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WASHINGTON AGRICULTURAL EXPERIMENT STATIONS

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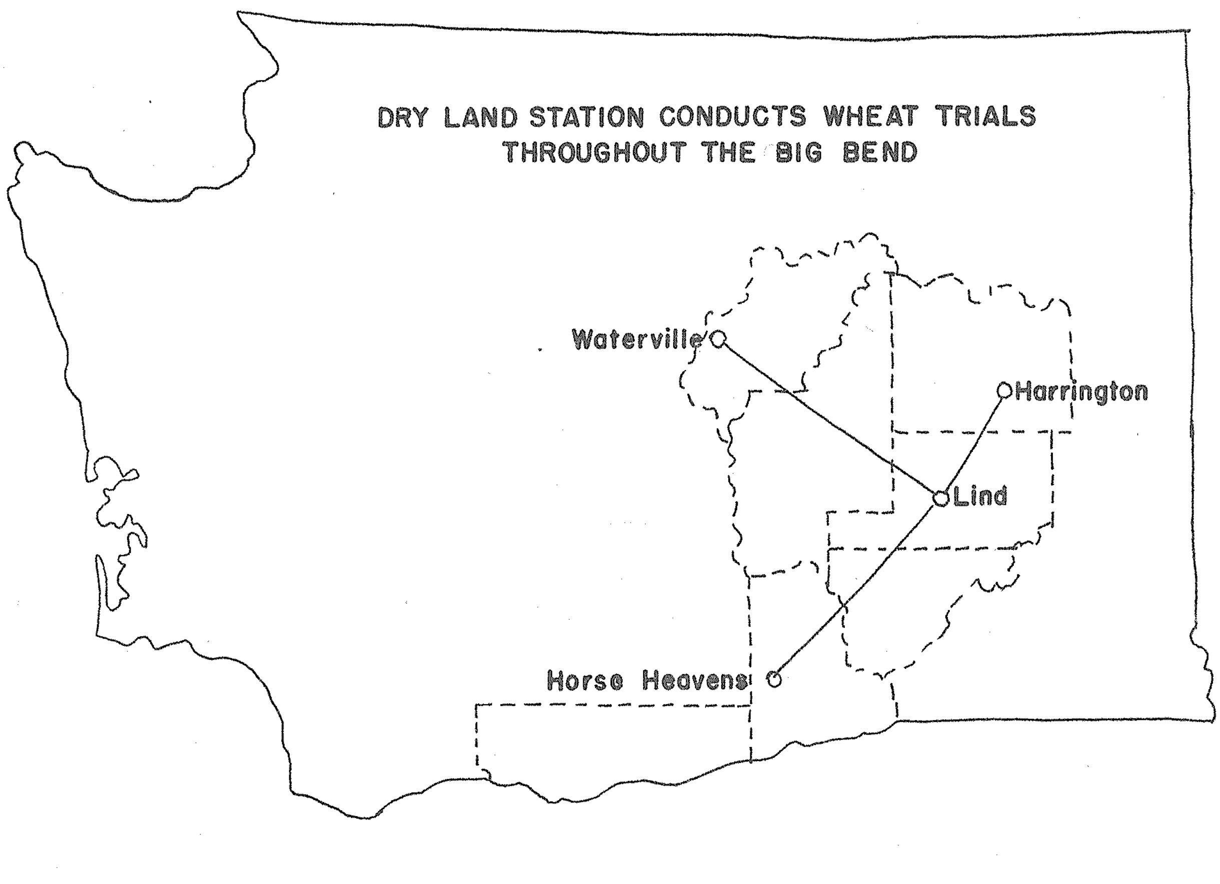

DRY LAND EXPERIMENT STATION
LIND, WASHINGTON

INTRODUCTION

The Dry Land Experiment Station, formerly the Adams Branch Experiment Station, first began 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 purchased 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 state supported, aside from a small labor fund contributed by federal agencies. The land is leased from Adams County. 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 approximately 4 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 divisions of the Washington Agricultural Experiment Stations 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 about June 15, to acquaint farmers, ranchers and townspeople of central Washington with the nature of the work being conducted and to furnish information collected from the many experiments in progress. The public is especially invited to attend these field days, although visitors are welcomed at all times.

Note: Data presented hereafter in this report are not for publication without consent of the Washington Agricultural Experiment Stations and cooperating agencies.

Walter L. Nelson

Walter L. Nelson, Superintendent

CLIMATIC INFORMATION

Table 1. Annual Rainfall Near Lind, Washington - 1897-1952.

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	1934-35	7.48
1898-99	8.76	1910-11	8.10	1917-18	6.64	1935-36	8.09
1899-00	12.00	1911-12	10.33	1918-19	8.10	1936-37	8.93
1900-01	15.34	1912-13	8.24	1919-20	6.56	1937-38	11.89
1901-02	12.33	1913-14	10.50	1920-21	7.01	1938-39	5.32
1902-03	13.67	1914-15	10.54	1921-22	6.99	1939-40	13.01
1903-04	15.03	1915-16	13.59	1922-23	10.92	1940-41	18.00
1904-05	11.34			1923-24	6.62	1941-42	12.29
1905-06	12.01			1924-25	8.32	1942-43	11.65
				1925-26	6.65	1943-44	8.60
				1926-27	12.65	1944-45	10.05
				1927-28	10.83	1945-46	11.80
				1928-29	5.77	1946-47	8.02
				1929-30	4.88	1947-48	23.07
				1930-31	6.91	1948-49	7.00
				1931-32	9.79	1949-50	9.89
				1932-33	8.39	1950-51	9.85
				1933-34	9.79		
Average	11.86		10.00				9.41

Average for 51 years: 9.93
Rainfall September 1, 1951 to June 1, 1952: 6.78

Approximately 55 per cent of the rainfall occurs during the winter months, 30 per cent in summer, and 15 per cent in the fall.

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 gage, sling psychrometer, and evaporation instruments. In addition, a continuous record of soil and air temperatures, relative humidity, and precipitation is taken by means of automatic recording instruments.

RESEARCH ON CEREAL CROPS

In 1950 the Dry Land Experiment Station enlarged the cereal breeding and 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 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 the breeding of new varieties.

Three new testing sites were set up in 1950 to adequately check cereal varietal response throughout the Big Bend. These sites are: the Nelson Bros. farm, Waterville; Leonard Schultz farm, Harrington; and the Horrigan Farms, Prosser. All experimental work at the outlying locations is conducted by the same methods as the work at the Station. The results from these trials and the trials at the Station will determine the value of any new selection for the Big Bend area. Farmers in the areas near these testing sites are urged to visit these plots on county tours or at any other time.

WINTER WHEAT

Twenty new hard red winter wheat selections are now under test at the four locations. These selections have all be screened for smut resistance and milling and baking quality. The selections are resistant to all common smut races and dwarf smut. More information is needed on milling and baking performance and yielding ability before these selections can be evaluated for possible use in the Big Bend. These selections will be used in the breeding program for further improvement.

Although no yield data were obtained in 1951 at Lind, notes were taken on winter hardiness and resistance to root rot diseases. Several of the hard red winter selections were satisfactory for winter hardiness, and some selections showed some resistance to root rot. Yield data from Moro, Oregon, which is similar to Lind in climate and soil type, indicated five of these selections yielded about 18 per cent more than the five highest yielding white wheat varieties, and were significantly better yielding than Rio.

Table 2. Yield and Test Weight of Winter Wheat Varieties Grown at the Dry Land Experiment Station.

Variety	No. Years Tested	Av. Yield Bu./Acre	Average Test Wt.
Elmar	4	29.6	58.1
Elgin	8	29.4	58.4
Hymar	8	29.1	58.5
Triplet	8	25.6	60.3
Kharkof (Turkey)	8	25.4	60.9
Rio	8	24.8	61.2
Requa	4	24.1	----*
Orfed	8	23.6**	61.7
Golden	8	22.2	57.8
Rex	8	21.2	59.3
Brevor	3	21.1**	----*
Wasatch	4	20.9	----*

* Test wt. data incomplete - all varieties satisfactory.

** Brevor and Orfed severely winter killed in 1951. Average yield decreased from previous reports.

As can be seen from Table 2, Elgin, Elmar, and Hymar have consistently out-yielded Rio and Turkey. However, these three varieties are not recommended for the Big Bend due to high protein level produced in this area. At high protein levels, they do not have satisfactory baking quality for either pastry or bread flours, Also, during the past 2 years, Elgin, Elmar, and Brevor have been more severely injured by winter kill and late spring freezes than Rio.

Only two winter wheat varieties are recommended for the Big Bend where rainfall is 12 inches or less. These are Rio and Wasatch. Wasatch is recommended only for Douglas County where dwarf bunt is severe. Turkey is satisfactory in areas where common or dwarf bunt is not present.

The other varieties listed in Table 2 have no particular advantage and in general are lower yielding than Rio. Orfed does not have enough winter-hardiness. Requa, Golden, and Rex have rather poor quality under Big Bend conditions. Triplet is satisfactory in quality and yield, but is susceptible to smut and is disagreeable to harvest due to fuzzy (pubescent) chaff.

SPRING WHEAT

The spring wheat program at the Dry Land Experiment Station has three main objects: 1) testing and introduction of available spring wheat selections from other areas, 2) improvement of superior spring wheat through crossing and back-crossing, and 3) incorporation of resistance to leaf and stem rust--including 15B stem rust--in the breeding of new spring wheat varieties adapted to the Big Bend.

Considerable progress has already been made in the last 2 years in this program. A new selection from South Dakota, H. R. P x Clar. 2202, was introduced. Although its yield performance is below Baart, this variety has proved a source of excellent milling and baking quality for improvement of Awned Onas and other poor milling, high-yielding spring wheat varieties. Awned Onas was crossed to H. R. P x Clar. 2202 in 1951, backcrossed to Awned Onas in the greenhouse in the winter of 1951-52, and ~~will~~ was be backcrossed again in 1952 to Awned Onas. It is hoped that the milling quality of Awned Onas can be improved and its yield characteristics retained by this program. H. R. P x Clar. 2202 has been used extensively in other spring wheat crosses.

In 1950, Henry, a variety from Wisconsin, was introduced by the Dry Land Experiment Station for testing in the Big Bend. Henry was developed by the Wisconsin Experiment Station and the USDA. It is the result of a double cross (Illinois No. 1 x Hope) x (Webster x Resaca). It is moderately resistant to stem rust (not resistant to 15B stem rust), and moderately susceptible to leaf rust, smut and root rots. It is a medium height, stiff-strawed, bearded hard red spring wheat, and matures about 2 to 3 days earlier than Baart. As shown in Table 3, Henry is equal to Baart in yield and is superior to other hard red spring wheat varieties.

In 1952, 30 acres of Henry were planted on the Iverson farm north of Waterville. This wheat will be trucked to Wenatchee for a large scale milling trial. The results of this trial and other small milling and baking trials will determine whether the variety will be released. If Henry is released, it will be for the purpose of reseeding into winter-killed fields of hard red winter wheat. At present, there is no satisfactory variety for this purpose. A decision on the release of Henry will be made by spring of 1953.

The Dry Land Experiment Station, in cooperation with the Agronomy Department at Pullman, is testing and breeding for resistance to 15B stem rust. To date, this disease is not a problem in the Big Bend. This resistance is being incorporated in new hybrids as a protection in case 15B rust becomes serious. The hybrids and selections developed at the Station and at Pullman are tested in the 15B rust nursery at Winnepeg, Canada, and during 1952 in a rust nursery in Mexico. Selections resistant to 15B at Winnepeg in 1951 will be tested in the Big Bend in 1953.

Table 3. Yield of Spring Wheat Varieties Grown at Four Locations in the Big Bend, 1951.

	Yield Bu./Acre				
Variety	Lind	Waterville	Harrington	Horse Heavens	Av. Yield 4 Locations
Marfed	23.9	29.8	33.9	27.1	28.7
Marfed x Merit (22)	22.5	30.4	29.8	23.2	26.5
Lemhi	22.0	29.6	29.5	22.9	26.0
Awned Onas	23.1	29.5	29.6	21.0	25.8
Federation	21.9	29.9	28.7	21.6	25.5
Idaed	17.7	29.5	30.8	22.8	25.2
Baart	21.8	29.5	27.0	20.2	24.6
Henry	19.7	25.8	29.4	22.5	24.4
Thatcher	16.7	25.4	27.2	19.5	22.2

Marfed was the highest yielding spring wheat in 1951 at the four locations. Marfed yields well in years when good June precipitation occurs. Its average yield over a period of years at Lind is below Baart. Awned Onas has been the most consistent high-yielding spring wheat at Lind. As shown by Table 3, Henry and Baart were about equal in yield at the four locations in 1951. At present, Baart is the only spring wheat recommended for the Big Bend.

FERTILIZER TRIALS

In cooperation with the Agronomy Department, Pullman, the Dry Land Experiment Station has conducted experiments with nitrogen fertilizer. These trials have shown a good yield response with application of nitrogen to summer fallow preceding seeding. In the Big Bend area where rainfall is less than 12 inches, the method of application is more important than the type of nitrogen fertilizer used. These data are given in Table 4.

Table 4. Yield of Rio Winter Wheat at Lind and Ritzville, 1951, Placement and Broadcast of Different Forms of Nitrogen.*

Source of Nitrogen[a]	Method of Application[b]	Wheat Yield		
		Lind	Ritzville	Average
		Bushels per Acre		
None	------	20.5	28.5	24.5
Anhydrous ammonia	Placed	28.2	34.1	31.2
Ammonium sulfate	Placed	25.3	36.8	31.1
Calcium nitrate	Placed	27.4	37.0	32.1
Ammonium sulfate	Broadcast	21.4	29.4	25.4
Calcium nitrate	Broadcast	25.0	32.2	28.6
Difference required for significance[c]		2.9	1.4	----

* From Stations Circular 179, The State College of Washington.

a Nitrogen was applied at the rate of 20 pounds per acre.

b Anhydrous ammonia was injected to a depth of 6 inches with shanks spaced at 14 inches. Ammonium sulfate and calcium nitrate were placed in bands 6 inches deep and 12 inches apart.

c A measure of the error involved in determining plot yields.

These data show that placing fertilizer increased the yield an average of 4.5 bushels per acre over the comparable broadcast treatments. The wheat plant utilizes the added nitrogen more efficiently when placed below the straw layer. The soil microorganisms are not able to utilize the applied nitrogen as readily when placed below the straw compared with the broadcast method which allows the nitrogen to penetrate through the straw layer.

Recommendations for the use of nitrogen fertilizers in the Big Bend are given in Stations Circular No. 179, available through your County Agent's Office.

ANNUAL CROPPING

Research on annual cropping was revised in 1952. The Dry Land Experiment Station and Agronomy Department, Pullman, set up five locations for annual cropping experiments. The locations are on farms throughout eastern Washington with a range in rainfall at the locations from 9.5 to 15 inches annually. Cooperating farms are: Lawrence Brown, Central Ferry; C. W. Eckhart, Packard; Leonard Schultz, Harrington; and Ed Steckle, Lacrosse. The fifth location is on the Dry Land Station. The location at Lacrosse is conducted in cooperation with the Soil Erosion Farm at Pullman and includes the study of crop rotation, green manure crops, and nitrogen fertilizers in annual cropping.

At all locations conventional equipment is used for tillage and harvesting. Three rates of fertilizer will be used on both summer fallow and annual cropping plots. These experiments will be conducted for 5 years of more at each location. The data should indicate the areas where annual cropping is an economically stable farming practice and what changes in farming practices are necessary for successful annual cropping.

FORAGE INVESTIGATIONS

Forage Adaptation Tests

Grasses and legumes for soil and moisture conservation are being tested at the Dry Land Experiment Station in cooperation with the Soil Conservation Service, Nursery Division.

The initial testing is done at Pullman; Lind is one of a system of outlying nurseries under different soil and climatic conditions to carry on secondary testing.

The following data supplement material presented at previous field days.

Fall 1943, Dry Land Grass Plots. Eighteen grasses were selected on the basis of past performance at Lind and seeded in the fall of 1943. The purpose of this planting was to compare conservation uses and hay yields for the 10- to 14-inch rainfall area. In dry land rotations grass roots add organic matter to the soil. This aids in maintaining fertility and improves the physical condition. The soil is more resistant to wind and water erosion when it is well supplied with fibrous grass roots and active organic matter. Hay yields, along with root production, longevity, drought resistance, ground cover and availability of seed, should be considered in selecting grasses for conservation seeding. The following grasses have been outstanding under dry land conditions at Lind:

Dry land bunchgrasses:	Crested wheatgrass
	Whitmar beardless wheatgrass
Sod-forming grasses:	Pubescent wheatgrass
Dry land bluegrasses:	Sherman big bluegrass
Fine-leaved fescues:	Sheep fescue P-274

From results obtained on this Station and other dry land areas, the following grasses can be recommended in the wheat-fallow area from 8 to 14 inches annual rainfall:

Range and Pasture

1. Crested wheatgrass - 6 lbs; and Bulbous bluegrass - 2 lbs.
2. Whitmar beardless wheatgrass - 8 lbs; and Bulbous bluegrass - 2 lbs.

Hay

1. Sherman big bluegrass - 4 lbs;and Ladak alfalfa - 2 lbs., seeded in alternate rows.
2. Sherman big bluegrass - 4 lbs.

Methods of Planting Grasses

Among the several methods of planting grasses, the most satisfactory stands have been obtained by using a drill in a clean summer fallow. The drill can be adjusted to seed any desired rate and depth. If the stubble land is clean, grass can be successfully established by seeding the stubble in early fall. Since the grass grows very slowly during the seedling stage, the seedbed should be free from weeds.

The rate of seeding grass most suitable for pasture purposes is 5 to 8 pounds per acre. This will establish a stand uniform enough to prevent invasion of weeds. The depth should not be over 1 inch. Preferably it should be from 1/4 to 1/2 inch deep. Proper depth can be secured by using depth regulators on the furrow openers or having the hose fastened outside of the furrow openers. A drag chain may be used with the latter to cover the seed with about 1/4 inch of soil.

The best time to seed grass is in the fall. If moisture conditions are suitable, grass can be sown from as early as September 1 to as late as January 1, but the ideal time is from October 1 to 15. Spring seeding is not recommended unless it is done early enough for the grass to become well established before the onset of hot weather.

Depending on the use to which the grass is to be put, row spacing may vary from 7 inches to 3 feet. The wider the row spacing, the greater the forage and seed yield. Beyond the 2-foot row spacing, additional care is required to control the weeds that may invade the stand between the rows. The 14-inch row spacing seems to be the most satisfactory. Much wider spacings than this make the grass coarse and less desirable for pasture purposes, and--if the grass is cultivated for seed--seem to promote erosion.

Uniform stands of grass can be established by seeding a cereal nurse crop in alternate rows with grass. The grain yield of the nurse crops is approximately 80 per cent of normal, while at the same time satisfactory grass stands are established. The nurse crop can be cut for hay or left to mature for grain. The nurse crop utilizes the soil moisture which would otherwise be used up by the weeds, thereby providing a satisfactory weed control measure. The ordinary double run grain drill can be adjusted to seed the two crops in alternate rows by having removable partitions placed in the grain box. The rate of seeding for both the crops can be made at the same setting but for any desired variation. Reducers made of heavy wire can be used very effectively. Recommended rate of grass and nurse crop seeding is 8 pounds and 40 pounds, respectively. If rye is used as a nurse crop, the rate should be cut to 20 pounds per acre. Spring tension should be lessened on the furrow openers of the drill sowing grass so that the seed will not be buried too deeply in the soil.

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 windbreak purposes. Some trees on the Station are 27 years old, while others are 19 years old. Trees are a valuable asset to any farm, both in improving rural living conditions and in increasing the value of the property.

Initial obervational tests of woody 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 at 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, The State College of Washington.

A standard dry land windbreak planting consists of a minimum of five rows which, when properly established, gives excellent protection from the wind.

Table 5. 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*
1	Caragana	Erect shrub	3 ft.	18 ft.
2	Tamarix	Intermediate shrub	6 ft.	18 ft.
3&4	Black locust	Deciduous tree	12 ft.	18 ft.
5	Ponderosa pine	Evergreen tree	12 ft.	27 ft.

*Rows may be spaced wider apart if cultivation equipment requires it.

Results to date indicate that bladdersenna and southernwood are equal to caragana in the erect shrub group, except that neither is quite as winter hardy. Since Russian olive contains an unidentified disease, tamarix appears to be the most promising intermediate shrub. American plum may replace the tamarix, but further testing is needed on this shrub. Black locust is still the most promising deciduous tree. Other deciduous trees being tested include green ash and Oregon white oak. Rocky Mountain juniper appears promising as a replacements for Ponderosa pine in the evergreen group. Both Douglas fir and Blue spruce also appear to be well adapted.

Farmers contemplating a shelterbelt planting should realize that considerable work is involved. To survive under dry land conditions, trees require continuous clean cultivation. Row spacing between trees should be arranged so available machinery can be used. Trees and shrubs should be transplanted as soon as you get them. Pine and juniper require special care when transplanting. These trees should be unwrapped in water. The roots must not be exposed to sun and air for more than 30 seconds during transplanting. Instructions included with the shipment should be followed. If these suggestions are followed, good survival should be obtained and the work required to maintain a shelterbelt will be at a minimum.