the bands. Under identical fertilizer placement, but without an early irrigation, the root system was more severely burned. By comparison, the factor of timely irrigations is also important when considering the appropriate placement of fertilizer.

Where the bands were placed farther to the sides than is considered best the burning damage was insignificant. However, the roots were not in contact with the fertilizer material soon enough to achieve quickest and most ideal growth stimulation. Some delay in early growth resulted. Where the fertilizer was placed at a different level, a combination of effects was found. Each side responded independently, but in relation to the fertilizer and its placement.

In summary, the data would indicate that placing the fertilizer four inches to each side and two inches below the center of the seed piece is the most ideal location. Greatest benefits from this placement were obtained where the plants were irrigated early -- within three to four weeks from planting, or as soon as the stand was established. Delaying the irrigation at this stage can be detrimental. Placing fertilizer closer than four inches, or directly below the seed piece, should be avoided to minimize root and stolon damage. If precision placement cannot be achieved, it is better to locate the fertilizer slightly farther than four inches from the seed piece than to place it closer.

However, it should be remembered that placing fertilizers at a greater distance than the ideal decreases its efficiency and reduces the production capabilities of the plants, because it lengthens the time required for the plant to develop a root system that can reach and utilize the fertilizer.

Careful adjustment of the planting and fertilizer placement equipment, and timely and judicious application of irrigation water, are inseparable factors for maximum fertilizer efficiency and tuber production.

## Irrigation Practices with Potatoes

(W. D. Pew and J. H. Park)

Abstract: Data from five years of experimentation with irrigation and soil moisture levels indicate that a certain knowledge and general understanding of these factors is important in potato production. Nine treatments ranging from a constant very wet level to a constant dry treatment were used. Yield differences were significant and varied from a low of 321 cwt, from plants exposed to a very wet (18-20 centibars tension) level early in the season followed by a dry (75-80 centibars tension) condition during the last part of the growing season, to 416 cwt where the plants were kept at a dry level early and changed to a very wet level late in the season. Growers often unknowingly reduce yields and lower quality by applying excessive amounts of irrigation water.

## Introduction

In the semiarid (low rainfall) areas of Arizona the proper use of irrigation water is one of the greatest challenges to potato growers. Soil moisture produces perhaps the most interesting and pronounced effect on potatoes of any single production factor.

## Methods

Nine soil moisture treatments -- two constant level types and seven two-stage levels, were used. Tests were conducted on the University of Arizona Mesa Branch Station.

Both the Kennebec (a chipping type) and Red Pontiac and Red LaSoda (table stock type) varieties were used in these studies.

Planting was done the first three years with an experimental cell drop planter and the last two years with a commercial two-row picker type planter.

In all cases care was exercised to assure that the seed was placed six inches apart for the white variety and six inches apart for the red varieties in 34-inch rows. The soil is a laveen clay loam with an excellent water infiltration rate, water holding capacity, and of good tilth. Each crop received 1000 pounds of 16-48 ammoniated phosphate fertilizer applied at planting time. No additional fertilizer was used.

All cultural practices, except irrigation, were handled as nearly like the accepted commercial practices as possible for small plots. Plots were four rows wide and 60 feet long. All potatoes from each plot were sized and graded on a commercial sizer and weights of each classification were made.

Four replications were used. Dial-type moisture measuring devices were used to determine the soil moisture level. The instruments were placed in the two center replications and the average of the two readings was used to indicate irrigation schedules. The instruments were placed in one of the harvest rows and the porous cup (sensitive portion) was placed 10 inches deep and in the plant row.

## Results and Discussion

Data have been very consistent over the entire five-year period of the test. The yield values for the 1964 tests will be used as representative for these tests.

Table 1. Effects of variation of soil moisture levels on potato yield (Variety: Red LaSoda)

| Group | No. | Treatment Description | | Yield Cwt | Number of Irrigations |
|---|---|---|---|---|---|
| | | Soil Moisture | | | |
| | | Early Season | Late Season | | |
| A | 1 | Very Wet | Very Wet | 338 | 15 |
| A | 2 | Very Wet | Wet | 328 | 13 |
| A | 3 | Very Wet | Dry | 321 | 11 |
| B | 4 | Wet | Very Wet | 348 | 13 |
| B | 5 | Wet | Wet | 348 | 9 |
| B | 6 | Wet | Dry | 343 | 9 |
| C | 7 | Dry | Very Wet | 416 | 11 |
| C | 8 | Dry | Wet | 391 | 9 |
| C | 9 | Dry | Dry | 345 | 6 |

Very Wet - 18-20 centibars; Wet - 45-50 centibars; Dry - 75-80 centibars.

Considering the differences in yield between individual treatments within and between the three general groups in our Table, one quickly observes that when plants receive a high level of moisture early in the growing season, followed by a reduction during the later period when the tubers are enlarging rapidly and maturing, the yield is rather sharply reduced.

This is readily seen in comparing treatments 1, 2 and 3. Note the progressive reduction in yield as the soil moisture levels are lowered in the latter part of the growing period. In group C (treatments 7, 8, and 9) the opposite trend is true. Where the plants are started and grown under drier soil moisture conditions and then provided a greater amount of water as the tubers are developing and reaching maturity, yields progressively increase as the level of soil moisture is increased.

It will also be noted that in group B the yields are essentially the same for all treatments regardless of the level of moisture during the last part of the growing season. This indicates that the root system is adequate to compensate for higher or lower levels of moisture variations as they occur.

Observations taken concerning both tops and roots in these tests indicate that the effect of varying water regimes on yield is more closely associated to depth and volume of root growth than differences in top growth. High levels of moisture early in the season result in limited, shallow root systems which are incapable of adjusting to conditions of lesser amounts of soil moisture later in the season.

Since the roots thus developed are too localized and shallow, they are unable to use water in the deeper zones. Consequently, once the plants are started

under high soil moisture levels, they must continue at these levels if adequate yields are to be obtained. Whereas, plants grown on a more limited water supply in the early periods and then provided with more liberal quantities later are, because of better root development, better able to withstand the changes and can use the available soil moisture more effectively.

Tubers produced on plants grown in soils of high moisture were generally of poorer quality than where they received smaller amounts of water. The measure of poorer quality was based on lower total solids, more watery tissue, poorly set skins, rough and poorly-shaped tubers, and enlarged and unsightly lenticels.

The economics involved in the application of these findings also is important. Consider for a moment the number of irrigations required in each treatment as a measure of production efficiency. As an appropriate comparison use Treatment 1 with 15 irrigations and No. 7 with 11 irrigations. The data show that the plants in Treatment 7 yielded 78 cwt sacks more than those in Treatment 1 and yet the increased production required four fewer irrigations.

Thus, not only was the yield increased, but production costs simultaneously were reduced. These findings are of considerable economic value -- especially on crops normally high in production costs -- if the growers are to receive highest financial returns.

Based on these findings, growers should be especially careful concerning their irrigation program. It should be remembered that high initial levels of soil moisture, followed by drier soil conditions, will result in reduced yields. The reverse of these soil moisture conditions will give highest yields and best quality tubers.

Where continuously high moisture levels are maintained in an attempt to overcome the effects of poorly developed root systems, in an attempt to obtain good yields, quality usually is impared. Plants grown on intermediate levels of moisture early in the growth period produce relatively good yields regardless of irrigation practices later in the growing period. Generally, however, more control on yields can be exercised throughout the growing season if plants are given a limited supply of water rather than larger amounts in the growth period.

## Studies on Fall Production Problems with Irish Potatoes in Arizona

(Paul M. Bessey)

### Introduction

Frequent attempts have been made in Arizona to grow Irish potatoes as a fall crop for the winter "new potato" market and/or to supply high quality chip stock to local manufacturers.