MAIN CONSIDERATIONS FOLLOWED IN DEVELOPING COMMERCIAL BEET SEED GROWING IN THE SALT RIVER VALLEY OF ARIZONA

I. M. McDonald, A. A. Mast and R. C. Wood[1/]

Commercial beet seed production by the overwinter method in Arizona is now starting on the fifth season, this not including the 10 acre experimental planting harvested in 1935. During the past four seasons a total in excess of 22 million pounds of seed has been produced from 14,422 acres.

Drawing on the experience (1) gained in other seed producing areas and our own observations in the field, we have adopted basic practices that have consistently demonstrated better production and better quality of seed.

The necessary steps or stages leading up to successful seed production by the overwinter method are substantially the same regardless of the area of production. Stated briefly these are:

First Stage: Vigorous growth period in which good development of roots and tops is obtained.
Second Stage: Arrested growth approaching dormancy brought on by low temperatures.
Third Stage: Vigorous revival of growth with the return of warmer weather aided by those cultural practices making for rapid and sustained development through to practically the end of the fructification period.

The purpose of this paper is to discuss the steps followed in Arizona to achieve these objectives.

For the first stage the important considerations are:

1. Selection of Land.
2. Planting Dates.
3. Rate of Seeding.
4. Fertilizer Program.

Loam soils of good fertility, with a history of clean cultivation and good fertilizer practices, for obvious reasons, should be selected. Lettuce and melon land has always ranked at the top in beet seed performance. While yields on the basis of previous crops are pretty well in line, only the yields for the 1938-39 season are given in Table 1, for the reason that segregation for the 1937-38 crop and for crop years before that time are not as sharply defined, due for the most part to the over-lapping of previous crops for individual field units.

It should be pointed out at this time that none of the production figures given in this paper include yields for the U. S. curly-top varieties. This for the reason that much of this acreage has been placed outside the main beet seed growing areas, and that they permit a much greater latitude as to soils, fertility and cultural practices.

1/Manager and members of the "Western Seed Production Corporation," respectively.

Table 1.--Yields from Commercial Fields Segregated on Basis of Preceding Crop, 1938-39.

Preceding Crop	Number of Fields	Acres	Average Yield Per Acre
Spring Lettuce	4	365	2406 Pounds
Cantaloupes	4	186	2013 "
Fall Lettuce Followed by Small Grain	12	650	1962 "
Cotton Followed by Small Grain	6	403	1206 "
Cotton	5	131	879 "

The optimum dates for planting may vary from year to year for a given area. Comparison of yields from fields grouped according to periods over which plantings were made for the past two seasons, 1937-38 and 1938-39, show quite definitely that the planting in the Salt River Valley of Arizona should be completed by September 20th to 25th.

Dates Planted	Number of Fields	Total Acres	Average Yields Per Acre - Lbs. Seed
1937-38 Season			
Sept. 5 to 16	18	1005	1187
Sept. 16 to 21	17	1282	1346
Sept. 20 to Oct. 1	16	632	1010
Oct. 1 to 20	10	413	784
1938-39 Season			
Sept. 1 to 11	26	2307	2007
Sept. 11 to 21	18	940	1630
Sept. 21 to 30	8	283	1227

For the Season 1937-38 growth continued uninterrupted until almost the first of the year while for the 1938-39 crop year the fall season was rather short, with killing frosts coming before the middle of November. The two seasons included in this tabulation should well cover extremes in length of growing season that may be expected for the Salt River Valley.

Since the start of commercial beet-seed production in Arizona, the planting rate has been gradually reduced from 18 pounds to 14 pounds of seed per acre, maintaining throughout an average width between rows of 20 inches. Outstanding yields have been obtained from fields planted with less than 12 pounds per acre. For reasons that will be discussed later, the planting rate in Arizona cannot be safely reduced below that which will insure distribution of plants sufficient to give practically complete shading.

The fertilizer program at the start of the season should take into consideration the fertilizer requirement not only for the fall period but, insofar as this is possible, for the full crop year. It must be varied to meet the needs for the individual field.

The addition of phosphate to the beet seed crop through commercial

fertilizers in amounts of 50 pounds, or above, of available phosphoric acid is so well established that it might be termed routine. For most fields this is applied immediately before planting or as a side-dressing in the fall. Applications are made in the spring to those fields where the soil analysis shows a low available phosphorus level, less than 6 parts per million.

It has been demonstrated that adequate plant food, with especial reference to nitrogen, is an important factor in beet-seed production. (2) Our own observations, made in commercial fields, indicate that there is a very definite correlation between color of foliage during the vegetative period and yields. Fields maintaining good color stand out in seed performance. Distinct loss of color, leaves turning yellow through nitrogen deficiency, . . . leads up to yields well below the general average. That a nitrogen deficiency existed was determined by a comparison of analyses of roots taken from green and yellow areas within the same field, and this was further demonstrated by the marked responses in many fields following the application of nitrogenous fertilizers, especially those carrying readily available nitrogen.

Table 2.--Correlation Between Color of Foliage and Yields for Commercial Fields.

Group 1. Fields which maintained a dark green foliage color and good foliage growth throughout the season.
Group 2. Fields which showed an average color and growth, with parts of fields showing a slight yellowing and accompanying reduction in foliage during the winter months.
Group 3. Fields which showed considerable yellowing and reduction in foliage during the winter months.

Group	Number of Fields		Acre Yield of Seed - Lbs.	
	1938	1939	1938	1939
1	9	11	1581	2187
2	14	11	1247	1969
3	13	7	668	1241

While it is to be expected that fields of below average in fertility would fall in Group 3, this group also includes a good number of fields that started off with good promise, maintaining good color and growth into the late fall and early winter.

Time and method of application are important considerations in the commercial fertilizer program; application in time to prevent loss of color and retardation of growth, for reasons already given; placement of material for better economy and availability.

On the basis of observation made in commercial fields, our growers are turning to band placement in preference to the so-called broadcast method. The recent work of W. A. Frazier and W. T. McGeorge (3), based on tests upon fertilizer placement with lettuce in the Salt River Valley, indicate a superiority for the band placement method.

The two most important considerations for the winter, or dormant stage, are:

1. Moisture
2. Coverage

One works to the benefit of the other. By maintaining good shading and adequate moisture, lower mean temperatures and narrower daily fluctuations between night and day are obtained.

It should be added at this point that good shade holds back winter weeds and offers an environment less favorable to the beet leaf hopper, the latter always to be taken into account through the first two stages in Arizona.

Starting with the third and final stage, it has been well established that a good supply of plant food, with special reference to nitrogen, (4) and adequate moisture are essential to good seed performance; and this depends to a marked degree on early and uniform bolting with a high percentage of plants participating in the seed crop.

The irrigation frequency followed through the seed bearing period for the Salt River Valley varies somewhat depending upon the water retention property of the soil for the individual field. Overpeck (5) has pointed out that stopping irrigations too early or too wide a spread between irrigations may affect quantity of seed produced and very definitely influence quality.

A tabulation made for the 1938-39 season, segregating fields on basis of yields, shows that quality increases with the yield.

Table 3.--Segregation on Basis of Yields for Late Bolting Varieties, Showing Germination for Each Group - Season 1938-39.

Yields per Acre	Number of Fields	Percent Germination
Over 2050 Pounds	8	81.2
1700 to 2050 Pounds	9	77.4
Under 1700 Pounds	9	75.9

From the viewpoint of the commercial beet seed producer, yields are determined only after the completion of the harvesting and threshing of the crop; and the procedure followed in these operations has a definite bearing on final yields and quality. From the cooperative endeavor entered into by the Associated Beet Seed Producers at Denver, Colorado in January 1937, mechanical harvesting has progressed to the point that during the past season 1300 acres of beet seed were harvested with six machines in the Salt River Valley. For the larger operations mechanical harvesters are not only practical but have distinct advantages over the conventional hand methods employed. Provisions for the collection of shattered seed makes possible harvesting through the full 24-hour day and extends the harvesting season to a later stage of maturity. It deposits the stalks in continuous windrows, providing an ideal set-up for the traveling thresher. This type of thresher minimizes handling and thereby further reduces seed losses, which occur when material is collected by hand, placed on sleds and hauled to stationary machines.

With each succeeding crop we have come to a better appreciation of the importance of advancing the planting dates, and of maintaining a high level of soil nutrients and adequate moisture from the start to well toward the final stages of maturity for the crop. This and the greater mechanization of harvesting and threshing operations have done much toward stabilizing the sugar beet seed industry in the Salt River Valley of Arizona.

Literature Cited

(1)(2) Pultz, L. M. May 1, 1939. Relation of Nitrogen to Yield of Sugar-Beet Seed and to Accompanying Changes in Composition of the Roots. U. S. Dept. of Agr. Journal of Agricultural Research No. 9 Vol. 54.

(1) Elcock, Harry A. February 1933. Methods of Producing Sugar-Beet Seed in Southern New Mexico. U. S. Dept. of Agr. Bull. No. 207.

(1) (4) (5) Overpeck, John C. July 1937. Sugar-Beet Seed Production Studies in Southern New Mexico 1931-1936. U. S. Dept. of Agi. Bull. No. 252.

(3) W. A. Frazier and W. T. McGeorge, Arizona Agricultural Experiment Station. June 1939. Progress Report of Results of Various Methods of Fertilizer Application on Lettuce in Salt River Valley.

THE STORAGE OF BEETS BETWEEN THE TIME OF HARVESTING AND SLICING IN SOUTHERN ALBERTA, CANADA

A. E. Palmer[1/]

The chief hazard encountered so far in the production of sugar beets in southern Alberta has been the possibility of injury of beets by freezing occurring before the beets were all harvested. The length of the harvest period, that is considered quite safe, that is between the time the beets are ready and the final freeze-up is approximately forty days, commencing about September 20. Freezing temperatures usually occur during this period and in one-third of the seasons since 1925, temperatures have been low enough to freeze the crowns of unharvested beets before the 15th of October. Beets remaining in the ground after the middle of October definitely run the risk of being frozen. This condition has made it necessary to develop methods of storing partially frozen beets. The shortness of the season has made it essential also to adopt practices of handling the crop that would interfere as little as possible with the speed of harvesting operations.

Loss from Small Field Piles:

Several years ago, it was the practice of inexperienced beet growers in the Alberta territory to pile their beets in small piles in the field and, if there was no frost expected at night, the beets were left uncovered until it was convenient to haul them to the loading station. An experiment was conducted at the Lethbridge Station in 1931 to determine the probable loss that might be incurred from this practice under our climatic conditions. Freshly dug and topped beets were weighed into piles containing 200 pounds each and the piles were left uncovered. Beets in these piles were weighed daily and the following losses in weight were recorded:

1/ Assistant Superintendent, Dominion Experimental Station, Lethbridge, Alberta, Canada.