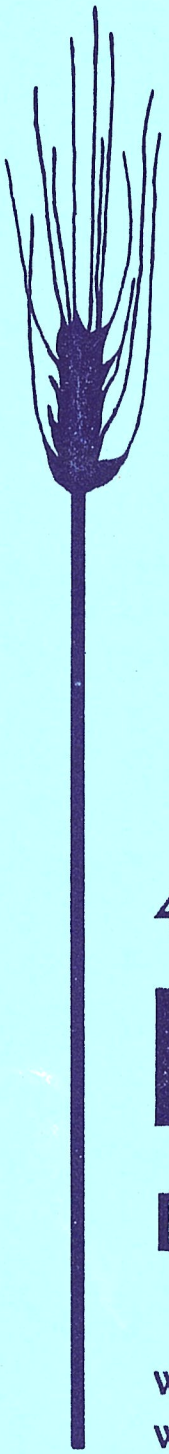

44th Annual

FIELD DAY

Dry Land Experiment Station

Washington Agricultural Experiment Stations
Washington State University

Institute of Agricultural Sciences
June 29, 1960

INTRODUCTION

The Dry Land Experiment Station, formerly the Adams Branch Experiment Station, was established in 1910 near Ritzville. 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. 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 Washington State University. 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.

Field Day is held each June to acquaint farmers, ranches, and townspeople of central Washington with 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 at the Dry Land Experiment Station, Lind, Washington, for crop year Sept. 1, to August 31, from 1916-1959.

1916-17. . . 7.60	1930-31. . . 6.91	1944-45. . .10.05
1917-18. . . 6.64	1931-32. . . 9.78	1945-46. . .11.82
1918-19. . . 8.10	1932-33. . . 8.39	1946-47. . . 8.02
1919-20. . . 6.56	1933-34. . . 9.79	1947-48. . .22.71
1920-21. . . 7.01	1934-35. . . 7.48	1948-49. . . 7.00
1921-22. . . 6.97	1935-36. . . 8.09	1949-50. . . 9.89
1922-23. . .10.90	1936-37. . . 8.93	1950-51. . . 9.85
1923-24. . . 6.62	1937-38. . .11.89	1951-52. . . 8.11
1924-25. . . 8.32	1938-39. . . 5.32	1952-53. . . 7.71
1925-26. . . 6.65	1939-40. . .13.01	1953-54. . . 7.98
1926-27. . .12.65	1940-41. . .18.00	1954-55. . . 7.40
1927-28. . .10.83	1941-42. . .12.29	1955-56. . .11.50
1928-29. . . 5.77	1942-43. . .11.65	1956-57. . . 7.73
1929-30. . . 4.80	1943-44. . . 8.60	1957-58. . .10.10
		1958-59. . .10.71

43 year average. . . . 9.30
Rainfall September 1, 1959 to May 20, 1960. . . . 8.43

CLIMATIC INFORMATION

Table 1 gives the annual rainfall at the Dry Land Experiment Station for the past 43 years. Approximately 90 per cent of the rainfall is between October 1 and June 30; 50 per cent of all rain falls between October 1 and January 31. Climatic measurements are made daily with standard U. S. Weather Bureau instruments. Data recorded are maximum and minimum temperature, daily precipitation, relative humidity, daily wind movement, and daily evaporation. In addition, a continuous record of soil and air temperatures, and precipitation is kept by means of automatic recording instruments.

RESEARCH ON CEREAL CROPS

The Dry Land Experiment Station cereal breeding and testing program has as its objective the development of new varieties of cereals adapted to the Big Bend area, where annual rainfall is from 9 to 13 inches. The 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 by conventional breeding methods and by induced mutations. Actual breeding and selection are done on the station with final testing at selected locations in the Big Bend.

These sites are presently located on the Bill Schmidtman farm, Waterville; Leonard Schultz farm, Harrington; and Vollmer and Bayne farm, 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.

Research with barley is limited to variety testing of standard varieties and new selections from WSU and other experiment stations in the Western states. Regional nurseries of barley and durum spring wheat are grown on the station.

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. During the past two seasons this combine has harvested 2500 plots at the rate of forty plots per hour with a crew of two. By hand labor, a crew of six men would be required for harvest at the equivalent rate.

WINTER WHEAT

The winter wheat breeding and testing program is pointed towards developing varieties of good quality adapted to early deep seeding. Selections from this breeding program are ready for extensive testing for yield. High quality selections are in the preliminary yield trials this year. This program has been handicapped by the lack of adequate equipment 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 selections in the 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. Years of data and total number of nurseries for each location are given at the bottom of the table.

Variety recommendations for eastern Washington for wheat, oats and barley are given 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[a]	Harrington[b]	Waterville[c]	Heavens[d]	Average, All Locations	Average Yield, Bushels Per Acre
Burt . . .	124%	122%	117%	112%	120%	37.1
Columbia.	99	105	117	107	107	32.4
Itana. . .	116	110	121	110	114	34.6
Omar[e] . .	117	125	132	117	122	37.0
Brevor. .	114	110	116	110	112	34.1
Rio . . .	100	100	100	100	100	30.4

[a]8 years of data, 8 nurseries
[b]6 years data, 9 nurseries
[c]5 years data, 6 nurseries
[d]6 years data, 10 nurseries
[e]3 and 4 years data at each location, 1956 first year 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.

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

Awned Onas, Marfed, Idaed, Baart and Henry have been crossed with good quality, high yielding spring wheat selections. Selections with good milling and baking quality from these crosses are now in state regional yield trials. Several thousand additional selections are being tested for quality and will be included in future yield trials. Preliminary milling and baking quality are 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 earlier in the breeding program. These new micro technics in quality permit selection for quality at the same time preliminary selection for other agronomic characteristics are made.

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 can produce high protein with good yield. It appears that some progress

has been made in this area. Several of the new selections have high protein with good bread quality and yield comparable with Marfed. These data are from one year of state wide yield trials and will need further testing to confirm the trend.

Table 3 shows the yields of six spring wheat varieties grown at Waterville, Harrington, Horse Heavens, and Lind for 6 or more years. The average yield figures at all locations show Marfed and Lemhi are the highest yielding varieties for these years. Both of these varieties have poor quality at high protein and are not recommended for low rainfall areas. Marfed is recommended for areas where precipitation exceeds 11 inches.

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

Variety	Harrington 9 Years	Horse Heavens 6 Years	Waterville 7 Years	Lind 7 Years	% Baart Yield, All Locations
Marfed	33.5	23.9	31.6	24.1	113
Lemhi	33.2	23.0	31.6	22.6	108
Federation	31.2	22.1	29.5	22.2	105
Idaed	33.1	22.2	26.8	19.5	102
Baart	29.2	21.7	27.9	21.6	100
Henry	31.6	21.1	25.7	19.1	99

SOILS AND FERTILIZER STUDIES

The soils and fertilizer research at the Dry Land Experiment Station is conducted cooperatively with the Agronomy Department, WSU, 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. The results of these studies are reported in Washington Agricultural Experiment Stations Bulletins 602, 608, and 609.

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.

Bulletin 608 summarizes 5 years of comparisons between annual cropping and summer fallow in the 10 to 15 inch rainfall areas. The average yield of wheat from annual cropping at optimum fertilizer rate was 13 bushes per acre at Ritzville, 23 at Harrington and 29 at Dusty. Although the yield of wheat was too low at Ritzville, the yields at Harrington and Dusty were high enough to consider annual cropping.

Bulletin 609 reports on the relationship of wheat yield, available moisture and available nitrogen. These data show about 3 pounds of nitrogen per acre are needed to increase the yield of wheat 1 bushel per acre, where nitrogen is limiting yield. Four inches of moisture is necessary to grow wheat to heading stage and each additional inch increases the yield by approximately 6 bushels per acre.

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

Management studies to determine the relationships of rate of seeding, date of seeding, and rate and date of fertilizer treatments as they affect different varieties have been conducted for 1 year. No results will be reported until after the 1960 harvest. A semi-dwarf short straw variety is included in these trials, which are now being conducted at three outlying locations as well as at the Station.

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 STUDIES

A study of the fungi of dry land wheat roots and crowns, sponsored by the Washington Wheat Commission and Washington State University, is entering its second year. This study has two major phases; a census of the fungi and a special study of those that are unknown or little known.

The "census" is a recording of the fungi as they are obtained from the plants, including the date or time of the year, the part of the plant, such as crown, seminal root, crown root, and the location in the soil, such as at 1 inch or 4 inches deep. In this way some idea of the sequence of fungi normally present in wheat plants is sought. There have been several studies of this type in different wheat regions of the world, but they have usually not been as systematic as this one. The main reason for this part of the work is that we believe that the dry land wheat region of Washington is a special region; studies of other areas might have little value here.

The emphasis of "little-known" fungi of the wheat roots is in the hope that new and different fungi may be found that will explain the cause of the dry land root rot, or premature blight of certain varieties that occurs in a wide region in central Washington. It is quite possible that some of the fungi ignored in the past really play a part in the root and crown-rot disease complexes.

The census has progressed well in this first year. Four-thousand cultures, mostly common fungi, have been studied. Among the 4000, however, Mr. Hoes, the research assistant actually performing these studies, has found one fungus that is definitely pathogenic to wheat and that as yet is unidentified. He plans to study this unknown pathogen this season.

STUDIES ON THE CONTROL OF CHEATGRASS IN WHEAT

T. J. Muzik and W. P. Anderson

Through a financial grant made available by the Washington Wheat Commission to the Department of Agronomy, Washington State University, an intensive research program was begun last summer aimed toward the selective control of cheatgrass (Bromus tectorum) in wheat. Extensive field experiments are located on the Dry Land Experiment Station at Lind and on the McGegor's Ranch at Hooper.

This program has resulted in promising leads for the use of several chemicals in selective controlling cheatgrass in wheat.

The five most promising chemicals from previous research were selected for testing and these were applied at each location on eight different dates and at several dosages. Of the chemicals tested, two continue to show considerable promise. These materials are Simazine and Atrazine. The time at which these materials are applied is extremely important. Applied too early they will eliminate the wheat crop; applied too late they will have no effect on the cheatgrass. In general, Simazine is more effective when applied in the late fall while Atrazine is most effective applied in early winter.

Before the use of these materials can be encouraged for the selective control of cheatgrass in wheat it is necessary to learn more about the requirements which determine the relatively safe period in which they may be used.

Tests are also underway with about twenty new chemicals to determine their value as selective herbicides for the control of cheatgrass in wheat. Of these twenty, four materials have shown sufficient promise to warrant further testing.

Correlated with the testing of chemicals for the selective control of cheatgrass in wheat is the use of these chemicals for the control of this weed in fallow lands.

This research program will be continued during the next crop year, financed by an additional grant from the Washington Wheat Commission. Major emphasis will be placed on developing the promising leads uncovered during the past year.

FORAGE INVESTIGATIONS

Grasses and legumes are studied for adaptation to the low rainfall areas. This work is conducted by the Agronomy Department, WSU, 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. Long time studies show that crested wheat grass will produce more forage in established stands than any other species of grass in the low rainfall area. Production averages less than 1000 pounds of forage per acre at Lind. Row spacings of 14" appears to be the most satisfactory for solid stands. A summary of 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 aws 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, Washington State University.

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 shrub. 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.