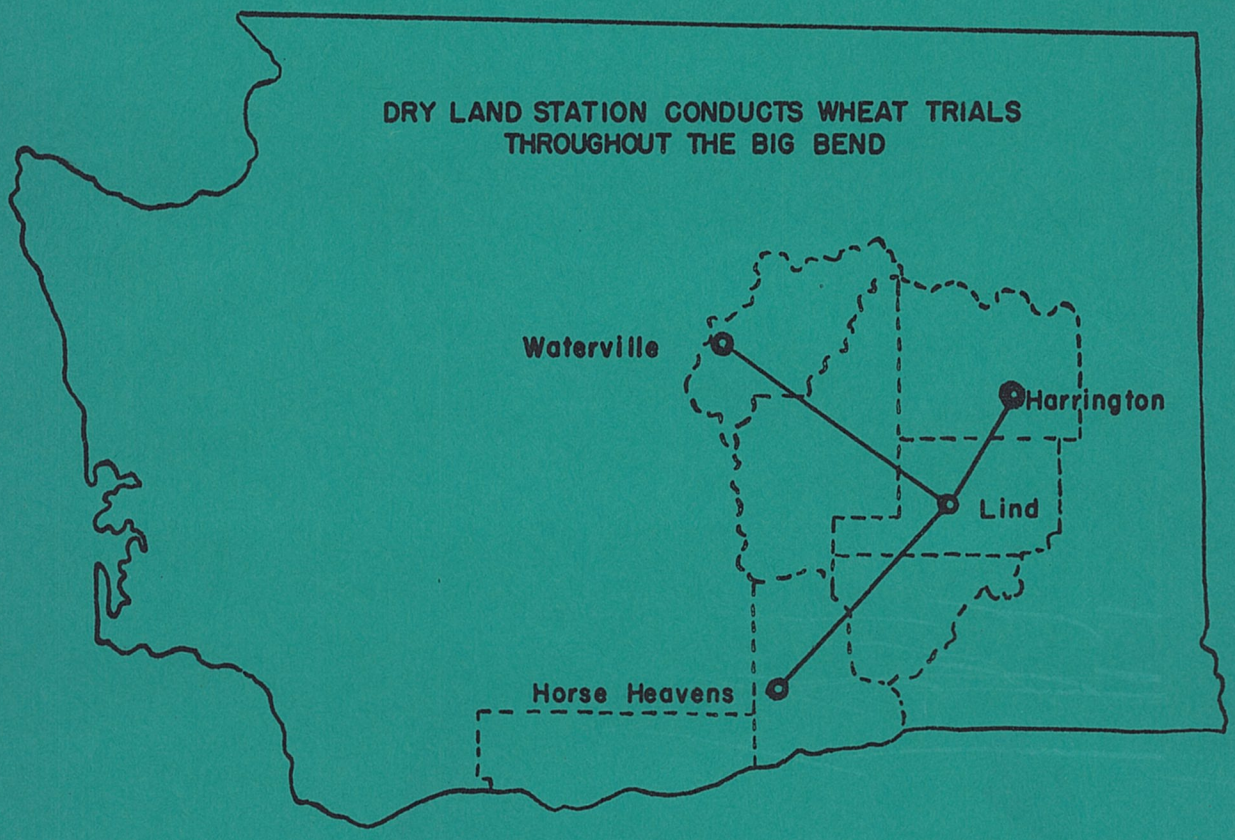
STATE COLLEGE OF WASHINGTON
INSTITUTE OF AGRICULTURAL SCIENCES
WASHINGTON AGRICULTURAL EXPERIMENT STATIONS

37TH ANNUAL FIELD DAY

JUNE 24, 1953



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NOTE: Data presented hereafter in this report are not for publication without consent of the Washington Agricultural Experiment Stations and cooperating agencies.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

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 gauge, 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.

Table 1. Annual Rainfall near Lind, Washington - 1897-1953.

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	1917-17	7.60	1935-36	8.09
1898-99	8.76	1910-11	8.10	1917-18	6.64	1936-37	8.93
1899-00	12.00	1911-12	10.33	1918-19	8.10	1937-38	11.89
1900-01	15.34	1912-13	8.24	1919-20	6.56	1938-39	5.32
1901-02	12.33	1913-14	10.50	1920-21	7.01	1939-40	13.01
1902-03	13.67	1914-15	10.54	1921-22	6.97	1940-41	18.00
1903-04	15.03	1915-16	13.59	1922-23	10.90	1941-42	12.29
1904-05	11.34			1923-24	6.62	1942-43	11.65
1905-06	12.01			1924-25	8.32	1943-44	8.60
				1925-26	6.65	1944-45	10.05
				1926-27	12.65	1945-46	11.82
				1927-28	10.83	1946-47	8.02
				1928-29	5.77	1947-48	22.71
				1929-30	4.80	1948-49	7.00
				1930-31	6.91	1949-50	9.89
				1931-32	9.78	1950-51	9.85
				1932-33	8.39	1951-52	8.11
				1933-34	9.79		
				1934-35	7.48		
Average	11.86		10.00				9.36

Average for 52 years: 9.88
Rainfall September 1, 1952 to June 1, 1953: 6.86

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 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: 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.

In addition to the locations mentioned above, small variety trials will be established in each county throughout the Big Bend. These trials will test standard varieties and new selections which may be released in the near future.

Winter Wheat

Table 2 tabulates the yields of standard varieties of white winter and hard red winter grown at Lind. The white winter wheat varieties are consistently higher yielding than either Rio and Turkey. Although Elmar, Elgin, Hymar, and Brevor are higher yielding, these varieties have not been recommended because of poor quality. When grown under dry conditions of the Big Bend, these varieties tend to produce high protein wheat. At protein above 8 per cent the flour does not make good pastry and is unsuitable for bread flour. The production of good quality wheat will become increasingly important as surpluses become larger and allotments are imposed. With the exception of Hymar, all of the white winter wheat varieties are less winter hardy than Rio.

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

Variety	No. Years Grown	Yield 1952	Av. Bu/A.	Test Wt. Av.	Plant Ht. Av.	Rank
Kharkof (Turkey)	8	23.0	24.7	60.7	*28	5
Rio	8	24.1	24.4	61.1	*28	6
Golden	8	21.0	21.6	57.6	*28	7
Elgin	8	26.7	28.2	58.6	*25	2
Elmar	4	25.3	30.3	58.3	24	1
Hymar	8	24.3	28.2	58.8	*30	2
Rex	8	19.7	21.2	59.5	*27	8
Brevor	4	24.4	26.4	60.0	23	3
Triplet	8	23.6	25.2	60.3	*29	4

*7-year average for plant ht. (No data 1944.)

The program of testing and breeding new hard red winter wheat varieties started at the Dry Land Experiment Station in 1950 is beginning to show results. From the screening program initiated in 1950, nine hard red winter selections look very promising. Eight of these selections were developed at Moro, Oregon, and one at Montana State College. These selections had an increase of 4 to 13 per cent in yield above Rio at the three testing locations, as shown in Table 3. Milling and baking characteristics appear to be equal, and in some selections superior, to Rio. All of these selections are resistant to the known races of smut. If these selections continue to look favorable in tests in 1954, one or more will be released for seed production in 1956.

The winter wheat breeding program at the Station includes many of the new selections reported in Table 3. These selections are being crossed to higher yielding new white winter wheat selections. It is hoped that the yields of these new selections can be increased. Selection from these crosses will be towards a quality which can be used at any protein level.

Table 3. Comparative Yields of Nine New Hard Red Winter Wheat Selections and Standard White Hard Red Winter Wheat Varieties Grown at Harrington, Waterville, and Lind in 1952.

Variety	C I No.	Water-ville	Harring-ton	Lind	Av. Yield	% of Rio
*Rio-Rex x Cheyenne	12925	34.5	35.5	21.9	30.6	104
*Rio-Rex x Cheyenne	12927	30.5	31.5	21.8	27.9	95
*Rio-Rex x Nebred	12928	36.4	38.1	20.7	31.7	107
*Rio-Rex x Nebred	12929	39.2	34.5	21.4	31.7	107
*Rio-Rex x Nebred	12930	37.2	39.2	23.7	33.4	113
*Blackhull x Rio-Rex	12931	35.5	34.2	22.3	30.7	104
*Blackhull-Rex x Rio-Rex	12932	38.2	36.7	24.5	33.1	112
*Blackhull-Rex x Cheyenne	12933	34.7	31.7	25.4	30.6	104
Rio	10061	30.7	35.0	22.8	29.5	100
Kharkof (Turkey)	1442	30.7	35.4	23.1	29.7	101
Elgin	11755	36.6	40.3	26.7	34.5	117
Elmar	12392	32.1	40.1	25.3	32.5	110
Brevor	12385	35.2	38.1	24.4	32.6	111
Hymar	11605	36.1	39.1	24.3	33.2	113
Comanche	11673	31.1	29.2	17.8	26.0	88
Wasatch	11925	28.2	30.9	23.3	27.5	93
*Turkey x Oro 221	12705	33.4	35.4	23.4	30.7	104

*New smut-resistant hard red winter wheat selections.

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 dwarf bunt is not present.

Spring Wheat

The spring wheat program at the Dry Land Experiment Station has three main objects: (a) testing and introduction of available spring wheat selections from other areas, (b) improvement of superior spring wheat through crossing and backcrossing, and (c) 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 backcrossed again in 1952 to Awned Onas. Some of these crosses made in 1952 were increased in Brawley, California, in the winter of 1952 and are being grown for milling trials this year. It is hoped that the milling quality of Awned Onas can be improved and its yield characteristics retained by this program.

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 the same time as Baart. Henry has yielded about 94 per cent of Baart in the Big Bend. For comparison, Thatcher has yielded about 89 per cent of Baart. This variety was released for reseeding into hard red winter in 1953 in the Big Bend area. Stations Circular No. 211, available through your County Agent, describes this variety and where it should be used.

In Table 4 are shown the yields, test weights, and heights of ten spring wheat varieties grown at the Dry Land Experiment Station. Of those varieties tested for 7 years or more, Baart is one of the highest yielding. Only Awned Onas and Lemhi are superior, and these varieties are not recommended because of poor quality. In certain years, Marfed and Idaed have been superior to Baart, but over the long-time average they have not proved to be any higher yielding than Baart. At the present time Baart and Henry are the only two spring wheat varieties recommended for areas where rainfall is 12 inches or less.

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 in a rust nursery in Mexico. Selections resistant to 15B at Winnepeg in 1951 will be tested in the Big Bend in 1953.

Table 4. Yield, Test Weight and Height of Spring Wheat Varieties Grown at Dry Land Experiment Station.

Variety	Years Tested	Yield 1952	Av. Bu/A.	Av. Test Wt.	Av. Plant Ht.	Rank
Idaed	8	22.2	24.8	59.0	25	5
Awned Onas	8	22.9	26.6	58.1	25	1
Marfed	7	23.2	24.4	58.3	25	7
Federation	8	22.2	24.7	57.6	24	6
Baart	8	24.8	25.2	60.2	28	4
Henry	2	20.0	21.4	58.3	27	8
Thatcher	4	19.6	20.0	58.0	26	9
Lemhi	8	26.0	26.4	56.9	26	2
Marfed x Merit 22	2	22.9	25.6	58.7	29	3
Idaed x Merit -2	2	23.5	24.7	58.2	28	6

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 yearly 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 5.

Table 5. 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 No. 179, 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 micro-organisms 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 Stations Circular No. 179, available through your County Agent's office.

The Dry Land Experiment Station is testing different methods of application of nitrogen fertilizer and the use of sulfur and phosphate fertilizers. To date there has been no significant response to sulfur and phosphate fertilizers. There are indications in these trials that these two elements might be needed in the future. Continued testing of these two elements will determine when they can be used profitably in the fertilizer program.

There are some objections to the application of anhydrous ammonia in the fall of the year preceding seeding of fall wheat on summer fallow. The applicator disturbs the soil and increases soil moisture loss. The combined application of anhydrous ammonia and spring plowing or rod weeding operation is a method of overcoming this difficulty and decreasing the cost of application. There is no loss of nitrogen during the summer months from early applications.

Farmers are urged to check the response to fertilizer applications. Whether the rate of nitrogen added has been determined by a soil test or not, the only method of determining the return to the farmer is through yield checks of fertilized and unfertilized wheat. Stations Circular No. 179 describes two methods by which a farmer can very easily check the yield response to fertilizer on his own fields. A good rule of thumb for determining efficiency of nitrogen utilization is 1 bushel for 3 pounds of available nitrogen added. If 4 or 5 pounds of nitrogen are added for each bushel of increase in yield, then the rate can be cut down. If an increase of 1 bushel of wheat for every 2 or 3 pounds of nitrogen added is obtained, then the rate of application can profitably be increased.

ANNUAL CROPPING

Research on annual cropping was revised in 1952. The Dry Land Experiment Station and Agronomy Department, Pullman, set up four locations for annual cropping experiments. The locations are on farms scattered throughout eastern Washington at locations with a range in rainfall from 9.5 to 15 inches annually. Cooperating farms are: C. W. Eckhart, Packard; Leonard Schultz, Harrington; and Ed Steckle, Lacrosse. The fourth 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 are used on both summer fallow and annual cropping plots. The soil is sampled in the fall to determine amount of available nitrogen and sampled again in the spring for moisture. In 1952, the preliminary year, yields of wheat under annual cropping were 7, 11, and 34 bushels per acre at Lind, Packard, and Harrington, respectively. There were no summer fallow checks in 1952, and only Harrington had a non-fertilized plot. Increase from 60 pounds of nitrogen at Harrington was 17 bushels per acre.

These experiments will be conducted for 5 years at each location. The data should indicate whether annual cropping is feasible in areas of less than 13 inches of rainfall and they should give additional information on farming practices necessary for 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 performace 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 at this Station and in 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 pounds; and Bulbous bluegrass - 2 pounds.
2. Whitmar beardless wheatgrass - 8 pounds; and Bulbous bluegrass - 2 pounds.

Hay

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

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 14. 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 which 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 tensions 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 twenty-eight years old, while others are twenty 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 observational 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 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 wind.

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, Bitter Cherry, and Bush Cherry may replace the tamarix, but further testing is needed on these shrubs. Black locust is still the most promising deciduous tree. Other deciduous trees being tested include Green ash and Chinese elm. Austrian pine, Scotch pine, and Norway spruce appear promising as replacements for Ponderosa pine in the evergreen group. Both Douglas fir and Blue spruce also appear to be well adapted.

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 Southernwood	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	Austrian pine Scotch pine Ponderosa pine Norway spruce	Evergreen tree	12 ft.	27 ft.

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

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.