yield trials this year. This program will be expanded when suitable equipment is developed for deep seeding individual plant lines.

Smut testing is in cooperation with USDA at Pullman under the direction of Dr. C.S. Holton. Quality testing is conducted at the USDA Western Wheat Quality Laboratory under the direction of Dr. M. A. Barmore, at Pullman. These cooperating agencies make possible a better and more rapid evaluation of the selections in a breeding program.

Since 1956, three varieties of winter wheat have been released to farmers in the Big Bend Area. These varieties are Columbia, Burt, and Itana. The varieties are described in Extension Circulars Nos. 275, 284, and 297 respectively. Table 2 gives the comparative yields of these varieties in percentage of Rio and of other standard varieties for the locations indicated.

Elmar, Omar and Brevor are not recommended for areas of less than 14 inches of rainfall. In the lower rainfall areas, these varieties are often too high in protein to produce suitable pastry flour. Data reported on Omar are from 2 to 3 years of trials. All other data are from 5 to 7 years of trials at these locations.

Variety recommendations for eastern Washington for wheat, oats and barley are given in Extension Misc. Publication 14, available from your County Agent.

Table 2. Comparative Yields of Winter Wheat Varieties Grown at Lind, Harrington, Waterville, and Horse Heavens, Dry Land Experiment Station, Lind.

Variety	Lind	Harrington	Waterville	Horse Heavens	Average All Locations	Average Yield (bu/A)
Rio . . .	100%	100%	100%	100%	100%	32
Columbia .	100	103	114	106	105	34
Burt . . .	129	121	114	111	119	38
Itana . . .	118	109	116	112	113	36
Elmar . . .	123	114	117	110	116	37
Brevor . .	120	108	113	113	112	36
Omar . . .	123	122	130	110	121	--[a]

[a]Only 2 or 3 years of data; figure would not be comparable with other varieties with 5 to 7 years of data.

SPRING WHEAT

The spring wheat program at the Dry Land Experiment Station has four main objectives:

1. Test and introduce available spring wheat varieties and breeding material from other areas,

2. Improve superior spring wheat varieties by various breeding methods,

3. Incorporate resistance to leaf and stem rust in varieties adapted to the Big Bend area, and

4. Improve the quality and protein content of spring wheat varieties adapted for this area.

Awned Onas has been crossed with good milling types of spring wheat. Selections from this cross with Hope-Reliance-Prelude x Clarendon Sel. 2202 have been tested for milling quality and are now in regional yield trials. Thousands of additional selections with Awned Onas, Baart, Burt, Idaed, and other good yielding varieties are being tested for quality and will be included in future yield trials. Preliminary milling quality is tested on a 5-gram milling--about 150 kernels. This can be done on an individual plant basis, and selection for quality can be started about 4 to 5 years sooner in the breeding program. By this early selection for quality, new high quality varieties can be developed in a much shorter time.

Considerable emphasis is being placed on breeding for protein and yield. Recent research has shown that both high protein and high yield can be attained in the same variety. Many of the recent crosses have included parents which have the ability to produce high protein with good yield. The goal of our breeding program is to have high yield, high protein, good milling, and quality, in varieties with good disease resistance and good agronomic characteristics.

Table 3 shows the yields of eight spring wheat varieties grown at Waterville, Harrington, Horse Heavens, and Lind for 5 or more years. The average yield figures at all locations show Marfed, Lemhi, and Awned Onas are the highest-yielding varieties for these years. These three varieties have poor milling quality and have not been recommended for the Big Bend Area.

The Dry Land Experiment Station, in cooperation with the Agronomy Department at Pullman, is testing and breeding for resistance to stem and leaf rust in spring wheat. To date, these diseases are not a problem in the Big Bend dryland areas. This resistance is being incorporated in new hybrids as insurance against possible future rust epidemics. Many of the new spring wheat selections in the preliminary yield nurseries have good rust resistance.

Table 3. Yield of Spring Wheat Varieties Grown at Harrington, Horse Heavens, Waterville and Lind for Number Years Indicated. Dry Land Experiment Station, Lind, Wash.

Variety	Harrington 8 Years	Horse Heavens 5 Years	Waterville 6 Years	Lind 6 Years	% Baart Yield, All Locations
Marfed	33.3	23.2	31.8	23.7	113
Awned Onas . .	33.5	22.0	32.3	23.0	112
Lemhi	31.7	21.6	32.2	22.3	109
Federation . .	31.1	21.4	29.8	22.3	105
Idaed	32.9	21.4	27.3	19.7	103
Baart.	29.8	20.9	27.6	20.7	100
Henry.	31.4	20.3	25.4	18.7	97
Thatcher . . .	29.1	18.7	24.0	18.4	92

SOILS AND FERTILIZER STUDIES

The soils and fertilizer research at the Dry Land Experiment Station is conducted cooperatively with the Agronomy Department, WSC, Pullman. This research is now under the leadership of Dr. Fred Koehler. During the past 10 years, extensive studies have been conducted on rates, date and methods of fertilizer application. Washington Agricultural Experiment Stations

Bulletin 602 summarizes 5 years' results from 112 fertility experiments in eastern Washington. This bulletin gives detailed results of these experiments and recommendations for nitrogen, sulfur and phosphorus for each rainfall area. For recommendations for your local area, see your County Agent; he is kept up to date on fertilizer recommendations.

Farmers are urged to check the response to fertilizer applications. A soil test to determine available nitrogen in the soil is advisable. However, a test is not complete without a yield check on the response to the recommended rate of nitrogen application. Reliable field checks on response to fertilizer can be made by leaving a check strip unfertilized over a representative portion of the field. By a double application along the side of this check strip, the farmer can check if his fertilizer rate was high enough.

Harvesting these strips and weighing separately will require more time in harvest, but will return many times over the cost and time involved if the farmer finds his rate of application was too high or too low. Each 3 or 4 pounds of nitrogen should increase the yield by 1 bushel per acre. This ratio can be used as a guide to determine if the correct rate of nitrogen has been applied.

To date, experiments with a sulfur or phosphate fertilizer have not given any significant yield increase. The Station will continue testing with these elements to determine when they might be used profitably in wheat production.

Annual cropping experiments have been conducted at Harrington, Packard, and Lind during the last 5 years. The data from these trials are in the hands of the publishers. They show that annual cropping was not economically feasible at any of these locations. Total yields from annual cropping were about equal to the yields obtained under summer fallow. The extra costs of fertilizer, seed and management make recropping impractical in areas of less than 13 inches of rainfall.

Future research in soil and fertilizers will try to determine water and nitrogen requirements of the growing wheat plant. Soil moisture will be measured periodically during the growing season at 1 foot intervals to a depth of 8 feet. Plants will be sampled periodically to determine nitrogen uptake. Water and nitrogen requirements of the wheat plant will be measured at different stages of plant growth, and at different rates of fertilizer application. Results of these studies will help determine how fertilizer and soil moisture can be used to produce wheat more efficiently.

DRY LAND ROOT ROT STUDY

Diseases of the roots and crowns of dryland wheat have long been a major problem, but researches to date have failed either to explain their true nature or to give real aid to their alleviation. This failure of ordinary research procedures in Washington has led to adoption of a more "basic" approach.

This basic approach is based on these assumptions:

1. we do not know the cause of dryland root rot;

2. we believe it caused by pathogenic microorganisms;

3. the most likely place to start is with root-attacking or root-associated fungi.

With this basic foundation in mind, Mr. John Hoes, a graduate student in plant pathology, is studying these fungi with all his research time.

Winter wheat is dug at intervals through the growing season. The fungi from the roots are isolated and cultured and saved for identification. The fungal populations of dryland wheat roots will be plotted. When the "normal" fungal population is known, populations from diseased plants can then be compared with that of normal plants. Deviations may show us the culprit or culprits.

This study is underway, financed by the Washington Wheat Commission and Washington State College. It is expected that progress will be slow at first, because it is hard to identify many of these fungi. But the project will gather momentum as the researchers gain experience. The wheat plant is so important that a basic knowledge of parasites invading its roots is a worthy objective.

CHEATGRASS CONTROL STUDIES

T. J. Muzik and W. P. Anderson

Cheatgrass is one of the most serious weed problems in wheat in the dry land farming area. Experiments have been conducted by the State College on the control of this weed for several years. Recently this research work has been stimulated by a grant from the Washington State Wheat Commission. A new Agronomist, Mr. W. Powell Anderson, has been appointed on this grant.

Previous field work has shown that cheatgrass can be controlled by a number of chemicals. Most of these chemicals, however, also injure wheat. On some occasions successful control of cheatgrass has been obtained without apparent damage to the winter wheat. On other occasions, serious damage has occurred with these same chemicals. The data so far obtained indicate that climatic conditions are primarily responsible for these erratic results.

The grant from the Washington State Wheat Commission will enable the State College to investigate the environmental aspects of these experimental results more fully and more completely. The purchase of a plant growth chamber with grant funds will enable the study of effects of temperature, humidity, and light under controlled conditions. By thus determining the interaction of the environment with the chemical, it may be possible to apply the chemical at the most opportune time for best weed control and least wheat injury.

For example, if it is found that injury to wheat, caused by a chemical that effectively controls cheatgrass, is influenced by temperature, then recommendations could be made for applying this chemical when temperatures were most favorable. Although we cannot control the climate, it is possible to adapt our spray program to it.

Mr. Anderson is a well-trained Agronomist with a Master's degree from Maryland. He has had an additional year of graduate study at Oregon State College and has had several years' experience in the herbicide field. With this additional help, the State College will be able to pursue the leads so far discovered in field work and to test these under controlled conditions as well as under field conditions. A concerted attack on this serious weed by laboratory, greenhouse, and field methods is our best hope of obtaining a practical means of control.

FORAGE INVESTIGATIONS

Grasses and legumes are studied for adaptation to the low rainfall areas. This work is conducted by Agronomy Department, WSC, and the Soil Conservation Service, Nursery Division, Pullman, Washington. Grasses which show promise of adaptation to this area are tested for yield, longevity, ease of establishment, stand, and other agronomic characteristics.

A summary of these and other forage studies in Washington is given in Stations Circular 267, April, 1959 revision. This is available from your County Agent.

In 1956, a source nursery was established at the Dry Land Experiment Station. This work is under the direction of C. L. Canode and E. V. Horning, ARS, USDA, Pullman, Washington. This nursery was established to supply material to initiate a breeding program to develop grass varieties better adapted to the dry land areas of Washington. Varieties, experimental seed lots, and seed from individual plant selections of wheatgrasses are exposed to natural climatic selection for 3 to 5 years. After natural selection has eliminated or at least indicated the plants that are not well adapted, the remaining plants will be carefully screened. We should thus find material that appears outstanding in drought resistance, seed production, and quality.

Seed will be harvested from selected plants and planted to provide second cycle source material. Vegetative material will be taken from each plant selected and a permanent nursery will be established from the cuttings. The selected plants from this nursery will in this manner furnish the basic material for the breeding program.

The planting in the north half of the field was made December 14, 1956 with seed of Greenar intermediate wheatgrass (Agropyron intermedium), Whitmar bluebunch wheatgrass (Agropyron inerme) and three experimental varieties of bearded bluebunch wheatgrass (Agropyron spicatum). All of these species are well adapted to the dry land area of central Washington but have undesirable characteristics that must be overcome before they can be considered highly desirable or competitive with Nordan crested wheatgrass.

The south half of the field was planted October 30, 1957 with seed from a large number of individually selected plants of intermediate, inerme, and spicatum. Most of these plants were selected from the dry land areas of Central Washington for their outstanding agronomic characteristics.

TREES AND SHRUBS FOR DRY-LAND PLANTING

Several species of trees and shrubs are included in the Station forestry project for farm-home landscaping and windbreaks. The first plantings are now over 30 years old. Plantings have been made at intervals since the original planting. The Station planting is now considered to be one of the best in the West for studying trees and shrubs adapted to dry-land conditions. A publication summarizing the results of these plantings will be available to farmers in the near future.

Initial observation tests of wood species are carried on at the Soil Conservation Nursery at Pullman. Secondary tests are carried on cooperatively at experiment stations at Prosser and Lind, Washington, and Moro, Oregon. The present testing program at Lind was started in 1928 by the Dry Land Experiment Station and the Department of Forestry and Range Management, State College of Washington.

A standard dry-land windbreak planting consists of a minimum of five rows which, when properly established, give excellent protection from the winds. Results to date indicate that Caragana is still the best erect shrub. Blue leaf honeysuckle and Nanking cherry are showing considerable promise. Russian olive is the recommended species of intermediate shrubs. Hawthorn and a strain of wild crab apple are showing promise. Black locust is still the most promising deciduous tree. Green ash and Chinese elm are good but they do not show the promise of black locust. Austrian pine is the outstanding evergreen tree, being superior to both Scotch and Ponderosa pine. Norway spruce, Douglas fir and Blue spruce can be grown but require more care and have a much slower growth. Rocky Mountain juniper is showing the most promise in this group.

Farmers contemplating a shelterbelt planting should realize that considerable work is involved. To survive under dry-land conditions, trees require continuous clean cultivation. Space rows between trees so available machinery can be used. Transplant trees and shrubs as soon as you get them. Pine and juniper require special care when transplanting. Transplanted evergreen stock has given better survival than seeding stock. Although transplanted stock is more expensive, the superior survival will compensate for the extra cost.

Table 4. Standard Species, Arrangement, and Spacing of Trees and Shrubs for Windbreak Plantings in the 8-10 Inch Rainfall Area.

Row No.	Species	Growth habit	Spacing in row	Minimum distance from next row[a]
1. . . .	Caragana	Erect shrub	3 ft.	18 ft.
2. . . .	Russian Olive	Intermediate Shrub	6 ft.	18 ft.
3 & 4. .	Black Locust	Deciduous tree	12 ft.	18 ft.
5. . . .	Austrian pine	Evergreen	12 ft.	27 ft.
	Scotch pine			
	Ponderosa pine			
	Norway spruce			

[a]Rows can be spaced wider apart if cultivation equipment requires it.