UNIVERSITY OF FLORIDA

Institute of Food and Agricultural Sciences
North Florida Research and Education Center – Suwannee Valley

Snapbean and Sweet Corn Response to N Rate and Furrow-Placed Growplex Humate 97-21

George J. Hochmuth[1]

Abstract

Snapbeans and sweet corn were grown with various proportions of base N (90 lb/acre for snapbean and 150 lb/acre for sweet corn) ranging from zero to 100%. Growplex humate at 0, 1, or 2 lb/acre was factorially combined with N rate. Nitrogen fertilization increased yield and improved plant vigor of snapbean and sweet corn with yield of both crops maximized with 100% of the base rate, the recommended rate. Humate application had little effect on vigor or yield of either crop; although under suboptimal N with sweet corn, furrow applied humate resulted in yields similar to those with the full rate of N.

Materials and Methods

Snapbeans and sweet corn were grown in the fall season at the University of Florida Horticultural Research Unit in Gainesville, FL to evaluate plant growth and yield responses to N fertilization and humate applied in the seed furrow. Soil was plowed and disked in preparation for planting. Soil samples were taken from the upper 6 inches of soil and analyzed for P, Ca, K, Mg, Cu, Mn, and Zn concentration by Mehlich-1 extraction at the Extension Soil Testing Laboratory of the University of Florida in Gainesville, FL.

Beds were formed on 4-ft centers and preplant fertilizer was incorporated in the beds by rototilling on 13 August 1997. N and K_2O were applied at the rates of 20 lb/acre each from ammonium nitrate and potassium sulfate to each plot, except no N was applied to the plots receiving zero base N. Total N treatments were 0, 25, 50, 75, and 100% of the recommended (base) N, 90 lbs/acre for snapbean and 150 lbs/acre for sweet corn. Remaining N and K was side dressed. Beds were 6 inches high and 24 inches across the top. Beds were pressed and shaped and two grooves each 2 inches deep were made 12 inches apart in the bed surface in which to place seeds and humate.

On 13 August 1997 seeds of 'Seville' (Rogers Seed Company) snapbeans and 'Primetime' (Rogers Seed Company) sweet corn were placed in the furrows. Growplex humate (Grow-Plex SP, Earthgreen Products, Dallas, TX) was immersed in water and sprayed with a CO_2-powered backpack sprayer into the furrow with the seeds. Humate was applied once at 0, 1, or 2 lb of product per acre. An additional set of treatments

[1] George J. Hochmuth, Professor, Horticultural Sciences Department, University of Florida, Gainesville FL 32611

were used to evaluate foliar humate. Using the 75% base N fertilizer level and 0, 1, or 2 lb humate per acre, foliar humate was applied twice at midseason. Foliar Grow-Plex SP was applied at 4 oz/acre in 30 gal water with a CO_2-powered backpack sprayer. The first spray was made 8 September when beans were beginning to show flower buds and when sweet corn was 12 inches tall. A second spray was made on 15 September when beans were flowering and corn was 24 inches tall.

After seeding and humate application, the furrows were closed. Herbicides were used for weed control: Eptam, 3.5 pts/acre plus Dual, 1.25 pts/acre for the snapbeans, and Dual, 1.5 pts/acre plus Atrazine, 2 qt/acre for sweet corn. Irrigation was applied from overhead sprinklers to wet soil in beds. Irrigation was used in the season to keep soil moisture in beds at -8 to -10 on a tensiometer with the ceramic tip placed 6 inches deep in the root zone.

On 18 August, bean and corn plants had emerged. On 25 August, snapbean and sweet corn plant stands were thinned to 3 inches apart for snapbean and 10 inches apart for sweet corn. Snapbeans were forming the first trifoliate leaf and corn was 4 inches tall at this time. Also on 25 August, the first N and K side dress was made. At this time, 50% of the remaining N and K_2O was applied by sprinkling fertilizer on the bed surface between the two rows of snapbean or corn and incorporated with a potato rake. Crops were irrigated immediately after fertilization. The second side dress of the N and K fertilizer was made on 2 September when the snapbeans were 4 inches tall and no flower buds visible and when the sweet corn was 8 inches tall. Total K_2O was 120 lbs/acre.

Snapbean and sweet corn plants were evaluated for growth vigor on three occasions 25 August, 28 August, 15 September for snapbeans, and on the same dates plus 15 October (harvest) for sweet corn. Plant vigor was rated as 1 = very small, yellow plants fo 5 = very vigorous and dark green.

On 2 October 1997, snapbeans were harvested. Marketable, straight, and well-formed beans were weighed. Number of plants harvested from the 10-ft section of bed (both rows) was recorded. Sweet corn was harvested on 15 October 1997 by taking the upper ear from each plant. Ears were graded into marketable and cull categories, counted, and weighed.

All data were subjected to analysis of variance, first by analyzing data from all 18 treatments so effects of foliar humate could be tested. Then main effects of N rate and humate rate were tested. Where significant, means were compared using least significant difference.

Results

Soil for the sweet corn field tested very high (174 ppm) in P, low (30 ppm) for K, high (57 ppm) for Mg, and adequate in Ca (550 ppm), Mn (14.0 ppm), Cu (2.1 ppm), and Zn (4.0 ppm). Soil for the snapbean field tested very high (181 ppm) in P, low (32 ppm) for K, high 75 ppm) for Mg, and adequate in Ca (658 ppm), Mn (14.5 ppm), Cu (2.5 ppm), and Zn (3.4 ppm). Soil test values were Mehlich-1 indices.

Fertilization treatments had significant effects on nearly all snapbean variables (Table 1). For some reduced levels of N, the intermediate rate of humate led to greater plant vigor, especially for 25 and 50% base N. Foliar humate did not appear to improve plant vigor late in the season over that with furrow-applied humate alone. Yield was improved with N application but little benefit was apparent with furrow-applied humate alone. With 25, 50, and 75% N, humate at 1 lb/acre improved yield but this yield was not as great as that with 100% base N. With 75% base N, and foliar humate, increases in yield were realized with the highest rate of humate but, this yield was not as great as with 100% base N alone.

Analysis of main effects of N and humate rate showed that snapbean yield responded most to N rate (Table 2). Effects of humate on snapbean yield were negligible.

Sweet corn responded to N and humate in fashion similar to snapbean (Table 1). One exception was treatment 11 where humate at 1 lb/acre with suboptimal N rate of 75 lbs/acre resulted in one of the highest yields. Foliar application in addition to furrow-applied humate led to yield increases with increased humate rate with the suboptimal N rate of 75% base N. The highest yield was still not as great as with 100% base N or with humate and the reduced rate of N. On average, foliar humate reduced sweet corn yields compared to 75% base N with furrow humate alone. Yields with 75% base N plus 1 lb humate resulted in yields similar to those with 100% base N without humate indicating the possibility of reducing N rate somewhat when humate is used in the seed furrow.

Sweet corn yield main effects responded to N fertilization with yield maximizing with 100% base N (150 lbs N/acre) (Table 4). Humate had little effect on sweet corn yields.

In summary, sweet corn and snapbean responded to N fertilization with greatest yields with 100% base N, the recommended N rate for both crops. Responses to humate, when present, appeared to be most likely under suboptimal (75%) N fertilization. With snapbeans, best yields resulted with 100% base N regardless of humate. With sweet corn, yield with 75% base N without humate, indicating possibility of reducing N rate with use of furrow humate.

Table 1. Effects of Growplex humate and N fertilization on snapbean plant vigor and yield, University of Florida, Gainesville FL – Fall 1997.

Treatment			Plant Vigor[v]			No. plants per plot	Yield	
			sample					
No.	Base N[x] %	Humate lb/acre	1	2	3		box/acre[t]	gr/plant
1	0	0	2.3	3.3	2.0	69	113	20
2	0	1	1.8	2.5	2.8	56	112	25
3	0	2	1.8	2.5	2.0	65	130	25
4	25	0	3.5	3.3	208	62	138	29
5	25	1	3.8	4.0	2.5	58	168	37
6	25	2	3.5	3.5	3.3	67	131	25
7	50	0	4.3	4.3	4.5	70	203	37
8	50	1	4.5	4.0	47.5	73	217	38
9	50	2	4.3	4.0	4.5	61	216	44
10	75	0	3.3	4.0	3.8	68	159	30
11	75	1	4.0	4.0	4.3	66	206	40
12	75	2	3.3	3.8	4.3	66	176	34
13	100	0	3.8	3.0	3.8	65	245	47
14	100	1	3.3	3.8	4.3	65	249	48
15	100	2	3.5	3.8	4.3	60	207	43
16[y]	75	0	4.0	3.5	4.0	67	148	31
17[y]	75	1	3.8	3.5	3.5	66	179	34
18[y]	75	2	4.5	4.3	4.0	74	188	32
F test[z]			**	*	**	NS	*	*
LSD (.05)			2.7	0.24	0.26	NS	20	4

[z] Treatment effects significant at 1% (**) or 5% (*) probability level or not significant (NS).
[y] Treatments 16, 17, and 18 received humate as two foliar applications of 4 oz/acre each in addition to the furrow applied humate.
[x] Base N was 90 lbs N per acre.
[w] Rate of Growplex humate calculated on basis of beds on 4-ft centers but applied in the furrow with seed.
[v] Plant vigor was rated as 1 = very small, stunted, and yellow to 5 = very vigorous and dark green.
[u] Plot was 4 ft by 10 ft with 2 rows of snapbeans. Target population at seeding was 80 plants per plot.
[t] Number of 30 lbs boxes per acres.

Table 2. Main effects of N rate and furrow-applied humate rate on snapbean plant vigor and yield, University of Florida, Gainesville, FL – Fall 1997.

Base N(%)[y]	Humate lb/acre[x]	Plant vigor[w] sample			No. plants per plot[v]	Yield	
		1	2	3		box/acre[u]	gr/plant
0		1.9	2.8	2.2	63	118	24
25		3.6	3.6	2.8	62	146	30
50		4.3	4.1	4.5	68	212	40
75		3.5	3.9	4.1	66	180	35
100		3.5	3.5	41	63	234	46
F test[z]		**	**	**	NS	**	**
	0	3.4	3.6	3.4	67	172	33
	1	3.5	3.7	3.7	63	190	38
	2	3.3	3.5	3.7	64	172	34
	F test[z]	NS	NS	NS	NS	NS	NS

[z] Treatment effects significant at 1% (**) or 5% (*) probability level or not significant (NS).
[y] Base N was 90 lbs N per acre.
[x] Rate of Growplex humate calculated on basis of beds on 4-ft centers but applied in the furrow with seed.
[w] Plant vigor was rated as 1 = very small, stunted, and yellow to 5 = very vigorous and dark green.
[v] Plot was 4 ft by 10 ft with 2 rows of snapbeans. Target population at seeding was 80 plants per plot.
[u] Number of 30-lb boxes per acres.

Table 3. Effects of Growplex humate and N fertilization on sweet corn plant vigor and yield, University of Florida, Gainesville FL – Fall 1997.

Treatment			Plant vigor[w]				Yield		Mkt	Mkt doz
	Base	Humate	sample				boxes/acre			
No	N[x] %	lbs/acre[w]	1	2	3	4	Mkt	Cull	%	per acre
1	0	0	2.5	2.3	1.8	1.0	0	0	0	0
2	0	1	1.8	2.0	2.0	1.0	0	0	0	0
3	0	2	1.5	2.0	1.8	1.0	0	0	0	0
4	25	0	2.8	3.5	3.5	3.1	47	33	69	397
5	25	1	3.5	3.8	4.3	4.0	48	19	68	431
6	25	2	3.3	3.5	3.3	3.0	52	48	42	443
7	50	0	4.0	3.5	4.3	4.3	145	49	74	1123
8	50	1	3.8	3.5	4.3	4.8	106	46	68	919
9	50	2	3.8	3.8	4.3	4.0	170	17	87	1350
10	75	0	3.8	3.3	4.0	4.4	225	28	88	1826
11	75	1	3.8	3.3	4.3	4.5	298	15	95	2314
12	75	2	3.0	3.0	3.8	4.6	236	34	88	1917
13	100	0	3.8	4.0	4.8	4.6	319	23	93	2439
14	100	1	3.0	4.0	3.9	4.5	261	31	89	1928
15	100	2	4.0	3.5	4.3	4.6	292	31	90	2291
16[y]	75	0	3.0	3.5	4.0	4.9	108	39	68	862
17[y]	75	1	2.5	3.3	3.8	4.8	131	31	81	1213
18[y]	75	2	3.0	3.5	4.3	4.8	177	36	80	1407
F test[z]			**	**	**	**	**	**	**	**
LSD (.05)			0.31	0.24	0.24	0.17	18	7	5	143

[z] Treatment effects significant at 1% (**) or 5% (*) probability level or not significant (NS).
[y] Treatments 16, 17, and 18 received humate as two foliar applications of 4 oz/acre each in addition to the furrow applied humate.
[x] Base N was 150 lbs N per acre.
[w] Rate of Growplex humate calculated on basis of beds on 4-ft centers but applied in the furrow with seed.
[v] Plant vigor was rated as 1 = very small, stunted, and yellow to 5 = very vigorous and dark green.

Table 4. Main effects of N rate and furrow-applied humate rate on sweet corn plant vigor and yield, University of Florida, Gainesville, FL – Fall 1997.

Base N[y] %	Humate lb/acre[x]	Plant vigor[w] sample				Yield Boxes/acre		Mkt %	Mkt doz/acre
		1	2	3	4	Mkt	Cull		
0		1.9	2.1	1.8	1.0	0	0	0	0
25		3.2	3.6	3.7	3.4	49	34	60	424
50		3.8	3.6	4.3	4.3	141	37	77	1131
75		3.5	3.2	4.0	4.5	253	26	90	2019
100		3.6	3.8	4.3	4.6	291	28	91	2220
F test[z]		**	**	**	**	**	**	**	**
	0	3.4	3.3	3.7	3.5	147	26	65	1157
	1	3.2	3.3	3.7	3.8	143	22	64	1118
	2	3.1	3.2	3.5	3.5	150	26	62	1200
	F test[z]	NS	NS	NS	NS	NS	NS	NS	NS

[z] Treatment effects significant at 1% (**) or 5% (*) probability level or not significant (NS).
[y] Base N was 150 lbs N per acre.
[x] Rate of Growplex humate calculated on basis of beds on 4-ft centers but applied in the furrow with seed.
[w] Plant vigor was rated as 1 = very small, stunted, and yellow to 5 = very vigorous and dark green.