EFFECT OF DIFFERENT RATES OF N AND K ON DRIP IRRIGATED BEAUREGARD SWEETPOTATOES

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INTRODUCTION

The use of drip irrigation for sweetpotato production continues to grow in California, and now accounts for about 80% of the land area in production and increase from just 50% only five years ago. While fertilizer trials were performed in the 1960's and '70s with furrow irrigated fields, no controlled fertilizer trials with drip irrigation had been performed. Therefore, a nitrogen and potassium fertilizer trial was established under commercial conditions to essentially answer the question whether the use of drip irrigation changed the fertility requirements of the crop. 2002 concluded fours years of evaluating N and K rates for drip irrigated Beauregard sweetpotatoes. Some of the important conclusions that have been made from this project:
Best overall nitrogen rate was found to be 125 - 175 lbs per acre, when injected through the drip line during rapid vine growth. This rate resulted in maximum yield with little residual N at the end of the season.
There was little response to K fertilizer, even though the soil tested low (below 125 ppm exchangeable K). Because of some problems with the K results, the best recommendation that can be made at this time is to apply to meet nutrient removal (about 150 lbs K20 per A).
Petiole NO3-N and K sufficiency ranges were developed for two different time periods of crop development, at rapid vine growth (about 4-6 weeks after transplanting) and root bulking (about 2 months after transplanting): vining: 3000 - 5000 ppm NO3-N, 4.5 - 5.5% K
root bulking: 2000 - 4000 ppm N03-N, 3.5 - 4.5% K
Weight loss in storage was unaffected by potash treatment.

Residual soil nitrate was very low (< 10 ppm) down to 3 feet. This indicates that most of the applied nitrogen is being used by the crop and is not being leached to groundwater.

The objectives of this trial were:

1. Determine the optimal rates of N and K fertilizer for best yield and quality in drip irrigated Beauregard sweetpotatoes.
2. Determine the effect of different rates of potash and nitrogen on moisture loss in storage.
3. Re-evaluate current fertilizer application tissue analysis guidelines.
4. Determine if applications of N with the drip system results in substantial leaching of nitrate beyond the root zone.

TASK 1: Experimental setup.
A trial was initiated with a commercial sweetpotato grower in April 2001. Fertilizer rates were adjusted slightly from what was originally proposed to better correspond to the grower's practices. Nitrogen rates were 0, 50, 100, and 200 lbs N/A, and potash rates were 0, 75, 150, and 300 lbs K20/A. The irrigation system for the fertilizer trial was sectioned off from the main irrigation assembly so that nutrient inputs could be applied independent of the grower's fertilization schedule. No pre-plant incorporated fertilizers were applied. Beauregard sweetpotatoes were transplanted May 30, 2001. Plots are 2 rows (80") wide by 45 feet long, and replicated 4 times.

Field site with the same grower as last year was selected in April, 2002. The location was different than 2001, but was still in the Livingston area of Merced County. Beauregard sweetpotatoes were transplanted May 25, 2002.

Subtask 1.1: Pre-season soil samples.
Soil samples were taken in the area of the trial using a soil probe on 4/30/01 and 4/16/02 and sent to DANR labs for analysis. Samples were taken to 3 feet in one foot increments. Table 1.

Subtask 1.2: Apply potash and phosphate fertilizers.
Potassium sulfate was pre-weighed and applied to respective plots on June 1, 2001 and June 5, 2002. Phosphorous was applied as MAP at 60 lbs/A equivalent. Both fertilizers were hand applied in a furrow to the middle of each plot and covered.

Subtask 1.3: Install drip system.
The drip system for this trial was installed June 28, 2001 and June 14, 2002. Prior to this time, the plot area had been watered, but not fertilized, with the grower's initial irrigation assembly.

Subtask 1.3b: Water meter.
A water meter was installed July 30, 2001. Unfortunately, this meter failed and was replaced by a new meter on August 13. A water meter was installed June 14, 2002 when the drip system was separated from the field assembly. Water usage up to September 13 was 307,250 gallons, which is equivalent to almost 2 acre-feet.

Subtask 1.4: Nitrogen application.
Nitrogen applications through the drip system began July 5, 2001. Vines were beginning to run at this point. N source throughout the trial was CAN17. To better meet the growing demands of the crop and the availability of the N source, the injection schedule was adjusted slightly from what was originally proposed. In 2002, nitrogen was injected on 7 rather than 8 applications. The injection schedule used:

application	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
Date, 2001	7/5/01	7/13/01	7/18/01	7/2/01	7/30/01	8/3/01	8/8/01	8/13/01	
Date, 2002	6/26	7/5	7/10	7/16	7/23	7/29	8/2		
rate	1/2 x	1 x	1 x	1.5 x	1.5 x	1 x	1/2 x	1/2 x	Total
LbsN/A	3.5	7	7	10.5	10.5	7	3.5	**3.5**	**52.5**
	7.0	14	14	21.0	21.0	14	7.0	**7.0**	**105.0**
	14.0	28	28	42.0	42.0	28	14.**0**	**14.0**	**210.0**

Note: in 2002, only 7 applications were made, the last receiving a 1 x rate.

Water samples were taken during fertilizer injection from each drip line on August 13, 2001 to confirm that nitrogen was flowing through the system and that the irrigation water did not already contain high nitrate levels. Table 2.

Subtask 1 .5. Plant sampling.
Leaf and petioles samples were taken July 6, August 13, and September 17, 2001 and were sent to DANR labs for N and K analysis. Above ground biomass determinations were made September 17 by harvesting 10 feet of one row from the 150 lb K2O plots (samples were also measured in the 0 K plots that received 100 lbs N/A). Table 3.

Leaf and petioles samples were taken June 17, July 25, and August 15, 2002, and were sent to DANR labs for N and K analysis. Above ground biomass determinations were made September 12 by harvesting 10 feet of two rows from the 150 lb K_2O plots. Tissue samples were taken at that time to determine nitrogen in the leaves and stems. Results for the June sampling are listed in Table 4. Biomass weights are listed on Table 4.

Subtask 1 .6: Harvest.
Harvest occurred on Oct 31, 2001 and Nov 1, 2002. The plots were harvested using a commercial 1-row digger and then sorted using standard USDA classification into #1's, Mediums, Jumbos, and culls. Yield results are shown in Tables 5 and 6. There was a significant response to N in both years, but a response to K only in 2002.

Subtask 1 .7. Statistical analysis.
Means and treatment analysis are shown on the individual tables. Results were analyzed using standard AOV procedures for the split-plot design. Mean separation procedures used were Fishers Unprotected LSD at the 95% or 90% confidence level. Regression analysis was performed using linear or quadratic models that best fit the data. Results from the regression analysis are covered under Task 3: fertilizer guidelines.

TASK 2. Storage effects.
Weight loss in storage for the time period Nov 2001 to May 2002 is shown in Table 7 (2001 harvest) and for the period Nov 2002 to march 2003 is shown in Table 8. At almost all evaluations, no significant differences in weight loss due to fertilizer level were found. Cumulative weight loss for the 7 month period ranged from 10.7 to 12.7%. For the 2001 harvest, the 150 lbs K20/A rate had significantly higher weight loss than the other treatments. This did not occur in 2002.

TASK 3. Guidelines.
Subtask 3.1: Correlation curves. Correlation curves relating plant and soil response to fertilizer rate are shown in Table 9. In general, there was a significant response to N and K fertilizer in plant tissue and the soil as fertilizer rates increased. Increasing N rates increased yield, but there was no response to K fertilizer in 2001. In both years, these curves showed a significant correlation between the amount of K applied and that in the soil, but no relationship between soil K levels and yield. Furthermore, there was no strong relationship between tissue tests and yield.

Subtask 3.2: Tissue guidelines.
Very little relationship was found between the petiole N and K analyses and yield in either year. There was a slight positive relationship with both petiole N03-N and K to yield at the July sampling, but none with the August plant sampling. Nonetheless, the significant response curves to fertilizer rate suggest zones where levels are sufficient. Using these curves and others from previous years (Figures 1 and 2), new guidelines are listed in Table 9.

Subtask 3.3. Cost benefit analysis. A cost - benefit analysis is best run on #1 yields, both because this has the best fit for regression analysis and because this is the potato class than gives greatest monetary return to the growers. Based on 2001 yield data, there was no significant increase in yield of #1's when N rates increased from 100 to 200 lbs/A. A best fit regression curve fitted to the data gives the equation:

$Y_{boxes} = 328.2 + 2.11\ N - 0.00731\ N^2$ $\quad\quad R^2 = 23\%$

Where Y = #1 yield in boxes per acre and
N = nitrogen rate in lbs per acre.

Taking the first derivative of this equation gives the N rate where maximum yield occurs:

$N_{MAX} = dy/dx = 2.11 - 0.0146\ N$

Solving this equation gives maximum yield of 480 boxes /A at 145 lbs N/A. This rate is 25 pounds per acre higher than current recommended rates by UCCE.

Maximum economic yield can be calculated by using current fertilizer costs and sweetpotato prices with the above equation. Current prices received are about $6 per 40 lb box ($0.15/lb), while CAN17 runs about $175 per ton ($0.51/lb N).

$N_{ECONOMIC}$: 0.15/0.515 = 2.11 - 0.0146 N

Solving this equation gives maximum economic yields of 478 boxes per acre at 125 lbs N/A. This is considerably less than what most growers currently use.

In 2002, the best-fit regression curve for #1 yield:
$Y_{boxes} = 555.2 + 1.18\ N - 0.0053\ N^2$
and the maximum yield calculated to occur at 111 lbs/A and maximum economic yield at 84 lbs N/A.

Relative yields, where yields from the check plots are compared to the treated plots and expressed as a percent, can be used to compare treatment effects across all four years of this study. The relative yield chart for nitrogen is shown in Figure 3. Combining all years, best yields for #1's or TMY occurred at 125 - 175 lbs N per acre. Jumbo yields continued to increase as N fertilizer rates increased. A relative yield comparison was not done for potash because there was a response to fertilizer K in only one year of this study.

TASK 4. Nitrogen loss evaluation.
Subtask 4.1: Initial soil sampling.
Complete 4/30/2002. Results are listed in Table 1.

Subtask 4.2: Fall soil sampling.
Deep soil samples (0 to 3 ft in 1 ft increments) were taken for each plot in August in 2001 and 2002. Samples were composites of 3 cores per plot, taken directly beneath the drip tape. Grower was still irrigating and the profile was wet to at least 3 feet. Samples were air dried and sent to DANR labs for N and K analysis. Results are shown in Figures 4 - 7.

Subtask 4.3: Environmental Analysis.
Using the data from plant analyses, yield, and soil results, a nitrogen balance was calculated for this system for both years. About 200 lbs N/A was found in the treatments receiving 50 and 100 lbs of N, and 300 lbs N/A at the 200 lb fertilizer rate (Tables 10 & 11). It has already been shown that the best rate was 125 - 175 lbs N/A for maximum yield; this table shows that nitrogen fertilizer rates over 175 lbs per acre increase vine weight, leaf N, root N, and the amount of N03-N in the soil, but do not consistently increase yield.

Results from the deep soil sampling in the fall and spring suggest that there is little movement of unused nitrogen to depths lower than three feet in the soil. This may have occurred because the amount of water applied did not leach substantially beyond the root zone; because the crop utilized all of the available N, or because our sampling period missed flushes of nitrogen out of the root zone. Whether this occurred or not is beyond the scope of this research.

Subtask 4.4: Spring sampling.
Spring samples were taken in March, 2002 and 2003 to evaluate the NO3-N levels in the soil in the plots after the winter. Samples were taken in the 200 lb N/A plots to a depth of 3 ft. The ground where the plots were located had laid fallow all winter, and there had been no post harvest field work. In 2002, nitrate-N significantly increased with depth, suggesting that some movement on N did occur over winter (Figure 8). The amount found at 3 feet averaged less than 10 ppm N03-N, with maximum levels below 13 ppm.
In 2003, more nitrogen remained at the surface than was found at the lower depths.

OUTREACH

Results from this trial were presented at these conferences, meetings, and newsletters:

- ✓ Summary printed in proceedings from the FREP Conference, November 2003.
- ✓ National Sweetpotato Collaborators Trial, Mobile, AL. February 2003.
- ✓ Annual UCCE Sweetpotato Meeting, Merced, CA. February 2003.
- ✓ Sweetpotato Tips Newsletter, December 2002.
- ✓ Presented at the CDFA-FREP Conference, Tulare, CA. November 2002.
- ✓ Sweetpotato Research Progress Report, 2002. Summary report mailed to many growers and posted on the UCCE website.
- ✓ Article in Ag Alert (State Farm Bureau Publication) about December 2002.
- ✓ Annual UCCE Sweetpotato Meeting, Merced, CA. February 2002.
- ✓ Sweetpotato field meeting, September 5, 2001. Opportunity for growers to see the trial in the field before harvest.
- ✓ Sweetpotato Research Progress Report, 2001. Summary report mailed to many growers and posted on the UCCE website.
- ✓ Research report summary given at the Sweetpotato Council of California monthly meeting, fall of 2001 and 2002.

Table 1. Spring initial soil samples, 2001 and 2002.

Year	Sample depth	pH	EC	CEC	NO,N ppm	P ppm	Sol K ppm
2001	0 - 12"	5.8	0.79	6.8	13.7	58.1	51.0
	12-24"	5.2	0.64	9.0	8.6	23.8	23.1
	24-36"	5.5	0.53	8.4	6.2	15.8	11.9
2002	0 - 12"	4.7	0.89		21.5	68.6	86
	12-24"	5.0	0.44		6.2	27.9	50
	24 - 36"	5.5	0.62		9.4	19.2	52

EC = electrical conductivity in mmhos/cm.
CEC = cation exchange capacity in meq/100 g (not determined in 2002)

Table 2. Water samples taken during fertilizer injection on August 13, 2001:

N rate	pH	EC, mmhoslcm	K, ppm	NO3-N, ppm
0	6.05	0.05	1.1	< 10
50	6.13	8.3	3.6	835
100	6.40	16.0	6.0	1663
200	6.55	34.9	18.3	4570
LSD 0.05	**NS**	**12.0**	**3.9**	**1185**

Table 3. Leaf and petiole sample results, 2001.

N rate	July 6	Aug 13	Sept 17	Sept 17
Lbs/A	NO3-N ppm	NO3-N ppm	NO3-N pm	Vine weight, lbs/A
0	3765	223	1375	868
50		657	4210	1309
100		1398	2858	1437
200		3570	7433	1589
LSD 0.10		502	1935	345
K rate				
Lbs/A	K%	K%	K %	
0	5.19	3.37	2.56	---
75	5.52	3.46	---	---
150	6.11	3.74	2.72	1301
300	5.95	4.24	---	---
LSD 0.10	0.53	0.29	NS	---

1. Vine weight is the total dry weight (6% D.M.) of the vine plus leaves by the end of the season (September sampling). 150 K20 plot only sampled.

LSD = Least Significant Difference at the 90% confidence level. Means separated by less than this amount are not significantly different.

Table 6. Main effect of nitrogen and potash rate on yield and grade of Beauregard sweetpotatoes in 2002.

Treatment		#1's	Jumbos	Mediums	Total Market Yield	% #1's	Culls Bins/A
N rate			--------- 40 lb boxes/A --------				
	0	559	336	168	1063	52.7	1.04
	50	590	335	180	1105	53.8	1.38
	100	629	318	213	1160	53.5	1.14
	200	579	324	208	1112	52.1	1.34
LSD 0.10		39.0	NS	25.1	45.4	NS	NS
K rate	0	580	311	185	1076	53.9	1.31
	75	594	306	183	1083	55.1	1.00
	150	590	347	198	1135	52.1	1.08
	300	591	350	203	1145	50.9	1.52
LSD 0.10		NS	36.0	NS	38.4	2.5	NS
N x K LSD		NS	NS	NS	NS	NS	NS
CV, %		8.3	18.3	19.0	5.8	8.0	76.0

US #1's: Roots 2 - 3.5" in diameter, 3 - 9" in length, must be well shaped and free of defects.
Mediums: Roots 1 - 2" diameter, 3 - 7" in length.
Jumbos: Roots that exceed the diameter and length requirements of the above two grades, but are of marketable quality.
% US #1's: Wt. of US #1's divided by the total marketable wt (culls not included).
Culls: Roots >1" in diameter and so misshapen or unattractive as to be unmarketable.
LSD 0.10: Least significant difference at the 90% probability level. NS = not significant.
CV Coefficient of variation, a measure of variability in the experiment.

Table 7. Storage weight loss for sweetpotatoes as affected by fertilizer treatment for the period November 2001 to May, 2002.

N rate Lbs/A	*K2O rate Lbs/A*	*6 weeks*	*12 weeks*	*18 weeks*	*24 weeks*	*30 weeks*	*Cumulative*
			Post Harvest Weight Loss, **%**				
0		3.9	2.3	2.6	1.3	1.9	12.0
50		3.3	2.0	2.5	1.5	1.9	11.1
100		3.6	2.4	2.9	1.6	2.2	12.7
200		3.3	1.8	2.3	1.3	2.0	10.7
LSD 0.10		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	0	3.5	2.0	2.1	1.4	1.9	11.0
	75	3.5	2.2	2.7	1.4	1.8	11.6
	150	3.8	2.2	2.8	1.6	2.2	12.7
	300	3.2	2.1	2.7	1.3	1.9	11.1
	LSD	**NS**	**NS**	**0.5**	**NS**	**NS**	**1.3**

LSD = Least significant difference at the 90% confidence level.
NS = not significant

Table 6. Main effect of nitrogen and potash rate on yield and grade of Beauregard sweetpotatoes in 2002.

Treatment		#1's	Jumbos	Mediums	Total Market Yield	% #1's	Culls Bins/A
N rate		---------	40 lb boxes/A --------				
	0	559	336	168	1063	52.7	1.04
	50	590	335	180	1105	53.8	1.38
	100	629	318	213	1160	53.5	1.14
	200	579	324	208	1112	52.1	1.34
LSD 0.10		39.0	NS	25.1	45.4	NS	NS
K rate	0	580	311	185	1076	53.9	1.31
	75	594	306	183	1083	55.1	1.00
	150	590	347	198	1135	52.1	1.08
	300	591	350	203	1145	50.9	1.52
LSD 0.10		NS	36.0	NS	38.4	2.5	NS
N x K LSD		NS	NS	NS	NS	NS	NS
CV, %		8.3	18.3	19.0	5.8	8.0	76.0

US #1's: Roots 2 - 3.5" in diameter, 3 - 9" in length, must be well shaped and free of defects.

Mediums: Roots l - 2" diameter, 3 - 7" in length.

Jumbos: Roots that exceed the diameter and length requirements of the above two grades, but are of marketable quality.

% US #1's: Wt. of US #1's divided by the total marketable wt (culls not included).

Culls: Roots >1" in diameter and so misshapen or unattractive as to be unmarketable.

LSD 0.10: Least significant difference at the 90% probability level. NS = not significant.

CV Coefficient of variation, a measure of variability in the experiment.

Table 7. Storage weight loss for sweetpotatoes as affected by fertilizer treatment for the period November 2001 to May, 2002.

N rate Lbs/A	*K2O rate Lbs/A*	*6 weeks*	*12 weeks*	*18 weeks*	*24 weeks*	*30 weeks*	*Cumulative*
			Post Harvest Weight Loss, %				
0		3.9	2.3	2.6	1.3	1.9	12.0
50		3.3	2.0	2.5	1.5	1.9	11.1
100		3.6	2.4	2.9	1.6	2.2	12.7
200		3.3	1.8	2.3	1.3	2.0	10.7
LSD 0.10		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	0	3.5	2.0	2.1	1.4	1.9	11.0
	75	3.5	2.2	2.7	1.4	1.8	11.6
	150	3.8	2.2	2.8	1.6	2.2	12.7
	300	3.2	2.1	2.7	1.3	1.9	11.1
	LSD	**NS**	**NS**	**0.5**	**NS**	**NS**	**1.3**

LSD = Least significant difference at the 90 % confidence level.
NS = not significant.

Table 8. Storage weight loss for sweetpotatoes as affected by fertilizer treatment for the period November 2002 to March, 2003.

N rate		*K2O rate*	*8 weeks*	*18 weeks*	*Cumulative*
Lbs/A		*Lbs/A*			
				Weight loss, %	
0			4.9	5.1	9.7
50			4.7	4.6	9.6
100			5.0	4.9	10.0
200			5.4	5.6	10.7
LSD 0.10			**NS**	**NS**	**NS**
		0	4.8	4.7	9.3
		75	5.0	5.5	10.8
		150	4.8	5.2	10.1
		300	5.3	4.6	9.8
		LSD 0.10	**NS**	**NS**	**NS**

LSD = Least significant difference at the 90% confidence level.
NS = not significant.

Table 9. Correlation curves.

Year	Relationship	Equation	P value	R2
2001	N rate lbs/A to Aug petiole N03-N ppm	217 + 6.59(Nrate) + 0.05 1 (Nrate)2	0.001	81%
	K rate lbs/A to Aug petiole K%	3.31 + 0.003(Krate)	0.001	31%
	K rate lbs /A to soil K lbs/A	432 + 0.51(K20)	0.001	38%
	Aug. petiole N03-N ppm to TMY	715 + 0.10(N03)	0.05	8.8%
	Aug petiole K % to TMY	1160 - 96.3(K2O)	0.01	8.8%
	Soil K lbs/A to TMY	943	NS	---
	N rate to #1 yield	330 + 2.08(Nrate) - 0.0072(Nrate)2	0.01	25%
	N rate to TMY	709 + 1.09(Nrate)	0.01	20%
	K rate to #1 yield	434	NS	----
	K rate to TMY	827	NS	---
2002	N rate lbs/A to July petiole N03-N ppm	2236 + 25.6(Nrate)	0.001	81%
	N rate lbs/A to Aug petiole N03-N ppm	1201 - 1.18(Nrate) + 0.160(Nrate)2	0.001	87%
	K rate lbs/A to July petiole K%	4.35 + 0.01(Krate) - 0.000021(Krate)2	0.001	51%
	K rate lbs/A to Aug petiole K%	3.89 + 0.0057(Krate)	0.001	52%
	K rate lbs /A to soil K lbs/A	587 + 0.44(Krate)	0.01	14%
	July petiole N03-N ppm to TMY	1010 + 0.04(N03) - 0.000004(NO3)2	0.10	5%
	July petiole K % to TMY	930 + 35.4(K)	0.05	7.5
	Aug petiole N03-N ppm to TMY	1101	NS	
	Aug. petiole K % to TMY	1041	NS	---
	Soil K lbs/A to TMY	1135	NS	---
	N rate to #1 yield	555 + 1.18(Nrate) - 0.0053(Nrate)2	0.01	16%
	N rate to TMY	1058 + 1.55(Nrate) -0.0063(Nrate)2	0.01	16%
	K rate to #1 yield	588	NS	---
	K rate to TMY	1080 + 0.24(Krate)	0.01	10%

TMY = total marketable yield in 40 lb boxes/A. Soil K = total cumulative K in 0 - 3 ft soil profile. P value = F statistic. NS = not significant.

Table 10. Suggested petiole nitrate and potassium sufficiency ranges as developed from the drip fertilizer trial, 1999 - 2002.

Sampling period	*Petiole NO3-N*	*Petiole K*
	Sufficiency ranges	
Vining (4 - 6 weeks post transplant)	**3,000-5,000 ppm**	4.5-5.5%
Root bulking (8 - 10 weeks post transplant)	2,000 - 4,000 ppm	3.5-4.5%

UCCE guidelines currently advise 2500 ppm N03-N, and 5% K at mid-growth. Petioles should be taken 6`n leaf from the growing tip, with the leaf blade removed (inclusion of the leaf blade dilutes the sample). A minimum of 30 petioles should be collected for a good sample.

Table 11. Partial soil N balance based on vine weight, root yields, and soil N03-N in the upper three feet of the profile for the 2001 season.

N rate	*Vine wt' Lbs/A*	*Vine N ppm NO3*	*Vine N Lbs/A2*	*Root wt Lbs/A*	*Root N %*	*Root N3 Lbs/A*	*Soil N' Lbs/A*	*TOTAL N Lbs/A*
1. 0 lbs/A	868	1375	30.6	27,400	0.85	48.0	18.5	97.1
2.50lbs/A	1309	4210	63.9	31,360	1.15	74.3	27.0	165.2
3. 100 lbs/A	1437	2858	59.9	33,200	1.01	69.1	37.3	166.3
4. 200 lbs/A	1589	7433	103.0	36,600	1.52	114.6	93.2	310.8
Average	1301	3969	64.3	32,200	1.13	---	44.0	
LSD 0.05	426	2388	25.2	6360	0.25	---	26.8	

1. Vine weight is the total dry weight (6% D.M.) of the vine plus leaves by the end of the season (September sampling).
2. Vine N estimated by converting N03-N values to total N% and multiplying by dry weight.
3. Root nitrogen is total dry weight of roots using total marketable yield (D.M. = 20.6%) multiplied by N% in roots.
4. Soil N is the sum of NO3-N in the upper 3 feet of soil based on soil bulk density of 1.7, 1.6, and 1.5 g cm -3 for the 1s` 2nd and 3rd foot in the profile, respectively (soil BD values based on USDA NRCS soil survey data).

Table 11. Partial N partitioning g based on vine weight, roots, and soil, 2002.

N rate	*Vine wt*	*Vine N*	*Vine N*	*Root wt*	*Root N*	*Root N*	*Soil N*	*TOTAL N*
Lbs/A	*Lbs/A'*	*%*	*Lbs/A*	*Lbs/ZA*	*%3*	*Lbs/A*	*Lbs/A4*	*Lbs/A*
0	1883	2.29	43.1	12,760	0.85	108	11.7	162.8
50	2459	2.61	64.2	13,270	1.15	153	17.1	234.3
100	2600	2.36	61.4	13,920	1.01	141	40.0	242.4
200	3048	3.15	96.0	13,340	1.50	200	61.5	357.5
LSD 0.1 1	385	0.28	12.0	545	---	---	10.0	

1. Vine weight is the total dry weight (12.5% D.M.) of the vine plus leaves at the end of the season (September sampling).
2. Root weights are at 30% D.M. of TMY.
3. Root N% based on 2001 data.
4. Soil N is the sum of N (as NO3) in the upper 3 feet of soil based on soil bulk density of 1.7, 1.6, and 1.5 g CM -3 for the 151, 2nd, and 3`d foot in the profile, respectively (soil BD values based on USDA NRCS soil survey data). LSD value determined on natural log adjusted values and converted back for this table.
5. LSD 0.10 = least significant difference at the 90% confidence level. Means separated by less than this amount are not significantly different.

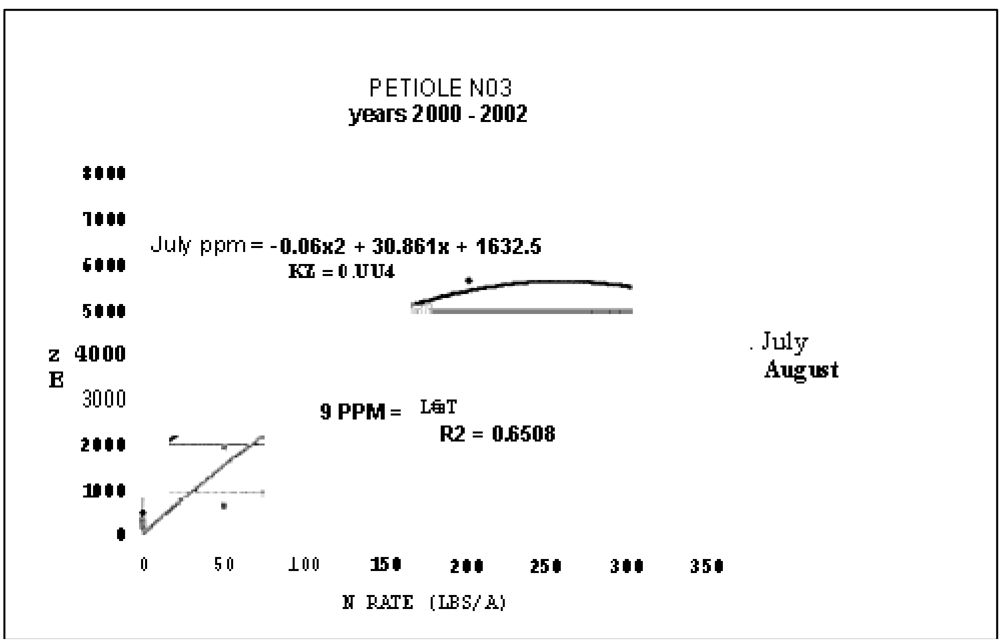

Figure 1. Correlation between petiole NO3-N and N rate for July (top line) and August (bottom line) for years 2000 - 2002. Boxes correspond to that area where yield was maximized (125 to 175 lbs N/A).

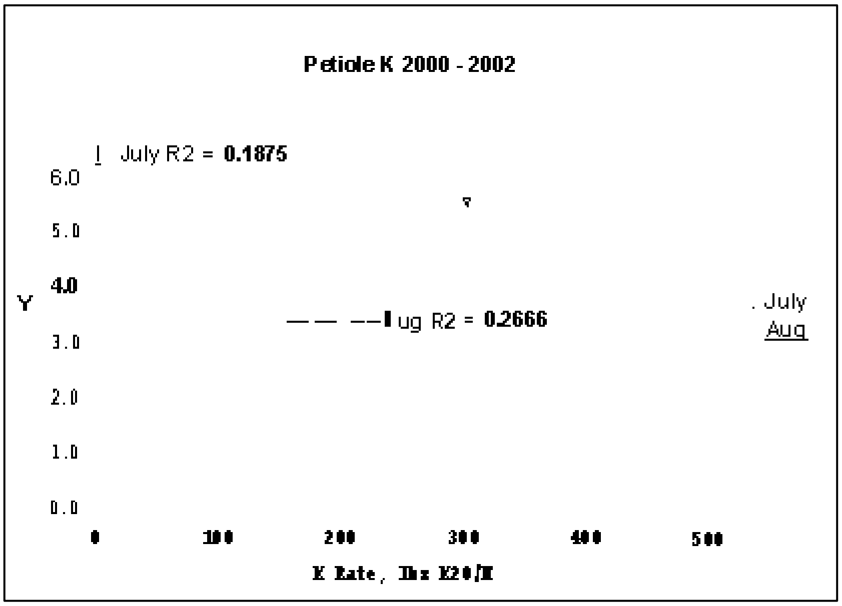

Figure 2. Correlation between petiole K and potash rate as measured in July (top line) and August (bottom line) from 2000 - 2002

Relative Yield

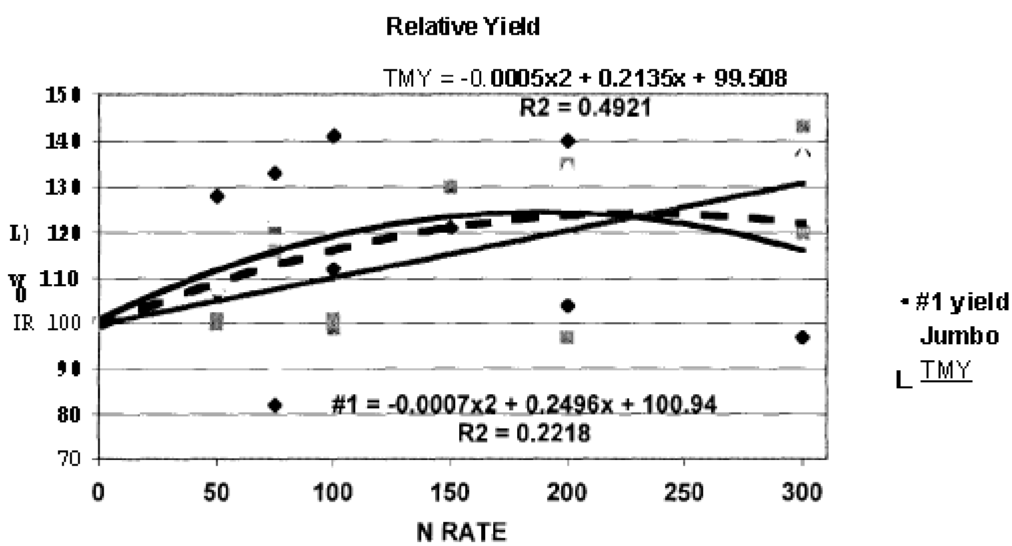

Figure 3. Relative sweetpotato yield response over 4 years, % increase as compared to untreated control. Best overall yields occurred at 125 - 175 lbs N/A.

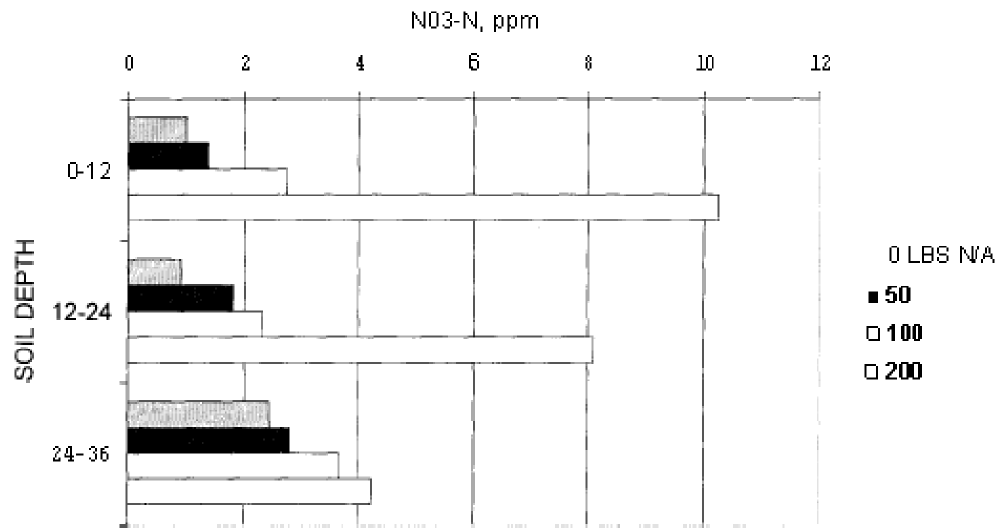

Figure 4. Average soil nitrate-nitrogen (N03-N in ppm) in Aug 2001 for different depths and nitrogen fertilizer treatments. LSD (0.90) for 12, 24, and 36" depths are 2.41, 2.28, and 1.15 ppm respectively.

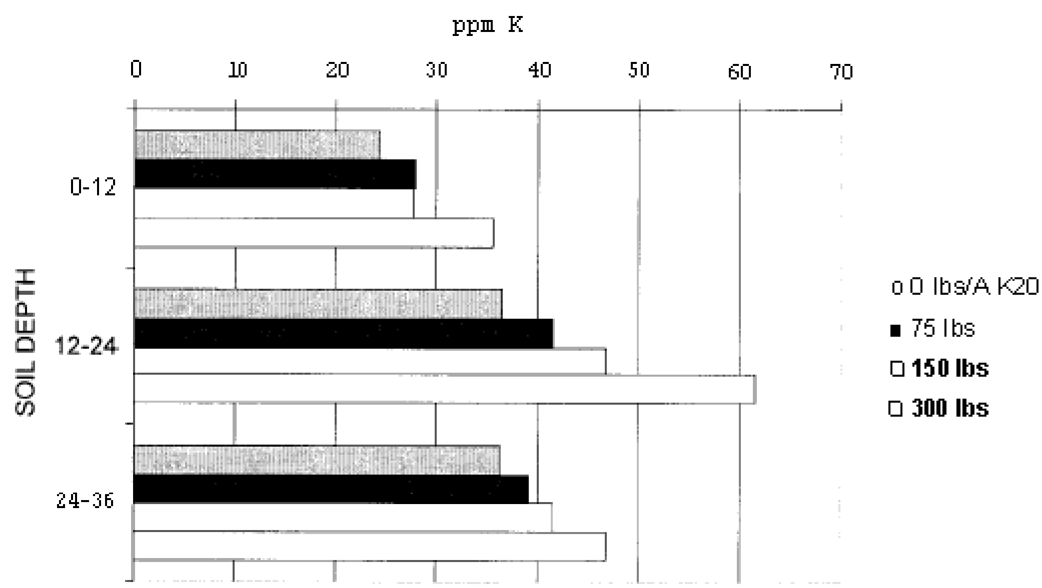

Figure 5. Average soil potassium (as ppm K) from 0 to 3 feet as affected by potash fertilizer rate, Aug 2001. LSD (0.90) for 12, 24, and 36" depths are 4.16, 7.05, and 4.33 ppm respectively.

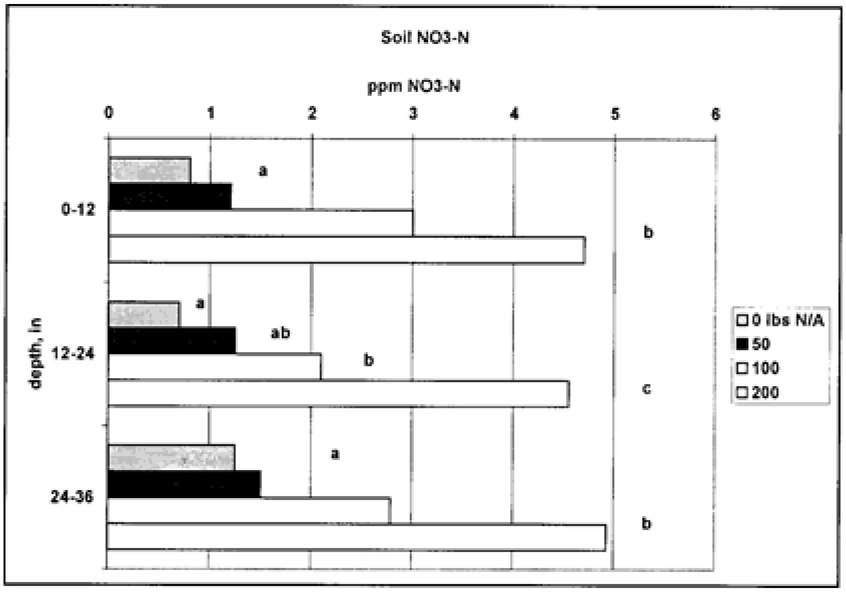

Figure 6. Fall 2002 soil sample NO, -N results at 1, 2, and 3 feet for the various nitrogen treatments. LSD 0.05 performed on log-transformed data. Bars with the same letter are not significantly different.

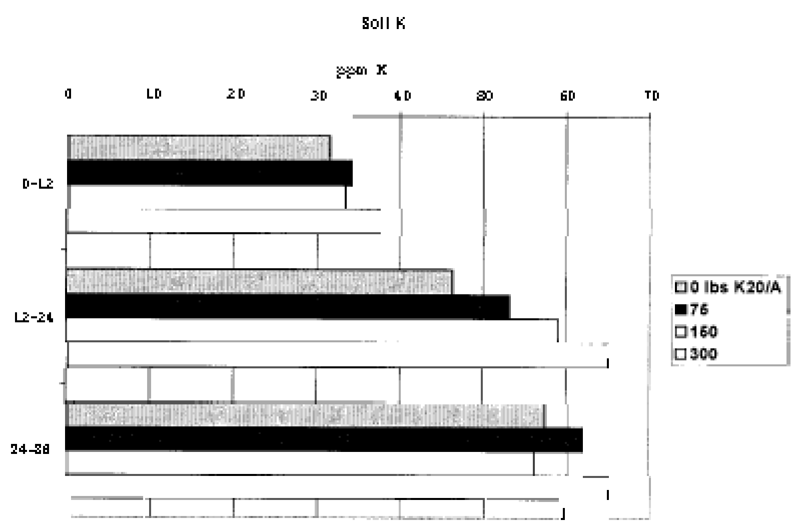

Figure 7. Soil K levels for different depths as affected by potash treatment, fall 2002. LSD 0 . 10 for 1, 2, and 3 feet are NS, 10 ppm , and NS, respectively (means separation performed on log -transformed data).

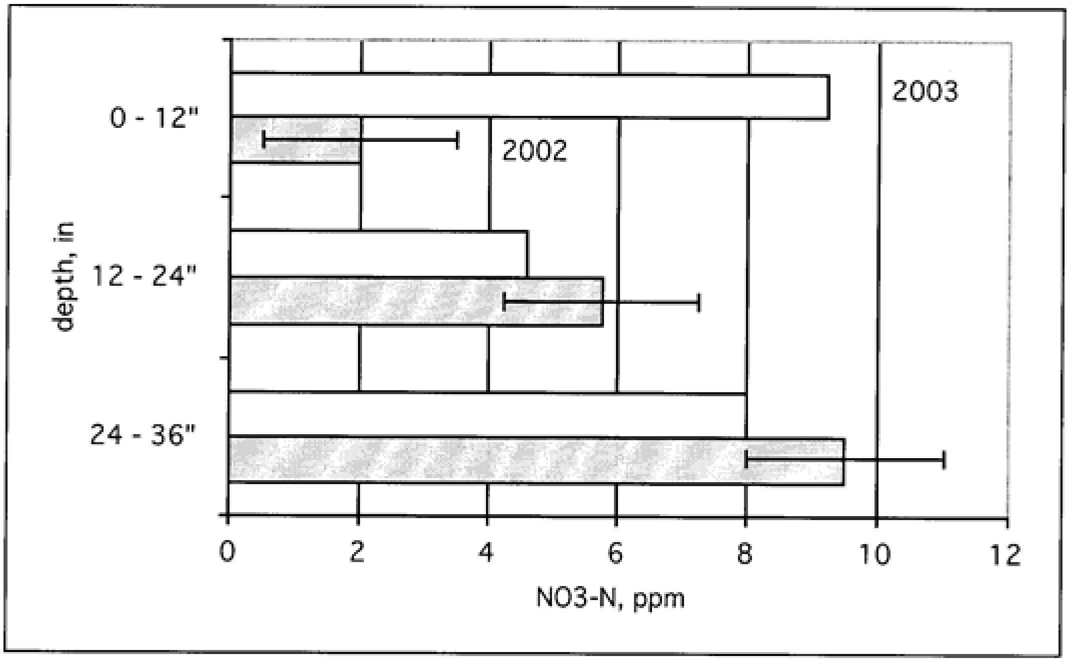

Figure 8. Spring 2003 (top) and 2002 (bottom) soil samples N03-N results in the soil profile for the 200 lbs/A nitrogen treatments. 2002 LSD 0.05 = 3.1 ppm. No stats could be run on the 2003 data.