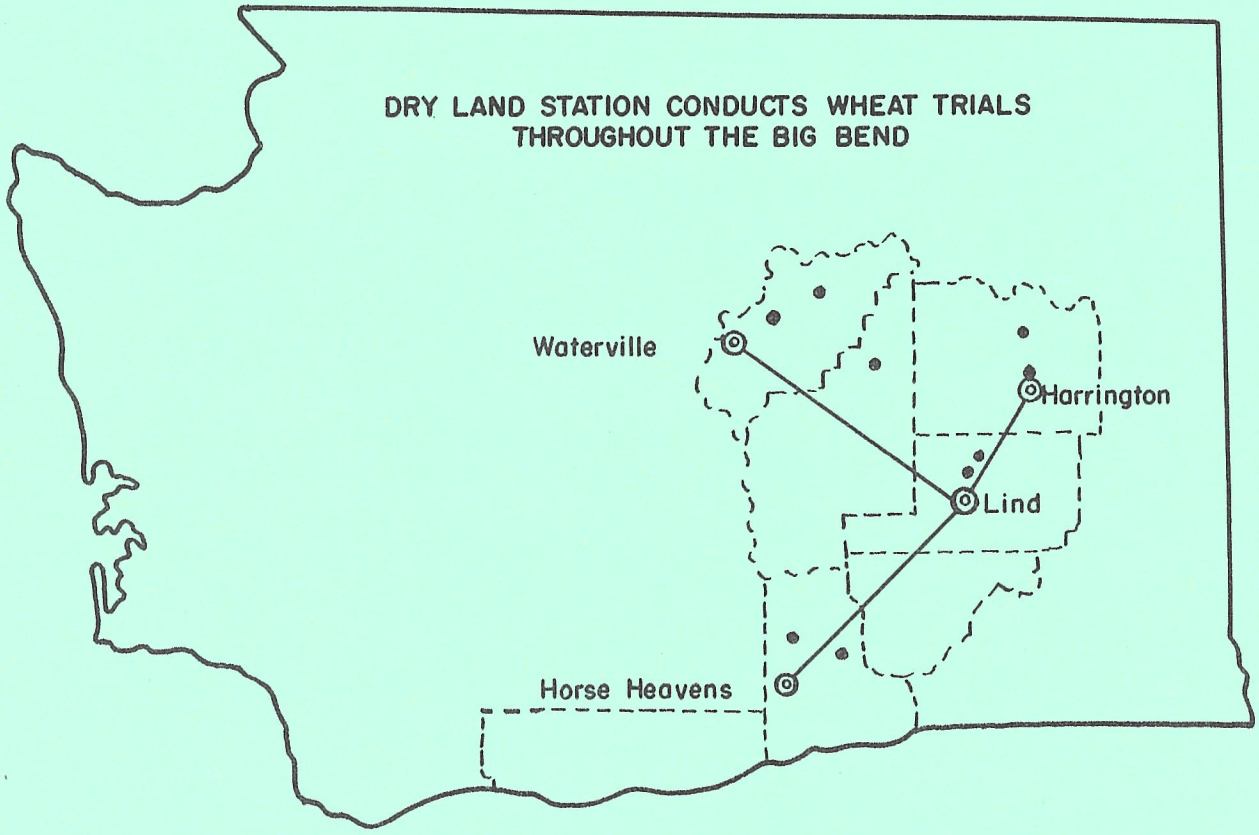
42nd ANNUAL

FIELD DAY

DRY LAND EXPERIMENT STATION



LIND, WASHINGTON
JUNE 26, 1958

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	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	10.65
				1926-27	12.65	1945-56	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	1952-53	7.71
				1934-35	7.48	1953-54	7.98
						1954-55	7.40
						1955-56	11.50
						1956-57	7.73
Average	11.87		10.01				9.27

Average for 57 years: 9.77

Rainfall September 1, 1957 to June 1, 1958 9.03

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 shows 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% 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 new testing sites were set up in 1950 to adequately check cereal varietal response throughout the Big Bend. These sites are: 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.

In addition to the locations mentioned above, small variety trials are conducted on the following farms: Ed Tyacke in Benton County; Phil Wainscott and Smith Brothers in Douglas County; Oscar McCoy in Grant County; and L. H. Bowman, Davenport. From ten to fifteen varieties each of winter and spring wheat are grown at most of these locations. Varieties included in these small trials are standard varieties and new selections being considered for possible release. Farmers in these areas are urged to visit the plots on county tours or at any other time. The results of these small trials and larger testing areas with the trials at the Station will determine the value of any new selection for the Big Bend area.

WINTER WHEAT

Table 2 tabulates the yields of standard varieties of white winter and hard red winter grown at Lind. The white club winter-wheat varieties are consistently higher yielding than either Rio or Turkey. Although Elmar, Elgin, and Omar 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 9 per cent, the flour does not make good pastry and is unsuitable for bread flour. With the exception of Hymar, all of the white winter wheat varieties are less winter hardy than Rio. Omar has been slightly higher yielding than Elmar for the two years tested.

Table 2. Yield in Bushels and Percentage of Rio, Plant Height, and Test Weight of Winter Wheat Varieties Grown at the Dryland Experiment Station in the Uniform Regional Nursery.

Variety	No. Years Grown	Yield 1957	Av. Bu/A	Av. Test Wt.	Av. Plant Ht.	% Rio
Burt	4	32.5	32.4	62.3	26	133
Elmar	6	32.6	29.1	59.4	23	123
Elgin	6	34.2	28.7	59.8	23	122
Itana	4	30.5	28.2	61.7	27	116
Brevor	5	32.3	26.3	60.8	25	114
Kharkof	6	28.6	24.3	61.4	28	103
Columbia	4	27.5	24.3	61.9	26	100
Rio	6	28.4	23.5	61.7	28	100

Table 3 compares the yield of three new bread type winter wheat selections with standard white and red winter wheat varieties. The variety Columbia was released to growers in 1955. Columbia was developed by the Sherman Branch Experiment Station, Moro, Oregon. Columbia is a selection from the cross Rio-Rex x Nebred. Columbia is about five days earlier than Rio, smut resistant, stiff strawed and shatter resistant. Columbia is equal to Rio in winter hardiness, milling and baking quality. The variety is bearded, red chaffed and easily distinguished from other hard red varieties. In tests all over the Big Bend Area during the past 5 years, Columbia has been equal in yield and generally superior to Rio. In all tests Columbia has exceeded Rio yield by 5 per cent. Columbia is recommended for rainfall areas of 10 inches or less.

Table 3. Average Yield of Winter Wheat Varieties Grown at Lind, Harrington, Waterville, and Horse Heaven for Number of Years and Trials Indicated, Dryland Experiment Station, Lind, Washington.

Variety	Harrington 6 years 6 trials	Horse Heaven 3 years 5 trials	Waterville 3 years 4 trials	Lind 4 years 7 trials	% Rio All Locations 16 trials
Burt	50.7	24.5	40.5	31.9	122
Elmar	46.3	25.1	40.1	30.4	116
Itana	44.2	24.7	40.1	28.6	112
Brevor	42.9	25.1	39.9	29.2	111
Columbia	42.1	22.8	39.2	24.8	105
Rio	40.7	22.0	34.7	24.6	100

The variety Burt was released to growers in 1956. Burt was formerly identified as 27 - 15 x Rio-Rex Selection 41. Burt is superior in yield to all varieties tested, averaging 22 per cent more than Rio in the Big Bend area during the past 5 years. Selection 41 is smut resistant, stiff strawed, bearded, white chaffed, and 2 to 3 days earlier than Rio. It is somewhat susceptible to shattering, only slightly superior to Elmar in winter-hardiness, and less winter hardy than Columbia. It is a hard white wheat with bread quality. Burt is recommended for the 9 to 14 inch rainfall area.

Itana is a selection developed with Columbia. It is a cross of Blackhull-Rex x Cheyenne. This variety was released jointly by Idaho and Montana in 1956. It is the highest yielding hard red winter variety tested in the Big Bend area. Itana is superior in quality to Rio and Columbia. Straw characteristics are intermediate between Rio and Columbia. It is shatter resistant, and resistant to most of the smut races. Itana is more resistant to blasting than Rio or Columbia. It does not break over at the base like Columbia. It is three days earlier than Rio. Itana will be recommended for areas of 10 inches or less of rainfall.

The winter-wheat breeding program at the Station is pointed toward increasing the yield, maintaining and improving smut resistance, and improving the winter hardiness and quality of hard red winter-wheat varieties. 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.

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

SPRING WHEAT

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

(1) Testing and introduction of available spring wheat varieties and breeding material from other areas,

(2) Improvement of superior spring wheat varieties by various breeding methods,

(3) Incorporation of resistance to leaf and stem rust, including 15 B stem rust, in varieties adapted to the Big Bend area, and

(4) Improving the quality and protein content of spring wheat adapted for this area.

Awned Onas had been crossed with good milling types of spring wheat. Selections from this cross have been milled and are now in yield trials. Thousands of additional selections with Awned Onas, Baart, and other good yielding varieties in their pedigree are being tested for quality and will be included in future yield trials. 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 quality, and varieties with good agronomic characteristics.

Table 4 shows the yields, test weights, and heights of eight spring wheat varieties grown at the Dry Land Experiment Station. Of those varieties tested for 7 years, Marfed, Awned Onas, and Lemhi have been the highest yielding. These varieties have not been recommended for this area because of poor quality when grown under low rainfall.

Baart is the recommended variety. Baart produces more straw and is more drought resistant. Baart yield has been satisfactory over a long time average not reported here. For spring-wheat recommendations for your area, contact your County Agent.

Table 4. Yield, Test Weight, Height and Percentage of Baart of Spring Wheat Varieties Grown at the Dryland Experiment Station.

Variety	No. years grown	Yield, 1957	Av. Bu/A.	Av. Test Wt.	Av. Plant Ht.	% of Baart yield
Marfed	7	31.2	24.5	59.5	23	113
Lemhi	7	28.2	24.1	58.5	25	111
Awned Onas	7	31.2	24.1	59.7	24	111
Federation	7	32.2	23.7	59.3	23	110
Baart	7	25.4	21.6	60.0	26	100
Idaed	7	25.8	21.4	59.8	23	99
Henry	6	22.7	19.1	59.5	24	91
Thatcher	7	24.6	18.9	59.3	24	87

In Table 5 are shown the yields of eight spring wheat varieties grown at Waterville, Harrington, Horse Heaven, and Lind for 4 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 15B stem rust in spring wheat. To date, this disease is not a problem in the Big Bend. This resistance is being incorporated in new hybrids as protection in case 15B rust becomes serious. The first of these resistant selections were in the yield-testing stage in 1955. The hybrids are tested for 15B rust in a cooperative program with the University of Manitoba, Winnepeg, Canada, and in rust nurseries in Mexico.

Table 5. 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 7 years	Horse Heavens 4 years	Waterville 5 years	Lind 5 years	% Baart Yield, All Locations
Marfed	34.8	25.2	30.9	24.7	112
Awned Onas	34.9	23.9	31.3	23.7	111
Lemhi	33.5	23.4	32.3	23.2	109
Federation	32.5	23.1	29.5	23.1	105
Idaed	34.8	23.3	27.7	20.5	104
Baart	31.3	22.8	28.0	21.2	100
Henry	32.9	22.1	26.1	19.3	98
Thatcher	30.7	20.2	22.8	18.8	91

Fertilizer Trials

In cooperation with the Agronomy Department, Pullman, the Dry Land Experiment Station has conducted experiments with nitrogen fertilizer for seven years. Previously reported work (Stations Circular 179) has shown that the type of nitrogen fertilizer was less important than the method of application. The data showed that placing the fertilizer was more effective than broadcasting. The wheat utilizes the added nitrogen more efficiently when it is placed below the straw layer. For recommendations on nitrogen fertilizer, farmers are referred to their County Agents, who are kept up to date on recommendations for particular rainfall areas.

In Table 6, 7-year average data are given on different rates of anhydrous ammonia fertilizer applications on summer fallow and seeded to Rio winter wheat. Fertilizer applications were made in the fall preceding seeding. Cost figures and net profit figures are approximations on average for a 7-year period. In 2 of the 7 years, fertilizer response was not significant. Protein content of the wheat was increased at 40- and 80-pound treatments, which would increase the net return slightly above figures given. The most return was from 40-pound applications. There was a net loss at the 80-pound application, although the yield was increased over the check.

Recommendations for the 9- to 11-inch rainfall area, based on these 7 years' data and other trials, are 25 to 40 pounds of nitrogen per acre on summer fallow. All types of nitrogen fertilizer have been equal in yield response when placed at a depth of 6 inches. Broadcast application is not recommended in the 9- to 10-inch rainfall area.

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 unfertilized 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 and phosphate 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 five years. The data from these trials will be published soon. 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.

Table 6. Summary of 7 years' Data of Different Rates of NH_3 Fertilizer on Winter Wheat, Variety Rio, Dry Land Experiment Station-Lind, Washington

Treatment lbs N/A	1950-56 7-yr. Av. Yield	Lbs. N per bu. inc.	Av. bu. per acre inc.	Net per acre profit[b] cost-ret. from Fertilizer
0	19.2	0.0	0.0	0.00
20	23.4	4.8	4.2	5.40
40	25.3	6.6	6.1	6.20
80	24.3[a]	15.7	5.1	-1.80

[a]Five year average.

[b]Cost of N at 15¢ a pound applied. Wheat value at $2.00 per bushel.

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.

From results obtained at this Station and in other dry-land areas, the following grasses can be recommended in the wheat-fallow area of 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.

*Bulbous bluegrass is not recommended where rainfall is less than 11 inches.

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 seeding stage, the seed bed should be free of weeds.

The rate of seeding grass for pasture is 5 to 8 pounds per acre. The depth should be set for 1/2 to 1 inch. Proper depth can be secured by using depth regulators on the furrow openers or by having the hose fastened outside of the furrow openers. A drag chain or press wheel may be used with the latter to cover the seed with about 1/2 inch of soil.

The best time to seed grass in the 8 to 12 inch rainfall area is in the fall. Depending on the moisture conditions, grass can be sown from September 15 through January. The moisture conditions are usually best during late October and November. Spring seeding is not recommended.

Grass seeded for forage can be seeded in row spacings of 7 to 14 inches. Seed production is more successful in rows 28 to 36 inches apart. Seed production fields must be cultivated for good yields and weed control.

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 70 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 that 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 crops can be made at the same setting. Reducers of heavy wire can be used effectively to adjust seeding rate of either grass or wheat. The recommended rates of grass and nurse crop seeding are 8 and 30 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 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 7. 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 Scotch pine Ponderosa pine Norway spruce	Evergreen	12 ft.	27 ft.

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