

FOLIAR APPLICATION OF NUTRIENTS TO PINTO BEANS ON NAPI AND THE AGRICULTURAL SCIENCE CENTER

Greig Weiler¹

OBJECTIVES

This test was conducted to test the effect of foliar nutrients on pinto beans on the Agricultural Science Center and NAPI Fields #6-18 and #6-20. Foliar were sprayed twice on plots on those two areas and plants samples were taken to track uptake of nutrients on those plots.

MATERIALS AND METHODS

Three fields were planted to pinto beans in June of 1989. At the Agricultural Science Center, UI-126 pintos were planted at a rate of 105 lb/ac on June 1, 1989. On NAPI Field #6-18 on June 7, UI-126 pintos were planted at a rate of 103 lb/ac. On June 7, NAPI field #6-20 was planted to Topaz pinto beans at a rate of 99lb/ac.

At the end of July when 75% of the bean pods were 3" long on all fields, plots were marked out in 10ft by 5ft segments. Each plot was three rows by 10ft by 5ft segments. Each plot was three rows wide by 10ft long, with foliar applied parallel to the rows. All treatments were applied in a randomized complete block design with four replications of each treatment made on all fields.

An R & D Backpack sprayer (301D), equipped with a single boom sprayer nozzle (601D). A single 5 lb CO tank and a 3 gal Sparten Stainless Steel Beverage Tank was also attached with a pressure regulator to release spray at 40 psi. All treatments were applied at rates recommended by the foliar manufacturer and calibrated to the sprayer. Each plot received approximately 250 mls. of liquid at the above pressure

The agricultural Science Center received foliar treatment on July 27, 1989 and August 9,1989. Fields #6-18 and #6-20 received foliar on July 28, and August 9,1989. Below is an outline of treatments and rates applied.

Treatment ²	Nutrients applied	Rates of Applications
Check (no foliar)	-----	-----
Folizyme	15-2-0-3Ca	1 gal/ac
Trigger	0.002% cytokinin	4 oz/ac
12-48-8+Micros	12-48-8+Mg, Fe, Mn, Cu, Zn, B, Mo, Co	2 lb/ac + 1 lb/ac
Zinc	Amino Acid Chelates	32 oz/ac
Iron	Amino Acid Chelates	32 oz/ac
Manganese	Amino Acid Chelates	32 oz/ac
Folizyme + Trigger	15-2-0-3Ca + Citokinin	1 gal/ac + 4 oz/ac

Plant samples were taken before spraying from just outside the plot area on all fields. Two weeks after each foliar, individual sample from each plot were taken. Samples consisted of 30 of the 1st mature leaves from plants in each plot.

All the beans in the three rows of plot sprayed were hand harvested, thrashed with an Almaco low profile plot thrasher, and then weighed for total weight per plot and weight per 1000 beans.

¹ Soil scientist, BIA/NAPI, New Mexico State University

² Zinc, Iron and Manganese are amino acid chelates supplied by JH Biotech, Inc.

RESULTS AND DISCUSSIONS

Yields of beans of all fields were quite variable and showed no significant difference due to foliar applied (Table 1). The highest yielding treatment on the Ag Science center was manganese amino acid chelate at 32 Oz/ac that yielded 1907 lb/ac. The second highest treatment yielded 1850 lb/ac beans when 12-4-8 and micronutrients were applied in combination. On field #6-18 the application of cytokinin 4 oz/ac yielded 3887 lb/ac beans, the higher on that field. The second highest yield (3765 lb/ac) was when zinc amino acid chelate was applied at (32 oz/ac). The third highest Trigger (cytokinin) at rate of 1 gal + 4 oz/ac. Iron amino acid chelate at 32 oz/ac yielded highest at 3929 lb/ac. The second highest was with application of no foliar yielding 3870 lb/ac. Folyzime at 1 gal/ac yielded third highest at 3866 lb/ac.

The reason for the large difference in yields through the three fields cannot be explained by treatments. With the weather being unusually hot for an extended period of time, bean plants were growing extremely fast. Application of foliar in this type of weather may best be completed in the first few weeks of vining of the plants to be most effective. The application of foliar was not completed until pods were three inches long on the NAPI fields, and not until blooms had begun to abort on the Ag Science Center field. Some of the abortion of bloom on the Ag Science Center field was due to poor water applications to that field. The low yields as compared to the NAPI fields are a reflection of that difference in watering.

Weights of Beans per 1000 were not significantly different due to treatment applied (Table 2). On the Agricultural Science Center, application of 12-48-8 + micronutrients produced the highest weights. Fields on NAPI produced different results.

On field #6-18, iron amino acid chelate produced the highest weights. Folyzime applied at 1 gal/ac on field #6-20 produced the highest weights of beans. Also on that field, iron amino acid chelate produced the second highest weights.

The application of foliar to fields did produce some significant results on the levels of nutrients in plant tissue (Table 3,4,5). At the Agricultural Science Center, only zinc was significantly higher in tissues and only on the second sample date. The zinc amino acid chelate caused zinc in tissues to be significantly higher than the check where no foliar was applied. When zinc was applied, tissue levels of 47 ppm Zn, versus only 34 ppm Zn in check tissue. Levels of nutrients in tissues at the Science Center were lower at the second sample date in total N, P, K and B, but higher or nearly the same for Ca, Mg, Zn, Fe, Cu, and Mn on the second sample date.

Table 1. Yield of Beans on Three Fields Sprayed with Foliar Nutrients, 1989-Test Year

Treatment	Ag Sci. Cent. lb/ac	Fld #6-18 lb/ac	Fld # 6-20 lb/ac
Check (no foliar)	1621	3658	3870
Folyzime	1703	3651	3866
Trigger	1682	3887	3732
12-48-8 +Micro	1850	3592	3734
Zinc Chelate	1758	2765	3822
Iron Chelate	1845	3522	3929
Manganese Chelate	1907	3659	3756
Folyzime + Trigger	1630	3692	3839
AVG:	1749	3678	3819
LSD @ .05 =	ns	ns	ns
LSD @ .01 =	ns	ns	ns
CV =	19	7	6

Table 2. Weight Per 1000 Beans (grams) of Samples From Foliar Applications of Nutrients to Dry Beans.

Treatment	Ag Sci Cent. lb/ac	Fld #6-18 lb/ac	Fld #6-20 lb/ac
Check (no foliar)	332.7	376.7	390.7
Folizyme	328.8	373.0	396.4
Trigger	323.0	382.7	382.9
12-48-8 + Micros	335.6	378.7	384.3
Zinc Chelate	332.8	386.4	389.5
Iron Chelate	330.4	389.6	391.6
Manganese Chelate	331.9	387.2	389.3
Folizyme + Trigger	326.7	384.9	386.4
AVG:	330.2	382.4	388.9
LSD @ .05 =	ns	ns	ns
LSD @ .01 =	ns	ns	ns
CV =	5	3	3

On NAPI fields #6-18, plant nutrient levels were significantly different due to treatments for zinc and manganese only. Zinc levels were 12ppm higher at the first sample date and 5 ppm higher on the second sample date than the check (no foliar) when zinc amino acid chelate was applied. Manganese levels were significantly higher only on the second sample date. When manganese amino acid chelate was applied levels were 12 ppm higher than the check where no foliar was applied. Tissue levels of N, P, K were again lower at the second date of sampling, even when NPK fertilizers were applied.

Field # 6-20 on NAPI was planted to Topaz pintos and those tissue analyses showed different results than the other two fields. Significant differences were found in levels of K, Zn, Fe, and Cu. Potassium levels were significantly different only on the first date of sampling. The highest level of K was when Folizyme + Trigger were applied at 1 gal + 4 oz/ac or when Manganese amino acid chelate was applied at 32 oz/ac. Levels were 2.97 % K versus 2.63 % K with the check. Applications of amino acid based zinc foliar produced 41 ppm in tissues versus only 32 ppm in the check sprayed plots on the first sample date. On the second sample date, that same foliar produced a level of 54 ppm in foliar zinc treated versus check treated tissues, which had only 34 ppm in their tissues. Cooper levels were significantly higher only on the second sample date. With Trigger (cytokinin) applied at 4 oz/ac tissue levels of cooper were 23 ppm versus 17 ppm with no foliar applied.

On fields #6-20, levels of plants N, P, K, and Mg dropped from the first to the second sample dates. Plant tissue Ca, Zn, Fe, Cu, Mn, and B increased from the first to the second sample dates, exactly as happened on fields #6-18.

Comparing the two NAPI fields, tissue levels of nutrients in UI-126 pintos were different than Topaz pintos. Potassium levels in UI-126 pintos were lower than in Topaz pintos. Levels of micronutrients were generally higher in Topaz than in UI-126 pintos.

Previous research on pinto beans completed here in Northwestern New Mexico has shown little significant difference in treatments yields due to foliar applied, except when zinc or nitrogen or a combination of both were in the foliar. This year's research was quite variable and showed no significant differences due to zinc or nitrogen sources applied.

Table 3A. Plant Tissue Analyses From Two Dates; Two Weeks After Each Foliar Application of Nutrients to UI-126 pinto beans, Ag Science Center Test.

Treatment	N	P	K	Ca	Mg
Dates	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22
Check (no foliar)	3.65 2.47	0.26 0.15	1.71 1.11	2.41 3.30	0.36 0.37
Folizyme	3.68 2.60	0.26 0.17	1.71 1.29	2.35 3.28	0.35 0.37
Trigger	3.66 2.70	0.26 0.16	1.68 1.09	2.45 3.17	0.36 0.37
12-48-8 + Micros	3.71 2.53	0.26 0.15	1.84 1.14	2.50 3.29	0.37 0.39
Zinc Chelate	3.60 2.48	0.24 0.15	1.66 1.13	2.47 3.57	0.36 0.40
Iron Chelate	3.62 2.58	0.25 0.16	1.63 1.08	2.41 3.06	0.36 0.37
Manganese Chelate	3.47 2.48	0.23 0.15	1.60 1.09	2.54 3.47	0.37 0.39
Folizyme + Trigger	3.57 2.58	0.23 0.14	1.53 1.02	2.50 3.18	0.35 0.37
AVG:	3.63 2.55	0.25 0.15	1.67 1.12	2.45 3.29	0.36 0.38
LSD @ .05 =	ns ns	ns ns	ns ns	ns ns	ns ns
LSD @ .01 =	ns ns	ns ns	ns ns	ns ns	ns ns
CV =	4 6	8 9	8 9	5 10	5 9

Table 3B. Plant Tissue Analyses From Two Dates; Two Weeks After Each Foliar Application of Nutrients to IU-126 Pinto Beans, Ag Science Center Test (micronutrients)

Treatments	Zn	Fe	Cu	Mn	B
Dates	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22
Check (no foliar)	33 341	158 158	10 13	57 58	31 29
Folyzime	35 35	149 147	10 14	56 57	32 29
Trigger	33 28	142 152	10 14	56 57	32 29
12-48-8+ Micros	35 33	165 158	11 14	69 69	31 28
Zinc Chelate	37 47	136 178	9 15	66 66	29 31
Iron Chelate	32 30	139 208	9 14	62 60	29 28
Manganese Chelate	29 28	124 151	9 15	71 77	30 29
Folizae + Trigger	32 41	138 157	9 13	61 59	29 28
AVG:	33 34	145 164	10 14	62 64	31 29
LSD @ .05 =	ns 10	ns ns	ns ns	ns ns	ns ns
LSD @ .01 =	ns ns	ns ns	ns ns	ns ns	ns ns
CV =	11 21	23 30	14 19	14 17	7 6

Table 4A. Plant Tissue Analyses From Two Dates; Two Weeks After Each Foliar Application of Nutrients to UI-126 Pinto Beans, NAPI Fields #6-18

Treatment	N	P	K	Ca	Mg
Dates	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22
Check (no foliar)	3.71 3.50	0.28 0.22	2.05 1.69	1.67 3.15	0.26 0.30
Folizime	3.90 3.60	0.28 0.23	2.00 1.73	1.64 3.05	0.26 0.30
Trigger	3.71 3.53	0.28 0.23	1.95 1.61	1.65 3.14	0.25 0.31
12-48-8+ Micros	3.65 3.43	0.27 0.22	1.79 1.55	1.68 3.27	0.28 0.34
Zinc Chelate	3.73 3.48	0.27 0.22	1.90 1.54	1.67 3.08	0.26 0.30
Iron Chelate	3.59 3.43	0.24 0.22	1.72 1.42	1.71 3.31	0.28 0.37
Manganese Chelate	3.48 3.38	0.26 0.21	1.84 1.55	1.70 3.27	0.25 0.30
Folizyme + Trigger	3.68 3.48	0.28 0.22	1.97 1.55	1.75 3.08	0.27 0.33
AVG:	3.68 3.48	0.27 0.22	1.90 1.58	1.68 3.17	0.26 0.32
LSD @ .05 =	ns ns	ns ns	ns ns	ns ns	ns ns
LSD @ .01 =	ns ns	ns ns	ns ns	ns ns	ns ns
CV =	6 6	8 8	9 11	6 5	7 12

Table 4B. Plant Tissue Analyses From Two Dates; Two Weeks After Each Foliar application Of Nutrients to UI-126 Pinto Beans, NAPI Fields #6-18 (micronutrients)

Treatments	Zn	Fe	Cu	Mn	B
Dates	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22
Check (no foliar)	27 30	75 95	6 16	66 107	32 32
Folyzime	32 38	93 143	6 20	65 104	31 34
Trigger	26 31	80 109	6 16	62 104	29 32
12-48-8+ Micros	30 30	84 98	7 15	61 98	31 34
Zinc Chelate	39 45	80 76	6 14	67 103	29 32
Iron Chelate	26 30	91 128	6 15	61 101	29 33
Manganese Chelate	26 26	77 104	6 15	76 119	28 32
Folizae + Trigger	29 31	89 112	6 14	68 108	31 32
AVG:	29 33	84 108	6 16	66 106	30 33
LSD @ .05 =	5 9	ns ns	ns ns	ns 11	ns ns
LSD @ .01 =	7 12	ns ns	ns ns	ns ns	ns ns
CV =	13 18	11 25	14 24	10 7	6 9

nsI- significant at 0.10 level of confidence; LSD @ 0.10 = 84

Table 5A. Plant Tissue Analyses From Two Dates; Two Weeks After Each Foliar Application Of Nutrients to Topaz Pinto Beans, NAPI Fields #6-20.

Treatment	N	P	K	Ca	Mg
Dates	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22
Check (no foliar)	3.58 3.63	0.30 0.24	2.63 2.24	1.99 3.47	0.25 0.25
Folizime	3.95 3.76	0.32 0.26	2.71 2.29	1.87 3.10	0.24 0.20
Trigger	3.75 3.52	0.31 0.24	2.67 2.15	1.81 3.11	0.23 0.21
12-48-8+ Micros	3.72 3.73	0.28 0.24	2.60 2.25	2.00 3.28	0.23 0.22
Zinc Chelate	3.70 3.56	0.30 0.24	2.71 2.14	1.94 3.20	0.24 0.20
Iron Chelate	3.82 3.70	0.32 0.25	2.81 2.30	1.81 3.11	0.23 0.21
Manganese Chelate	4.00 3.80	0.33 0.27	2.97 2.36	1.77 3.11	0.23 0.21
Folizyme + Trigger	3.88 3.70	0.31 0.25	2.97 2.34	1.98 3.31	0.24 0.21
AVG:	3.80 3.67	0.31 0.25	2.76 2.34	1.90 3.20	0.24 0.21
LSD @ .05 =	ns ns	ns ns	0.24 ns	ns ns	ns ns
LSD @ .01 =	ns ns	ns ns	0.32 ns	ns ns	ns ns
CV =	5 6	8 9	6 10	9 6	8 14

ns-- @ 0.10 level of confidence; LSD @ 0.10 = 0.22

Table 5B. Plant Tissue Analyses From Two Dates; Two Weeks After Each Foliar Application Of Nutrients to Topaz Pinto Beans, NAPI Fields #6-20 (micronutrients)

Treatments	Zn	Fe	Cu	Mn	B
Dates	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22	8/8 8/22
Check (no foliar)	32 34	85 109	11 17	176 220	40 42
Folizime	34 41	88 117	11 17	167 217	40 44
Trigger	30 34	79 140	10 23	155 207	40 41
12-48-8+ Micros	28 34	87 131	11 19	160 234	39 45
Zinc Chelate	41 54	83 96	10 17	137 209	39 40
Iron Chelate	29 36	103 202	10 19	124 210	39 40
Manganese Chelate	30 33	78 117	10 18	143 247	40 41
Folizae + Trigger	32 44	93 112	10 17	158 208	39 40
AVG.:	32 39	87 128	10 18	152 219	40 42
LSD @ .05 =	5 9	15 ns	ns 4	ns ns	ns ns
LSD @ .01 =	7 12	ns ns	ns ns	ns ns	ns ns
CV =	12 16	12 37	13 14	28 33	6 8