Low Salt Fluids and Irrigated Potatoes

Maintaining adequate P availability is imperative.

Drs. Terry Tindall and Galen Mooso

The Fluid Journal • Official Journal of the Fluid Fertilizer Foundation • Summer 2016 • Vol. 23, No. 3, Issue #93

Summary: *Potato production requires adequate nutrients provided throughout their entire production profile, including high-concentrated fluid starters applied at planting. Providing these enhanced early-season and extended Nitrogen-Phosphorus-Potassium (NPK) available and soluble fertilizers is an essential part of any potato fertilizer program. It is imperative to maintain adequate P availability over the course of the growing season and can be a significant challenge. This is particularly important in calcareous soils where orthophosphate can be quickly tied up by soil cations of calcium (Ca) and magnesium (Mg), rendering P less available to the crop.*

A low salt 6-24-6, developed in the western U.S., is a 50-50 blend of both ortho-poly phosphates developed to provide both improved early season P availability to crops as well as enhanced P availability later in the growing season. It is highly soluble and the orthophosphate is readily absorbed by plant tissue when applied as a foliar spray. This application has been recommended to help enhance P fertilizer efficiency. The polyphosphate-P is initially protected from being tied up by soil cations, but when conditions are favorable (warm soil) it is hydrolyzed to release orthophosphate, which is immediately available in the right source for plant uptake.

In addition, 6-24-6 has a relatively low index, which allows it to be applied closer to the seed than many conventional fertilizer sources. It is also compatible with a wide array of micronutrient solutions and can be easily blended to provide an excellent source of macro- and micronutrients.

Field trials

This report is meant to be a preliminary industry update and is designed to only look at the trends of the research within some of the critically measured metrics. Complete statistics are not provided at this time, but will be in a follow-up report.

Goal. The University of Idaho conducted field evaluations on irrigated potatoes at two locations and over the 2014-15 growing season with one additional year currently established. The goal of these trials is to determine the effective placement, timing, rate, and source of low salt fluid starters of 6-24-6 (produced by the J.R. Simplot Company). Low salts in this case are being defined as sources of fluid fertilizers that use potassium hydroxide as the K source, which effectively reduces the fertilizer material's salt index, allowing greater concentrations to be made in direct contact with the potato seed piece. These trials were conducted at Aberdeen, Idaho's R and E Center by Dr. Jeff Stark, and by Dr. Mike Thornton at the Parma R and E Center located in Parma, Idaho.

4R's. Treatments for this potato study were conducted on medium soil testing P of 17-20 ppm with a soil pH of 7.5 to 8.0 and classed as silt loam with percent free lime of less than 5 percent. All of these are factors that would relate to an expected P-based low salt fluid like 6-24-6 fertilizer being used in potato production. Trials were established where the 4 R's of fertilizer were incorporated within the study. These include timing (6-24-6 applied either at planting or in-season or split applications between both timings), rate (applications of the 6-24-6 were applied at 3, 6, 9, and 12 gallons/acre) and placement (in-furrow or foliar). The 6-24-6 poly/ortho blend was not meant to be a stand-alone fertilizer treatment but as a supplement

to a well thought out strategic dry P fertilizer program that would maintain P soil test within an adequate range. These well thought out treatments combined the rates applied in-furrow with foliar so that the split applications had a portion of fertilizer applied (half furrow and the remainder as foliar). These treatment combinations made up a total number of 13 treatments (Table 1).

It should be noted that foliar 6-24-6 applications for treatments 6-9 were split equally between vegetative growth (plants 8-10 inches tall) and tuber set, while those for treatments 10-13 were split equally between vegetative growth, tuber set, and early bulking.

Yields. Total potato yields appear to be influenced across these four site years as the main effects of furrow, foliar, and combinations of both timings and placement from 6-24-6 (Figure 1). Total tuber yields improved above the untreated control (UTC) where adequate P as dry fertilizer was applied but no starter was applied directly with the seed piece. Total yield increase appeared to increase up to and including the 6 gal/ac rate, but not above this level. The UTC averaged 420 cwt/ac and increased to 445 cwt/ac with the 6 gal/ac rate of 6-24-6.

Quality. One of the major concerns in potato production is quality. Quality on a nutritional side may take on many parameters, but for this article quality is expressed as those tubers graded as U.S. #1 potatoes. These are considered potatoes within a certain size parameter, shape, and with minimum blemishes. The low salt liquid 6-4-6 when averaged over both sites and treatment indicates an overall improvement relative to treatments (Figure 2). There was an appreciable increase in U.S. #1 potatoes over the UTC and across application timing and placement up to 9 gal/ac. However, beyond the 9 gal/ac, there appears to be a suppression in tuber quality. This may be related to salt content at these higher rates when the 6-26-6 is applied directly in furrow and is coming in direct contact with the potato seed. Higher rates of fluid starter P are applied at planting in most Idaho potato fields, but these are kept from direct contact with the potato seed piece to avoid concerns with too high of rates with this particular timing and placement of fertilizer.

U.S. #1. Concerns have been

Table 1. Rates for banded and foliar applications of 6-24-6 in the 2015 potato study.

Treatment	Banded 6-24-6 (gpa)	Foliar[1] 6-24-6 (gpa)	Preplant Broadcast P (lb P_2O_5/a)	Total P Applied (lb P_2O_5/a)	N applied lb N/acre	K applied lb K_2O/acre
1	0	0	0	0	0	0
2	3.0	0	0	8	6	6
3	6.0	0	0	16	11	11
4	9.0	0	0	24	17	17
5	12.0	0	0	32	22	22
6	3.0	0	100	108	6	6
7	6.0	0	100	116	11	11
8	9.0	0	100	124	17	17
9	12.0	0	100	132	22	22
10	0	3.0 (3x1.0)	0	8	6	6
11	0	6.0 (3x2.0)	0	16	11	11
12	0	9.0 (3x3.0)	0	24	17	17
13	0	12.0 (3x4.0)	0	32	22	22

[1]Foliar 6-24-6 applications for treatments 6-9 were applied at one week intervals beginning July 7.

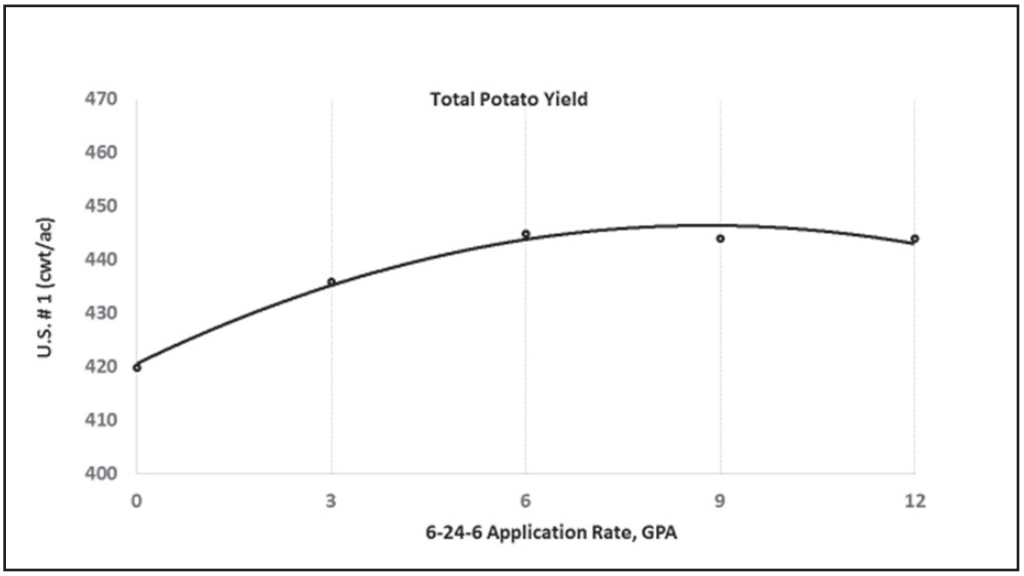

Figure 1. Total potato yield from 6-24-6 treatment applications across rate, timing and placement in irrigated field trials from Aberdeen (AB) and Parma (PA) Idaho 2014-15.

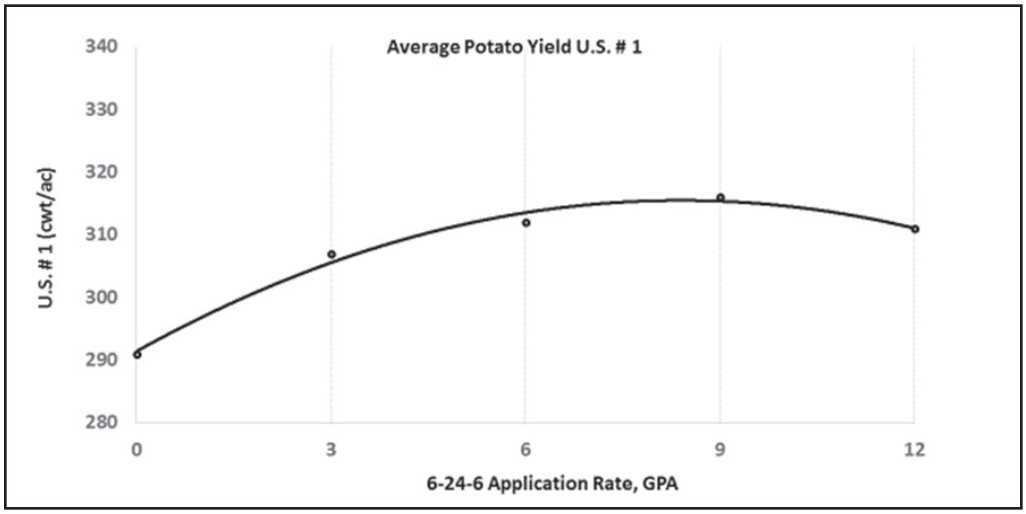

Figure 2. U.S. # 1 potato production from 6-24-6 treatment applications across rate, timing and placement in irrigated fields of Aberdeen and Parma Idaho 2014-15.

expressed as to how potatoes would respond to rates and timings of nutrients, and in this case, low salt 50-50 poly/ortho fertilizer blends to either furrow, furrow/foliar combinations or strictly foliar applications. Positive responses were observed over the UTC for all treatments, but it appears that the strongest response for total potato tuber yields came with a combination of furrow and foliar (data not shown). However, the most important information for potato processing a fresh market is the US #1 production (Figure 3). When applications are made across fertilizer rates it appears that the strongest contribution may actually come from foliar applications of low salt 6-24-6 applications. Or certainly, a combination of in-furrow with a combination of foliar, depending on the phosphorus content of the plant as indicated by petiole P concentrations (data not shown).

While U.S. #1 potato production is interesting to look at, it is also expressed in cwt/ac. Higher quality potatoes were increased over the UTC with applications of 6-24-6 when applied either at furrow, furrow + foliar or simply applied as a foliar (Figure 4). When averaged across all treatments and in both locations over the two years, there was little difference between combining a furrow with foliar applications of 6-24-6. Furrow applications alone were not enough to generate the highest U.S. #1 yields. From this study it appears that 3 gals/ac were the maximum rate that should be applied directly to the seed piece. However, higher yields were observed with either foliar alone or a furrow + foliar and at the higher application rates. There may also be site variations with the 6-24-6 applications between Parma and Aberdeen. Although the data were not shown, there was not as much suppression in potato yield with furrow applications in Parma as appeared in Aberdeen. This needs further evaluations.

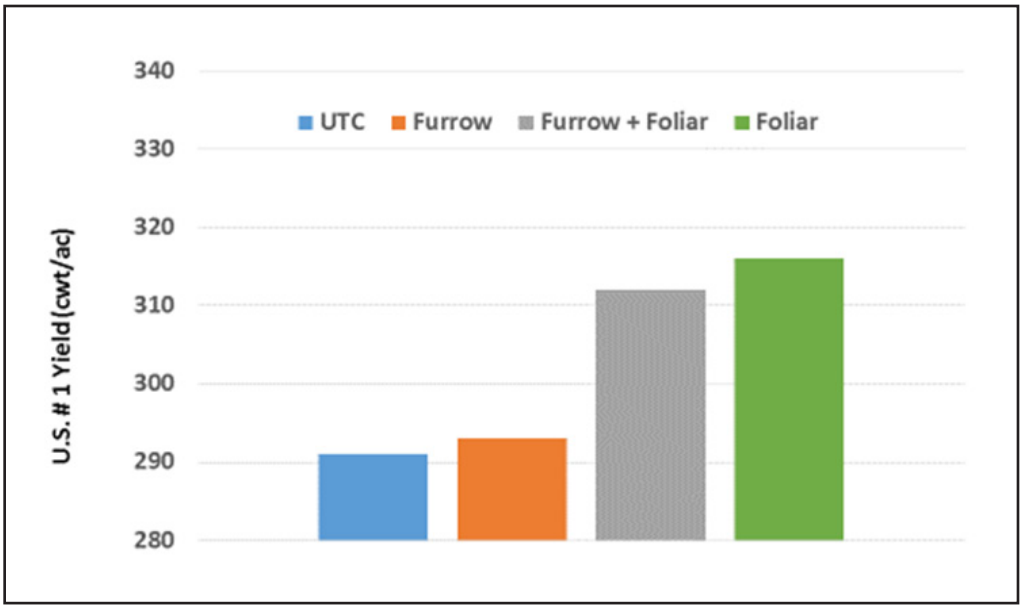

Figure 3. Fluid (6-24-6) timing and placement applications to U.S. # 1 yield of Russet Burbank potatoes produced under irrigation at Aberdeen and Parma ID during 2014-15.

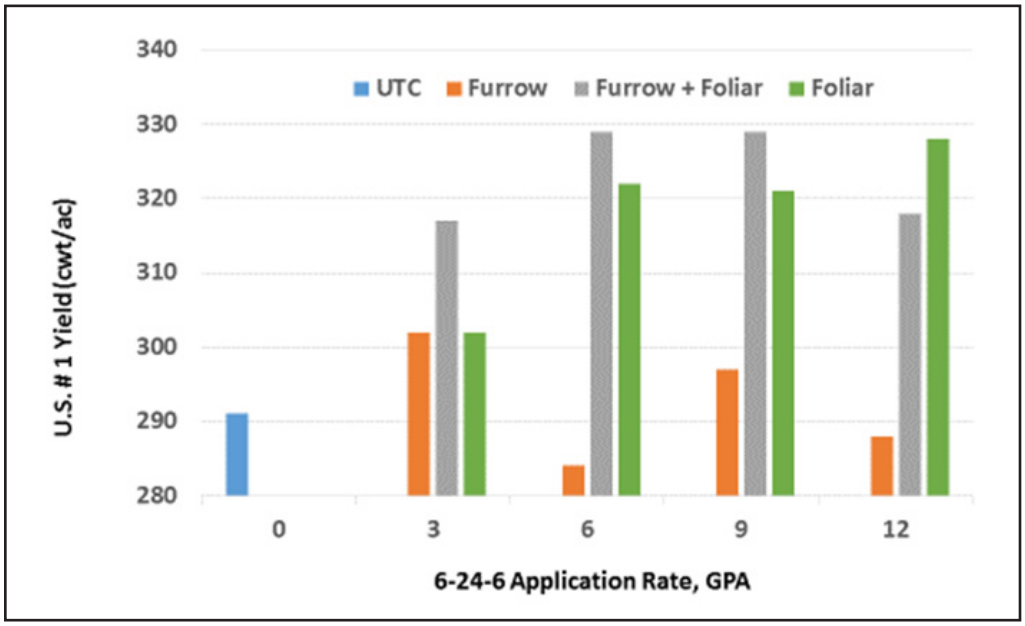

Figure 4. Timing, placement, and rates of low salt liquid 6-24-6 applications to Russet Burbank potatoes applied at Aberdeen and Parma Idaho 2014-15.

Summing up

Although the complete study has not been finished, there are interesting observations that can be discussed from using low salt fluid fertilizers in irrigated potato production in the Pacific Northwest.

The use of 6-24-6, which includes both N, P, and K in a formulation that would be classed as a low salt, can benefit both total and U.S. #1 yields.

The greatest production increases may come from a combination of in-furrow + foliar or with foliar applications when higher rates are used. Rates of 6 or 9 gallons/ac appear to maximize production parameters and could be used as guidelines for growers to initiate similar applications on their production fields.

The authors are not suggesting that these applications replace what has been a well-thought-out P nutritional program, but as an easy way to provide a high P fertilizer during times of high nutritional requirements. Additional information will be required to determine if higher yield environments make a difference as to optimum combinations of furrow and foliar 6-24-6 applications.

The authors would like to thank Dr. Jeff Stark and Dr. Mike Thornton and their staffs with the University of Idaho in conducting these studies in cooperation with the J.R. Simplot Company. The University of Idaho does not endorse this or any other products that might be discussed in this article.

Dr. Tindall is Senior Agronomist for the J.R. Simplot Company in Boise, Idaho, and is also a member of the FFF Board of Directors and its Fluid Journal Editorial Committee. Dr. Mooso is the Agronomy Manager for Simplot and member of the FFF R&E Committee.