Fertilizer Placement in Potato Production

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

Abstract: The importance of proper fertilizer placement has been demonstrated in recent greenhouse studies. Small, seemingly unimportant changes in fertilizer placement often in reality are very important. Specially constructed boxes with glass fronts were used to study root development as affected by fertilizer placement. Yields were significantly different one from another with the poorer ones resulting where fertilizers were placed too close to the seed piece. Yields ranging from 298 cwt, where the fertilizer was placed two inches to each side and level with the seed piece; up to 367 cwt where the fertilizer was placed four inches to each side and two inches below the seed piece. Root burning and speed of root regeneration represent the most important consideration to be reckoned within the proper placement of fertilizer.

Introduction

Eight treatments, representing various positions of two fertilizer bands in relation to the seed pieces, were used. Each band was placed in its respective position thereby studying the specific effect on the root activity. Tests were conducted under greenhouse conditions at The University of Arizona Mesa Branch Station, Mesa, Arizona.

Methods

Both the Kennebec and Red Pontiac varieties have been studied in these tests over the past four years. Specially designed boxes for growth chambers with glass fronts were utilized to permit the study of the root development and tuberization throughout the growing season.

The glass front growth chambers, tilted at a 30° angle, made it possible to examine and observe root growth and development or burning and tuber formation as they occurred. A single seed piece was planted in each chamber and handled so as to simulate field conditions insofar as cultural practices were concerned. Daily observations were made and pictures taken at regular intervals to obtain a pictorial record of the root development activity.

The amount of fertilizer used in each band was carefully calculated to represent a 1000-pound application per acre under field conditions. Fertilizer used was 16-48 ammoniated phosphate and was placed in the soil in the growth chambers just prior to planting the seed pieces. Perlite was added as a marker to locate the fertilizer bands and for ease in making the photographic record. Water levels were maintained as uniformly ideal as possible consistent with the objectives of the test.

Results and Discussion

Under conditions of the test, yields are often sharply reduced. Sometimes quality, expressed in terms of tuber size and smoothness, was impared. Reasons for this are presented and discussed herein.

Table 1. Effects of location of fertilizer bands on potato plant growth and tuber yield.

Treatment			Yield 100# Sacks/Acre Marketable Tubers
	Fertilizer Band Location		
No.	To Each Side	Depth of Seed Pieces*	
1	4 inches	both level	310
2	4 inches	both 2 inches below	367
3	4 inches	both 4 inches below	344
4	4 inches	one level one 2 inches below	331
5	4 inches	one level one 4 inches below	342
6	2 inches	both level	298
7	6 inches	both level	328
8	6 inches	both 2 inches below	350

*Depth measured from center of seed piece and not from bottom edge.

A review of data in Table 1 show that pronounced differences may be expected from the effects of these treatments. The differences, for the most part, could be attributed to the relationship between the effects of the fertilizer bands to root development, stolon formation, and flow of water through the soil from the irrigation streams.

Marked root damage and little or no regeneration occurred in the fertilizer band areas where the fertilizer was placed too close to the seed piece. Obviously, roots so damaged are incapable of producing plants for maximum production.

From careful study and observation, root systems so severely damaged show virtually no recovery, or the recovery is so limited that production capability is drastically reduced. In addition to root damage, the ends of the stolons (stems on which potatoes are found) are damaged similarly by the closely placed fertilizer. Stolons damaged in such a manner seldom produce marketable tubers.

The effect of a timely first irrigation is most pronounced. Root systems of plants receiving an irrigation three weeks after planting showed best root activity because the water movement reduced the concentration of fertilizer in

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.