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Comparison of Different Commercial Fertilizer and Poultry Manure Rates and Combinations in the Production of Eggplant 97-20

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Introduction

A large poultry industry has developed in the middle Suwannee Valley region of North Florida. Broiler production in Florida increased from 75.7 million birds in 1977 to 104.2 million in 1985, and to 132.7 million in 1994. Suwannee, Madison, and Hamilton counties are among the leading broiler producing counties in Florida. Total value of state-wide broiler production in 1994 was 191.2 million (Freie and Pugh, 1994; Geuder and Pugh, 1996). Broiler production is more common in northern Florida, with a typical grower harvesting between five and six flocks annually at approximately 70,000 birds per flock (Tervola, 1996). An estimated 4,400 lbs of manure are produced for every 1,000 broiler birds (Mitchell et al., 1990), resulting in a considerable amount of poultry manure to be managed.

The importance of choosing an appropriate rate of manure and of properly managing that manure has been stressed (Sims, 1986). Various equations have also been developed to estimate manure needs in order to supply crop N requirements (Douglas and Magdoff, 1991; Mathers and Goss, 1979; Pratt et al., 1973; Sims, 1986). Factors affecting appropriate manure application rates include: crop N requirement, N mineralization rate, N content of the manure, method and timing of manure application, prior and subsequent leaching and volatilization losses of N, and previous cropping history. Crop N requirements for vegetable crops in Florida have been summarized by Hochmuth and Hanlon (1995) and specific nutrient recommendations for eggplant are reported by Hochmuth and Maynard (1996).

Several research projects have been conducted at the North Florida Research and Education Center – Suwannee Valley to evaluate various nutrient management programs for eggplant (Hochmuth et al., 1991; Hochmuth et al., 1993a; Hochmuth and

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Hochmuth, 1994; Hochmuth and Hochmuth, 1995; Hochmuth et al., 1996). Poultry manure trials have also been conducted at the same location on cabbage (Hochmuth et al., 1993b). This trial was conducted to evaluate poultry manure as a potential nutrient source in the production of mulched eggplant with drip irrigation.

Materials and Methods

Plots were established on a Lakeland fine sand at the North Florida Research and Education Center – Suwannee Valley near Live Oak, Florida using a full-bed, polyethylene mulch system with drip irrigation. Treatments in 25 x 5 ft plots were arranged in a randomized complete-block design with 4 replications in the spring of 1997. Preplant soil tests (Mehlich-1 extract) showed 58 ppm P, 24 ppm K, 30 ppm Mg, and 376 ppm Ca (Table 1). Soil pH was 6.3 using 1:2 (soil:water) solution. The manure source was a broiler clean-out and was collected from piles stored under shelter. Manure rates were selected for trial based on estimated available N and targeting a low, medium, and high rate of application. The medium rate (6 tons/A) was estimated to supply the crop N requirements (160 lbs/A) assuming 50% or more of the N was mineralized over the season. The recommended rate and a higher rate of commercial fertilizer were also used based on the nitrogen content of the fertilizer.

Manure or commercial fertilizer was applied to the soil on 13 March 1997. All materials were applied to level ground over the center 3-ft width of each plot, rototilled to a depth of 6 inches, immediately bedded, and fumigated with a mixture of 98% methyl bromide: 2% chloropicrin at a broadcast rate of 400 lbs/A. Drip irrigation tubing was applied to the center of the bed and black polyethylene mulch was applied to form a 3-ft wide and 6-inch high production bed.

Eggplant transplants of the cultivar 'Classic' were planted in a single row per bed at spacing of 18 inches between plants on 28 March 1997. Eggplants were irrigated by drip irrigation using tensiometers as a scheduling aid. Water was applied to maintain a soil-moisture of -8 to -12 centibars at the 12 inch depth. Insecticide and fungicide applications were made in accordance with the University of Florida recommended spray program (Hochmuth and Maynard, 1996).

Eggplant fruits were harvested six times from 6 June to 10 July 1997. Number of fruit and total weight for each fruit grade per plot were recorded and the data subjected to analysis of variance.

Results and Discussion

Plants in all plots receiving a manure application exhibited symptoms (wilting and leaf scorch) resembling high salt levels in the root zone. The higher manure rate plots had the most severe symptoms. Commercial fertilizer only plots and unfertilized plots

showed no such symptoms. In plots with the highest manure rate a few plants were unable to recover. All other plants recovered and appeared normal for the remainder of the season. The same manure source in several past studies exhibited no symptoms resembling the symptoms in this study. Upon further investigation, it was found the poultry producer had added a material to the litter in the poultry house to reduce ammonia volitalization. The product, Poultry Litter Treatment (Cherry Farms, Lee FL), contains 93.2% sodium bisulfate, 6.5% sodium sulfate, and 0.3% moisture. This treatment is recommended to be applied at 3 to 5 lbs per 100 ft^2 once per flock. Further research is needed to investigate the role of this treatment on increasing salt damage in vegetable crops.

Early yield (first two harvests only) of large No. 1 fruit was highest with the three commercial fertilizer treatments near or over 400 cartons per acre. Intermediate early yield of large No. 1 fruit was found with the 3 ton/A rate of manure. The medium and high manure rates led to lower early yield than any other nutrient treatment. This is likely due to the effect of the higher salt levels in the treated manure. Plants in unfertilized check plots also had very low early yield of large No. 1 fruit. The same trend was seen in total early marketable yield.

Excellent total season yield of over 1500 cartons per acre was found using several nutrient sources and combinations. Highest total marketable yield was found for both commercial fertilizers using 13-4-13 (N-P_2O_5-K_2O) alone. There was no difference in the yields with the University of Florida recommended nitrogen rate (160 lbs/A) and the higher nitrogen rate of 200 lbs/A. All manure only treatments and the manure plus commercial fertilizer treatment resulted in similar intermediate total yield of 1419 to 1684 carton per acre. Lowest total marketable yield was found for plants in the unfertilized check.

Total season large No. 1 fruit yield was similar (900 to 1150 cartons per acre) with all treatments except the unfertilized check (241 cartons per acre). Average fruit weight for the total season was lowest from plants in the unfertilized check plots (0.9 lbs), while other nutrient treatments resulted in average fruit weights of 1.0 lb or greater.

In summary, the results supported the current University of Florida crop nutrient recommendation of 160 lbs of nitrogen per acre for eggplant. The higher nitrogen rate of 200 lbs/A resulted in the same yield and quality. The addition of the poultry litter treatment to the poultry litter used in this study seems to confound the results of the manure treatments. More research is needed on the effects of this product on plant growth. Once the initial negative effect on early plant growth disappeared, the manure treatments seemed to do very well as a nutrient source.

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Table 1. Soil test nutrient levels and nutrients supplied by the various experimental fertilizer treatments.

	Soil Test Level (ppm)[z]	IFAS Nutrient Recommendation (lbs/A)	Total Nutrients Supplied by Treatments (lbs/A)						
			No Fertilizer	13-4-13 Fertilizer		Poultry Manure			Manure + 13-4-13
				1230	1540	6,000	12,000	18,000	6,000 + 615
Nitrogen (N)	N/A	160	0	160	200	171	342	513	251
Phosphorus (P_2O_5)	58 (P)	0	0	50	60	66	132	198	91
Potassium (K_2O)	24 (K)	130	0	160	200	120	240	360	200

[z] Soil test (Mehlich-1) indices were high for P and low for K.

Table 2. Effect of various nutrient sources and rates on yield, quality, and average fruit weight of eggplant grown at Live Oak, FL.

Nutrient Source	Rate (lbs/A)	Yield (carton/acre)[y]							Average Fruit Wt.
		Total Mkt.	No. 1			No. 2			
			Small	Medium	Large	Small	Medium	Large	
		- Early Season [z] -							
Poultry Manure	6,000	380	0	45	317	0	2	16	
Poultry Manure	12,000	296	0	35	244	0	2	14	
Poultry Manure	18,000	180	0	18	156	0	0	5	
Fertilizer (13-4-13)	1230	571	0	57	468	0	16	30	
Fertilizer (13-4-13)	1540	496	0	54	468	0	16	30	
Manure + 13-4-13	6,000 + 615	446	0	31	396	0	5	15	
Unfertilized Check	0	142	0	36	90	0	11	4	
Significance [x]		**	N/A	NS	**	N/A	NS	NS	
LSD (p=0.05) [w]		130			142				
		- Total Season -							
Poultry Manure	6,000	1419	5	392	895	0	33	94	1.1
Poultry Manure	12,000	1684	9	463	1100	0	45	67	1.1
Poultry Manure	18,000	1581	1	422	1107	0	23	28	1.1
Fertilizer (13-4-13)	1230	1852	12	492	1137	1	96	115	1.1
Fertilizer (13-4-13)	1540	1869	9	503	1159	0	40	159	1.1
Manure + 13-4-13	6,000 + 615	1605	0	498	973	7	48	79	1.0
Unfertilized Check	0	651	16	295	241	0	71	28	0.9
Significance [x]		**	NS	NS	**	NS	NS	0	
LSD (p=0.05) [w]		272			318			75	

[z] Early season yield is calculated on the first two harvests only.
[y] One carton of eggplant weighs 33 lbs.
[x] Treatment effects were significant at either 5% (*) or 1% (**) probability levels or not significant (NS).
[w] Least significant difference at the 5% level of significance.