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SWEETPOTATO RESPONSE TO SOIL FUMIGATION, MYCORRHIZAE, AND FERTILIZER PHOSPHORUS TREATMENT

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INTRODUCTION

Preliminary research on sweetpotato slips grown in nutrient solution or in blasting sand irrigated with nutrient solution indicated the potential for vesicular arbuscular mycorrhizal fungi (VAMF) to increase number and production of storage roots (Paterson et al., 1986). Similar results were reported in 1987 (Don Paterson, Personal communication). Sweetpotatoes failed to respond to VAMF, nitrogen, and potassium due to drought conditions during a 1987 field study. In 1988, the treatments were changed to phosphorus (P) fertilizer rates applied with or without VAMF to fumigated and nonfumigated soils.

MATERIALS AND METHODS

A low P research site was located on a Bowie fine sandy loam by soil analysis. Soil test P ranged from 3 to 6 ppm, decreasing from south to north across the plot area. The experiment was replicated to account for this variation in available P. Methyl bromide was applied to randomized, 10 foot-wide strips through the 181 ft plot length at a rate of 320 lb A.I./ac. One fumigated strip and one nonfumigated strip constituted one 20 foot-wide (6 bed-row) block. Care was taken to avoid recontamination of the treated strips during subsequent tillage operations. Each 181 ft-long by 20 ft-wide block was split into four subplots separated by 3 ft alleys at each end. Each P treated plot was further split into four 10 x 20 ft subplots separated by 3 ft alleys at each end. Each of these 10 x 20 ft subplots within a fumigation treatment was randomly treated with 1.1 lb of a soil-washed sand mix containing either live or killed VAMF banded into the plant row during the transplanting operation. At this same time, the P treatments and the over-all fertilizer treatments were banded about 6 inches deep on both sides of the plant row. Phosphorus rates were 0, 40, 80, and 120 lb P_2O_5/ac. The overall plot area fertilizer treatment consisted of the per acre equivalent of 50 lb N, 150 lb K_2O, 44 lb S, 22 lb Mg and 2 lb B from ammonium nitrate, muriate of potash, potassium magnesium sulfate and fertilizer borate granular, respectively.

'Jewel' variety sweetpotato slips with the original roots removed were re-rooted and transplanted into bedded rows on 7 and 8 June. Trouble with the irrigation system and hot, dry weather required that several replantings of some of

the slips be made. A good stand was eventually obtained, but at the cost of a shortened growing season. Plant root and vegetative samples were collected on 12 Sept. and 19 Sept., respectively. Harvest was initiated on 17 Oct.

RESULTS

Yield was generally low during the 1988 drought year. The nonfumigated plots produced greater yield of canner and cull sweetpotatoes than fumigated plots (Table 1). Grade one and jumbo yields were approximately equal. The VAMF treatment main effects, averaged over P rates and fumigation treatments, had no significant effect on sweetpotato yield. Phosphorus at 40, 80, and 120 lb/ac increased grade one and jumbo yield compared to the zero P treatment. Total marketable yield was also increased by P.

Although VAMF alone failed to increase yield, it significantly increased the yield of the canner grade of sweetpotatoes when applied in combination with fertilizer P (Fig. 1). The greatest response occurred at approximately 40 lb P_2O_5/ac. Yields of canner grade sweetpotatoes were increased by VAMF over the P treatment alone, beginning at zero P and increasing to about 45 lb P_2O_5/ac. At P_2O_5 rates above this level, yield response from VAMF relative to the no VAMF treatment began to decline. Mycorrhizae had recolonized the fumigated strips by the end of the growing season.

DISCUSSION

The sweetpotato, like most other crops, responded to application of fertilizer P applied to this low soil test P site. Phosphorus had the greatest effect on the number one and jumbo grade sweetpotatoes. There was no yield increase in canner or cull grades due to P application. The increased yields of number ones and jumbos indicates the importance of P for root growth. Improved yields of canner grade sweetpotatoes due to the interaction of VAMF and P indicated an increased production of smaller sweetpotatoes, due possibly to the effect of VAMF on increasing the number of storage roots. These data are preliminary and from a short, dry growing season. The study will be continued in 1989 to reevaluate these responses.

REFERENCES

Paterson, D. R., R. A. Taber, K. E. Cushman, and D. R. Earhart. 1986. Influence of mycorrhizal infection and nutrient level on ion uptake and growth of *Ipomoea batatas* in sand culture. HortScience 21(3): 333.

Table 1. Response of 'Jewel' sweetpotato to soil fumigation, mycorrhizae inoculation, and phosphorus fertilizer rates.

Treatment	Grade				
	One	Canner	Jumbo	Cull	Marketable
	kg/plot				
Fumigated	7.39	2.25	0.52	3.41	10.20
Nonfumigated	8.55	3.25	0.30	6.27	12.10
	N.S.	*	N.S.	***	N.S.
VAMF	8.04	2.81	0.28	4.57	11.13
No VAMF	7.91	2.68	0.54	5.11	11.17
	N.S.	N.S.	N.S.	N.S.	N.S.
P_2O_5					
0	6.62	2.23	0.35	4.83	9.29
40	8.72	3.17	0.44	4.99	12.41
80	8.72	2.83	0	4.90	11.55
120	7.83	2.70	0.82	4.63	11.35
	*	N.S.	**	N.S.	*

Statistical significance at p levels: 0.1 = *, .05 = **, and .01 = ***

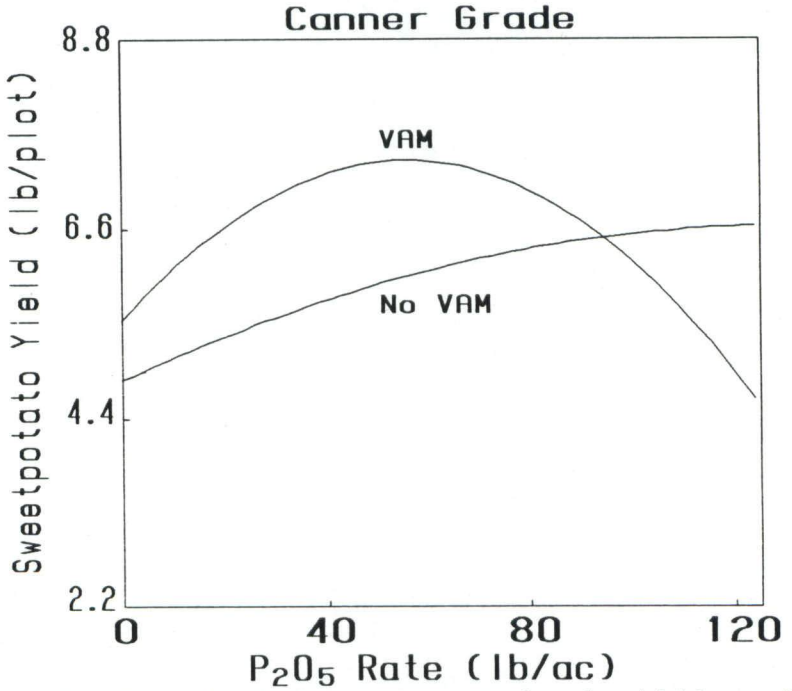

Fig. 1. Sweetpotato response to fertilizer P and vesicular arbuscular mycorrhizae (VAM)