

The Effects of Kickoff and Compost on Yield and Economic Value of Double Crop Potatoes

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ABSTRACT

This project evaluated Kickoff and compost as nutrient sources comparing the differences in yield and economic value. Norkota-8 potatoes were used for this project. They were planted in three different sections each equaling 30 acres. The three treatments were Kickoff, compost, and a control. Two samples were selected out each of these areas. The Kickoff yielded an average of 457.9 sacks per acre, the compost yielded an average 409.8 sacks per acre, and the control yielded an average of 388.8 sacks per acre. Yield differences were not significant. With the yield results and cost per acre an economic value was calculated. The break-even point for Kickoff was \$3.39 per sack, compost was \$3.70 per sack, and the control was \$3.74 per sack.

Keywords: *Kickoff, compost, petioles, yield, nutrients, soil sample, sacks (CWT)*

INTRODUCTION

Farmers in the San Luis Valley of Colorado have experimented with the use of compost, as a way to raise the organic matter percentages and other nutrients in the soil. This practice of applying compost has proven to be an effective practice, but it has not proven to be cost effective. The application of the minimum of one ton of compost costs the farmer \$43.33 per acre; and the majority of the farmers using compost to raise the organic matter percentages apply two to five tons per acre. With the ever increasing costs of doing business, it is necessary to look at alternative ways to reduce costs while maintaining high yields.

One such alternative could be the use of a relatively new product on the market called Kickoff. This product is applied through the sprinkler irrigation system during watering times as compared to a separate operation involving the dry application of compost. The application of Kickoff through the sprinkler system therefore eliminates some of the application costs. Studies have been done in the San Luis Valley by AgriEnergy Resources which show the application of Kickoff could increase the yields of potatoes to approximately 57 sacks per acre and thereby reduce the break-even point (Agrienergy Resources, 2002).

The purpose of this research was to find out whether the application of Kickoff or compost would affect the yield of a potato crop enough to compensate for any additional costs and to determine which was most cost effective.

MATERIALS AND METHODS

The research for this project was conducted in a field provided by CCFarms which is located in the San Luis Valley near Center, Colorado. The legal description of the field used is the southwest quarter, section 7, Township 41 north, Range 8 East. The crop history for the past three years for this field was wheat in 2000, wheat in 2001, and potatoes in 2002.

The application decisions for Kickoff and compost

were based on the 2002 applications dates and grower expertise.

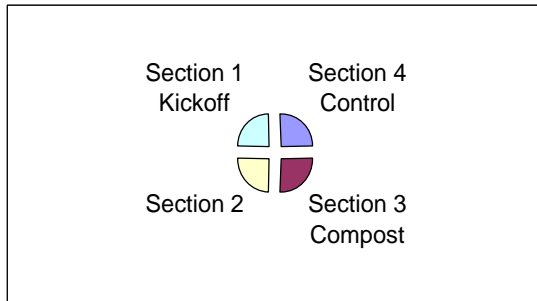
Table 1. Summary of Application dates

11/22/02	Soil samples were pulled and analyzed.
04/07/03	Compost was applied at the rate of 1 ton per acre
04/15/03	Pre-plant application of 60-100-0 at the rate of 50 gallons per acre.
Day 1	Norkota-8 potatoes were planted
Day 26	Cultivation of the potatoes was started.
Day 27	Cultivation of the potatoes was finished.
Day 27	Eptan Sencore was applied through the sprinkler at a rate of 8oz per acre of Sencore and at a rate of 58oz of Eptan.
Day 44	First application of Kickoff was applied at the rate of 3 gallons per acre.
Day 63	Top dress application of 28-0-0-5 was applied at the rate of 8.3 gallons per acre through the sprinkler irrigation system.
Day 65	Application of Headline was applied at the rate of 6.25 gallons per acre
Day 66	Second application of Kickoff was applied at the rate of 3 gallons per acre.
Day 71	Top dress application of 28-0-0-5 was applied through the sprinkler irrigation system at the rate of 8.3 gallons per acre.
Day 82	Last application of Kickoff was applied at the rate of 3 gallons per acre.
Day 113	Jackpot, a desiccant, was applied at 15 gallons per acre along with 7.5 gallons per acre of calcium to kill the potato vines.
Day 129	Yield samples were harvested.

Soil samples taken on 11/23/03 showed the nutrients that were present in the soil prior to the initiation of the project. Each soil sample was analyzed for nitrogen, phosphorus, potassium, sulfur, calcium, magnesium, sodium, zinc, iron, manganese, and

copper in the soil. Other analyses included the pH level, the amount of organic matter, the amount of excess lime, and the soluble salts that were present in the soil. Results included recommendations for each nutrient that was deficient. The process used for pulling soil samples was to use a soil sampler to take random samples throughout the selected areas. Nine samples were taken and the soil was thoroughly mixed in a plastic bucket and placed in soil sample bags provided by the Monte Vista CO-OP.

Figure 1. Location of treatments



The compost was applied with a spreader truck at a rate of one ton per acre. The compost was applied on April 7, 2003 to the north section, which is labeled as section three. The compost analysis is in Table 2.

Table 2. Compost analysis in lbs/tons

N =15.17	Mn =0.77	Na =5.44
P205 =26.30	Cu =0.19	S =4.68
K20 =36.84	B =0.05	Zn =0.27
Ca =36.84	Fe =27.06	MgO =12.20
Organic matter =385.91		
Ash =1182.29		
pH of 8.83		

The first application of Kickoff was on day 44 after emergence, the second application was on day 66 and the last application on day 82; all three were applied at the rate of three gallons per acre. The Kickoff was applied as a top dress application through the sprinkler. Kickoff is a mixture of compost extracts, vermicast extracts, plant extracts and mineral extracts, in addition to humic acids. The CO-OP received this information from AgriEnergy Resources; the company that produces Kickoff (Agrienergy Resources, 2002).

Two areas were selected for both yield samples and petioles samples. Section one and section three were sampled twelve rows in from the east side of the pivot road with section one 30 feet north and section three 30 feet south of the third wheel track. In section two the samples were taken twenty-four and forty-eight rows from the outside edge of the field directly east of the center pivot. To track the nitrogen rates in the plants throughout the growing season, petioles were sampled.

Two sets of petioles were pulled: one set on day 62

and the second set on day 78. The process was started by pulling off the fifth stem from the top of the plant and then removing all the leaves. There were 20 stems per sample and two samples per section. Over the growing session the potatoes were watered seventeen times, ranging from 1 inch to 2/10 of an inch of water per application. The watering rate and day of application are listed in Table 3.

Table 3. Watering days amounts shown in inches

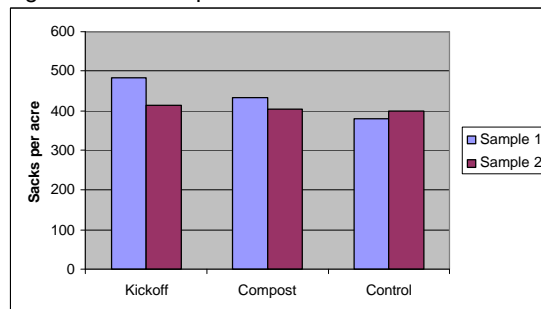
Day 27=6/10	Day 51=1	Day 67=1
Day 30=1/2	Day 54=1	Day 71=1
Day 34=1/2	Day 57=1	Day 72=1
Day 37=1	Day 61=1	Day 75=1
Day 41=3/4	Day 65=2/10	Day 79=1
Day 44=2/10	Day 66=2/10	Day 82=2/10

The yield was calculated per plot for each section. Comparisons of the cost /acre with the average yield were used to calculate the justification of the additional costs. The formula for calculating the yield is 43,560 (square feet per acre) x 2.8333 (feet per 34 inch bed) =15374.3 feet (the length of one 34 inch bed to equal one acre). The length of the trial (10 plants) was divided by 15374.3 to arrive at the percent of an acre in the trial. The percent of an acre was then multiplied by the number of pounds of potatoes from the sample to determine the yield per acre in each trial. An example of this calculation is: 43,560/2.8333 =15374.3/12ft = 1281.19 x 33.5 = 429.20 sacks (CWT) per acre. The results from the calculations gave an accurate comparison of the strengths and weakness for each of the six trials. The final analyses was to compare the cost per acre divided by the yield per acre to determine if the additional yield times the market value justifies the additional cost of applying compost or Kickoff.

RESULTS

The results showed a sizable difference in yield between the different trials. Plants appeared to be healthier and larger in both the Kickoff and compost treatments compared to the control. The control had the lowest average yield of the three with 388.8 sacks per acre, followed by the compost with a yield of 409.8

Figure 2. Yield of potatoes.



sacks per acre, and the Kickoff showed the largest yield with 457.9 sacks per acre. The results are shown in Figure 2. However when the results were analyzed statistically by ANOVA, the P-value of 0.30464 did not show a significant difference.

The nutrient levels through out the growing season are a good indication of where the plant is in the growing cycle. The nutrient levels also show if the plant has any nutrition deficiencies at the time of the sample. Petiole samples were pulled to track the different levels of nutrients. The results are shown in Tables 4 and 5.

Table 4. Results of petiole samples taken on day 62

Nutrient	Compos t	Control	Kickoff	Sufficient range
N	19243	18522	19147	17375
P	0.19	0.21	0.28	0.3-0.55
K	7.48	6.59	6.69	7.5-15
S	0.26	0.43	0.26	0.2-0.5
Ca	0.97	1.16	1.04	0.45-2
Mg	0.68	0.85	0.75	0.4-1.7
Zn	15	56	44	23-55
Fe	263	348	459	75-350

Table 5. Results of petioles samples taken on day 78

Nutrient	Compost	Control	Kickoff	Sufficient range
N	9534	9858	9723	9000
P	0.08	0.13	0.2	0.3-0.55
K	5.26	6.52	5.84	7.5-15
S	0.21	0.22	0.19	0.2-0.5
Ca	1.41	1.37	0.39	0.45-2
Mg	0.82	0.66	0.79	0.4-1.7
Zn	23	26	28	23-55
Fe	217	405	435	75-350

The results from the petiole samples in addition to the results from the soil samples allowed for an adjustment in the amount of top-dress fertilizer applied through out the growing season. Soil sample results are shown in Table 6.

The average cost per acre of the control trial was \$1065.00. The cost of the Kickoff trial and compost trial were calculated as follows: \$1065.00 plus an additional harvest expense of one dollar per sack in combination with the expense for the Kickoff or compost. The Kickoff cost \$1554.41 per acre; the compost cost \$1516.21 per acre; and the controlled area cost \$1453.80 per acre. The break-even price for the three plots was Kickoff \$3.39 per sack; compost \$3.70 per sack, and the control \$3.74 per sack.

DISCUSSION

There were two main goals of this research project.

The first goal was to see whether an application of Kickoff or compost would increase the grower's yield on a crop rotation of two consecutive years of potatoes. The second goal of this project was to determine whether it is cost effective for the grower to apply these products.

Table 6. Soil sample results in ppm

Nutrients	Kickoff	Compost	Control
N	11	9	4
P	34	30	36
K	246	202	205
Ca	2735	3066	3149
Mg	319	327	324
Na	70	42	45
Zn	0.9	0.8	0.7
Fe	7	11	6
O.M.	1.3	1.4	1.4

To address the first goal, the results of the research concluded that the application of either Kickoff or compost would increase yields. The compost showed a 21 sack improvement per acre and the Kickoff results showed an average increase of 69 sacks per acre. These results suggested that the Kickoff produced a greater improvement in the yields. This 21-sack per acre improvement over the entire field would result in 2520 sack increase in the total sacks available to be sold, and 69 sack increase would result in 8280 sack increase per field.

To address the second goal, the results indicated the break-even points for the three sections were as follows: the control trial at \$3.74 per sack, the compost trial at \$3.70 per sack, and the Kickoff trial at \$3.39 per sack. The results showed the application of Kickoff or compost to a field of Norcota-8 potatoes would increase the yield on a double crop year of potatoes. The increase in yield would allow a grower to operate at a lower break-even point. Given that the potato market has been low for the past two years, the results from this research may offer a way to lower the grower's break-even point, which will increase the opportunity for profit.

LITERATURE CITED

Agrienergy Resources, 2002. Potato Edition, Monte Vista Co-Op. Volume 1.