Rapid Increase Of Barley, Spring Wheat

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The Agricultural Experiment Station, North Dakota State University, now can increase one bushel of an experimental barley (potential variety) within the United States to 150,000 bushels (150,000 times) in one year or 7,500,000 times in 15 months in four crops (see example below). A few years ago this would have required three or more cropping seasons in North Dakota. In more recent years it has been accomplished in two cropping seasons by using an Arizona increase during the winter months.

Increase Cycle of Experimental Barley

August to November in California —
1 bushel* increased to 50 bushels

November to late April in Arizona —
50 bushels increased to ~~5,000~~ 3000 bushels

May to August in North Dakota —
~~5,000~~ 3000 bushels increased to 150,000 bushels

*If one assumes the 1 bushel was produced from 1 pound of barley increase to 50 pounds in North Dakota, May to August, the increase in 15 months is 1 pound to 150,000 bushels or approximately 7,500,000 times.

North Dakota State University has made considerable use of southern increases to hasten the release of new and needed grain varieties to North Dakota farmers. Early abundance of a new variety has been accelerated even more by making pre-release increases both in the south and in the state.

When Waldron hard red spring wheat was released on January 2, 1969, approximately 70,000 bushels of uncleaned Waldron seed were in the bin. This was the result of a pre-release southern increase of the hard red spring wheat line known as ND 363-1. Several years of agronomic and quality data supported the decision to make this increase although risk of discard of ND 363-1 was possible. The decision to make a pre-release in-

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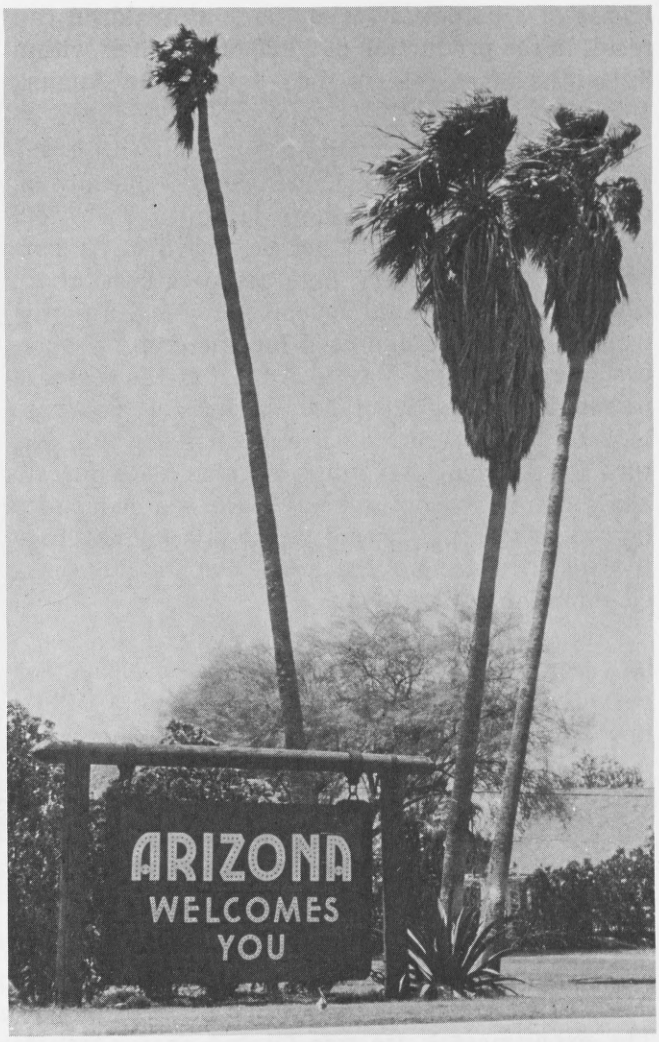

Figure 1. The climate of selected areas in Arizona and California is key factor in the southern seed increase program.

crease of a potential variety such as Waldron can result in the production of 2,000,000 bushels within 8 months after release, i.e., January to August, 1969.

Growing three crops in the field within one 12-month period in the United States logically involved two crops in southern latitudes. Two field crops in one year could not be grown in Arizona because of excessively high temperatures at all times other than from November to May, a period which is already being used for one crop of southern increase. Since May to August is the increase period in North Dakota, it became necessary to look for a temperate environment that would mature a crop from August to November. A temperate environment in southern latitudes would have to be cooled by ocean breezes or be at a high altitude free of frost from August to November, or be a combination of both.

For these reasons and economic ones, a site for crop increase in the August to November period on the California coast was sought. While the author was at Yuma, Arizona, supervising November to May cereal crop increases, he consulted California agronomists about possible sites for August-November cereal crop increases and selected two sites for exploratory trial planting.

Rancho Mission Viejo — 1966

Testing began in the late summer of 1966. Seed was delivered to Riverside, California, in July but seeding was not accomplished until August 30. The experimental site was located on a ranch in the mountains near San Juan Capistrano. The site was 400 by 240 feet and was irrigated by sprinkler system. Eight varieties of barley were grown in rod rows with five replications. Eleven durum varieties and experimental lines were sown in rod rows, and larger plots of two experimental wheats, Dickson barley and an experimental durum were included.

Valuable information was obtained but valid yield data could not be obtained due to crop damage by deer and jack rabbits. The site was in a remote area. A deer and rabbit tight fence was erected but only after much damage was done and maturity delayed. The following observations and deductions were made:

1. Excellent germination was observed from the August 30 planting.
2. August 30 was too late a planting date to mature the crop by November 15.
3. A very high incidence of barley yellow dwarf virus occurred on the wheat and barley.
4. An extremely high population of aphids moved into the plots from the surrounding desert mountains and probably were responsible for transmitting the barley yellow dwarf disease.

Orange Coast College — 1967

Due to a change in the management of Rancho Mission Viejo a new testing site had to be located. Fortunately, a site was obtained from the Agronomy Department of Orange Coast College near Costa Mesa, Calif. This location is approximately ten miles from the ocean at 133 feet above sea level with a latitude between 33° and 34° north.

A 280 x by 240 ft. plot was planted August 5, 1967, with several barleys of different maturity and daylength sensitive and daylength insensitive durum and hard red spring wheat as shown in Table 1.

Sprinkler irrigation was provided. The plot land had been summerfallowed but not fertilized. Thimet (systemic insecticide) was applied to one plot of Dickson barley at planting time.

Emergence occurred rapidly within three days after planting. Crabgrass and watergrass (barnyard grass) emerged profusely shortly after crop emergence and was so thick that yields were not taken at harvest. Hand labor could not be obtained in time to eliminate the weeds but valuable information was gathered nonetheless as follows:

1. Germination occurred three days after planting. California varieties usually require 10 days. This difference, also noted in Arizona, is probably due to the germplasm being developed under the different environments.
2. Planting August 1-5 coincides with highly favorable germination conditions for crabgrass and water grass. This is not a problem with the normal planting date of November and December in California for wheat and barley.
3. The daylength insensitive Chris and experimental durums were fully ripe on November 13. Manitou and Leeds were still green; however, seed was germinable when harvested and dried for several days.
4. All of the barley varieties matured by November 13.

Table 1. Crop varieties or experimental lines seeded, Orange Coast College, 1967.

Barley	Wheat
Primus	Chris daylength insensitive
Conquest	Manitou daylength sensitive
Dickson	Leeds durum daylength sensitive
Experimental 1	Experimental A durum daylength sensitive
Experimental 2	Experimental B durum daylength insensitive

Figure 2. Orange County (California) agricultural advisor Gale Gurtle (at left in both photos) and Ralph Elliott, a Pembina County, N. Dak. farmer, examine stands of grain in increase plots in southern California.

5. Thimet treated barley showed less evidence of damage from barley yellow dwarf than other plots.
6. Aphids appear to be less prevalent here than in the mountain site at Rancho Mission Viejo.
7. Vigorous hand weeding or chemical control will be required to prevent loss from warm season weeds.
8. August 1-5 is a satisfactory date to plant for early November harvest of barley and daylength insensitive wheat and durum.

Though yield determinations were not attempted, some seed of each entry was harvested on November 13. On November 17, after returning to Arizona, the heads were threshed and planted near Yuma. All the entries except Manitou and Leeds were fully ripe and harvested in late April, 1968.

Orange Coast College — 1968

Again on August 5 of 1968 seed was air freighted to the planting site at Orange Coast College. The nursery was planted the same day. All rows were spaced 1- or 2-feet apart to facilitate hand weeding. Arrangements were made to wheel-hoe and hand weed all the plots as soon as they emerged. Several selective herbicides were sprayed on parts of these test plots to find a herbicide that would kill the grassy weeds without damage to the crop. One barley plot was treated with Thimet and in late September 35,000 ladybird beetles were released in the plot. Control of aphids with ladybird beetles is a common practice on high income crops in this area of California.

Only one experimental barley was entered in the trial for yield purposes because past tests showed that barley matures readily for mid-November harvest. One known daylength sensitive wheat and one moderately insensitive wheat were entered along with one insensitive variety. Some plots were seeded at 60 pounds per acre and others at 40 pounds per acre. No fertilizer was applied.

The plots were kept relatively weed free and successful yields were obtained from the barley and daylength insensitive materials on November 13. Ten random rod row samples of the barley and wheat were harvested (Table 2).

From observations made during the season and from harvest results, the following conclusions were drawn:

1. August 1-5 is a satisfactory planting date.
2. Approximately November 15 will be normal harvest date for daylength insensitive barley, wheat and durum.

3. Use of ladybird beetles and Thimet appears to reduce incidence of barley yellow dwarf.
4. Leaf rust develops readily under sprinkler irrigation and may require foliar sprays of fungicides to control rust.
5. Selective herbicides may be successful in control of crabgrass and watergrass but further testing is required.

Growing a cereal crop in California during August-November involves a somewhat different environment than North Dakota. The days are growing shorter instead of longer. The soil and air temperatures are decreasing rather than increasing and the humidity is high due to proximity to the Pacific Ocean. Though there are differences, this did not prevent a normal production of barley and daylength insensitive wheat. Table 3 shows the mean temperatures for the growing periods at the two locations.

The differences in the two locations are the mean temperature at planting time and the decreasing minimum temperature at Santa Ana and the increasing minimum temperature at Fargo during the production periods. The California mean temperature in August is about 16.7° higher than the North Dakota mean temperature for May. This did not prevent good germination, however (Table 3).

Table 2. Seed yields of several barley and wheat experimentals, Orange Coast College, 1968.

	Seed yield bu/A
Exp. barley, 1968 seed - untreated	54.7
Exp. barley, 1967 seed - treated plus Thimet	74.5
Semidwarf wheat - daylength insensitive	26.6
Exp. wheat - daylength semi sensitive	34.7
Exp. wheat - daylength sensitive sown 60 lbs/A	26.1*
Exp. wheat - daylength sensitive sown 40 lbs/A	22.8

*Harvest January 5, other entries harvested Nov. 13 - Dec. 5.

Table 3. Mean temperatures for growing periods at seed fields in California and North Dakota.

	Santa Ana			
	August	September	October	November
Mean temp.	71.4	68.8	63.8	59.0
Max. mean	84.2	82.7	78.2	74.4
Min. mean	58.1	54.5	49.5	43.6
	Fargo			
	May	June	July	August
Mean temp.	54.7	64.6	70.0	67.8
Max. mean	66.7	75.9	81.8	79.9
Min. mean	42.6	53.3	58.1	55.7

SUMMARY

Although this experiment was exploratory and somewhat qualitative, the production of a seed crop of barley and daylength insensitive wheat during August to November appears quite feasible and satisfactory at Orange Coast State College near Costa Mesa, Calif. Costa Mesa is about ten miles from the ocean at 133 feet about sea level between 33° and 34° north latitude.

Increases up to 7,500,000 times in 15 months are now possible in four crops — two in North Dakota, one in Arizona and one in California.

The aphid population seems to be suppressed by use of ladybird beetles and Thimet and the damage from the barley yellow dwarf disease was decreased. Warm season weeds can be kept under control by cultivation and/or herbicides. Leaf rust builds up with use of sprinkler irrigation but probably can be controlled with foliar fungicide sprays.

Acknowledgment

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Outdoor Recreation In North Dakota

Tourism development in North Dakota is receiving great attention. This could result in an increased demand for recreation areas. Proposed federal, state, local and private recreation development may meet the need.

A study by the Department of Agricultural Economics at NDSU deals with the patterns of participation in 16 recreation activities. It also includes an examination of the kind of recreation North Dakotans participate in on vacations or on outings.

The future supply of recreation areas in the state in relation to demand is considered in the study, published as Bulletin 475. Copies are available from county agents or from the Agricultural Information Department at NDSU.