EFFECTS OF IPIL-IPIL AND AMMONIUM SULFATE AS NITROGEN SOURCES OF SWEET POTATO

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ABSTRACT

Nitrogen application, either with the use of ammonium sulfate or ipil-ipil leaves, significantly improved the yield and yield components of the three varieties of sweet potato, except in the number of non-marketable tubers. Among the varieties tested, BNAS-51 yielded the highest amount of marketable tubers with an average of 11.7 t/ha, followed by *Bakabakahan* and Bulacan with 8.03 and 6.6 t/ha, respectively. BNAS-51 and *Bakabakahan* produced more and heavier marketable tubers/plant, and longer and heavier fresh weight of vines/plant. BNAS-51 had fewer but heavier non-marketable tubers than the other two varieties. Plants which received nitrogen (N) from ipil-ipil leaves produced more and heavier fresh vines/plant than those without N. A lower percentage of dry matter content was observed in N-fertilized plants. In terms of tuber yield, plants which received 60 kg/ha, either from ipil-ipil leaves or ammonium sulfate, yielded more with 3.0 and 6.0 t/ha, respectively, than those plants which did not receive N. Despite the equal rates of N application, plants which were applied with inorganic N fertilizer (ammonium sulfate) produced significantly higher yields than plants which received organic fertilizer (ipil-ipil leaves).

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INTRODUCTION

Sweet potato (*Ipomoea batatas* L.), a trailing vine plant which is generally cultivated for its enlarged roots, can be grown throughout the year at an altitude of from sea level up to 1500 m in any kind of soil with minimum cultivation. This crop thrives well on a sandy loam soil with high organic matter and with a permeable subsoil (Cadiz and Bautista, 1967). To increase sweet potato yield per unit area, farmers generally use inorganic fertilizers. This practice, however, gives a minimal income to the farmers probably because of the high cost of inorganic fertilizers which is added to the production cost.

The introduction of locally available plant materials like ipil-ipil *(Leucaena leucocephala)* that can supply organic matter with high amounts of nitrogen will not only help farmers increase their production but also improve the physical and chemical condition of the soil. This study compared the effects of ipil-ipil leaves and ammonium sulfate as sources of N on the growth and yield of sweet potato, and determined the sweet potato varieties that would give the optimum yield when fertilized with ipil-ipil leaves and ammonium sulfate.

MATERIALS AND METHODS

Three varieties of sweet potato, namely, BNAS-51, Bulacan, and *Bakabakahan* were planted at the experimental area of the Department of Agronomy and Soils, Visayas State College of Agriculture, Baybay, Leyte, Philippines. The area was laid out in split-plot arranged in randomized complete block design with three replications with variety as the main plot and the different sources of N as sub-plots. The treatments used were as follows:

- F_0 = control (without N)
- F_1 = ipil-ipil leaves at 60 kg N/ha (equivalent to 6.97 t/ha of fresh ipil-ipil leaves using the analysis of Benge, 1977)
- F_2 = ammonium sulfate at 60 kg/ha

Each experimental plot consisted of five rows measuring 4 m long and 1 m apart with an area of 20 sq m.

Sweet potato cuttings of about 30 cm long were planted at a distance of 25 cm between hills and 100 cm between rows with one cutting per hill. Ammonium sulfate was applied using the split method: one-half of the total amount was applied at planting time and the other half side-dressed one month after planting. Two weeks before planting, the whole amount of fresh ipil-ipil leaves was incorporated into the soil all over the plot. All plots received 50 kg/ha of P and K. The recommended cultural practices were used, such as weeding, spraying pesticides and irrigation.

Four months after planting, plants from the three middle rows of each treatment were harvested. Yield (t/ha) of tubers was calculated from plot yield.

RESULTS AND DISCUSSION

Growth Parameters.

Length (m) and fresh weight (kg) of vines. Fertilizer application, regardless of the nitrogen source, significantly increased the length and weight of vines (Table 1). As source of N, ipil-ipil leaves increased the length and weight of vines by as much as 30% and 24%, respectively. However, the increase in these parameters was notably greater with the application of ammonium sulfate than with ipil-ipil leaves. This was because ammonium sulfate was readily utilized by the plants few days after it was applied to the soil,

Table 1. Length and fresh weight of vines, dry matter content and harvest index as affected by ipil-ipil leaves (organic fertilizer) and ammonium sulfate (inorganic fertilizer).

Treatment		Vines per plant		Dry matter %	Harvest index (HI)
Variety	Fertilizer	Length (m)	Fresh weight (kg)		
BNAS - 51	Control	2.7	1.4	31.02	0.20
	Ipil-ipil leaves	3.7	1.8	29.21	0.20
	Ammonium sulfate	4.0	2.9	28.15	0.19
Mean		3.5	2.1	29.45	0.20
Bulacan	Control	2.2	1.2	29.82	0.14
	Ipil-ipil leaves	2.8	1.3	28.18	0.17
	Ammonium sulfate	3.0	1.8	27.30	0.16
Mean		2.7	1.4	28.43	0.16
Bakabakahan	Control	2.4	0.9	29.71	0.18
	Ipil-ipil leaves	3.0	1.3	28.59	0.16
	Ammonium sulfate	3.6	2.2	26.72	0.14
Mean		3.0	1.5	28.34	0.16
Means for the three varieties					
	Control	2.43	1.18	30.18	0.18
	Ipil-ipil leaves	3.18	1.47	28.66	0.18
	Ammonium sulfate	3.53	2.27	27.39	0.16

whereas an organic fertilizer like ipil-ipil leaves was gradually released making it difficult for the crop to utilize it fully. This finding conforms the report of Wang, *et al.* (1975) who found that the growth and yield of sweet potato vines increased when N was applied. In gabi plants, Banaag (1958) reported that N application at the rate of 150 kg/ha produced large amounts of vegetative parts.

Yield and Yield Components.

Variety had a marked influence on the weight of marketable and number of non-marketable tubers produced per plant. Highly significant variations were noted among nitrogen sources. Significant interaction effects were noted on the weight of marketable tubers and number of non-marketable tubers.

Marketable tubers. Plants that received nitrogen from ipil-ipil or ammonium sulfate had significantly greater marketable tubers per plant (32 and 42%, respectively) over the control (Table 2). This indicates that tuber formation of sweet potato was influenced by nitrogen application regardless of the sources used, although the effect of ammonium

Table 2. Tuber yield of sweet potato as affected by ipil-ipil (organic fertilizer) and ammonium sulfate (inorganic fertilizer).

Treatment		Tuber yield				
Variety	Fertilizer	Marketable		Non-Marketable		Total Yield
		No./pl	Wt (t/ha)	No./pl	Wt (t/ha)	(t/ha)
BNAS-51	Control	2.4	8.1	0.88	1.44	8.5
	Ipil-ipil leaves	2.5	11.9	0.84	1.83	12.4
	Ammonium sulfate	3.5	15.1	0.81	2.13	15.2
Mean		2.8	11.7	0.84	1.8	12.03
Bulacan	Control	1.5	3.7	1.04	0.747	4.2
	Ipil-ipil leaves	2.7	6.9	1.18	1.29	7.2
	Ammonium sulfate	2.8	9.2	1.01	1.56	9.6
Mean		2.3	6.6	1.08	1.19	7.0
Bakabakahan	Control	2.6	5.5	2.45	1.45	6.5
	Ipil-ipil leaves	3.4	7.9	1.94	1.74	8.6
	Ammonium sulfate	3.1	10.7	1.10	1.94	11.2
Mean		3.0	8.03	1.80	1.71	8.77
Means for the three varieties						
	Control	2.17	5.0	1.46	1.21	6.4
	Ipil-ipil leaves	2.87	8.9	1.32	1.62	9.4
	Ammonium sulfate	3.13	11.7	0.97	1.88	12.0

sulfate was significantly better than that of ipil-ipil leaves. This result corroborates the findings of Soriano (1967) who observed a marked increase in number of tubers of Irish potato applied with higher rates (120 to 200 kg/ha) of N.

Of the three varieties, BNAS-51 produced the heaviest weight of marketable tubers with an average of 0.46 kg/plant. In general, application of ipil-ipil leaves and ammonium sulfate increased the weight of marketable tubers/plant. This suggests that nitrogen application increased not only the number but also the size of tubers. However, it was only BNAS-51 and *Bakabakahan* varieties where ammonium sulfate application proved to be significantly superior over the control. The effect of ipil-ipil leaves was statistically comparable to the control in all the three varieties.

Variations in marketable tuber yields were observed although these were not significant. BNAS-51 had the highest yield (11.7 t/ha), followed by *Bakabakahan* (8.03 t/ha) and Bulacan (6.6 t/ha).

Among the nitrogen treatments, F_1 and F_2 showed highly significant increase in yields of marketable tubers compared to F_0. This suggests that N fertilization, regardless of sources used, considerably increased the yield of sweet potato. F_1 and F_2 showed a marked increase in the yield of sweet potato by 3.0 and 5.8 t/ha., respectively, over F_0. Brewbaker and Guerrero (1975) and Guevarra (1975) had similar results on corn, when they noted higher yields with crops fertilized with *Leucaena* and urea over the unfertilized crop.

Non-marketable tubers. BNAS-51 and Bulacan had lesser non-marketable tubers (0.84 and 1.07, respectively) than *Bakabakahan* (1.83 t/plant). This was probably due to varietal characteristics.

Nitrogen application significantly decreased the number of non-marketable tubers/plant. This result suggests that nitrogen application significantly decreased the number of non-marketable tubers, thus increasing the number of marketable tubers.

Analysis of variance revealed that the different sources of N application significantly affected the yield of non-marketable tubers. However, no significant differences were noted among the three varieties of sweet potato and in the interactions between varieties and N sources.

Tuber Yield (t/ha). Significant differences in tuber yields were observed and these were suspected to be due to the nitrogen source used (Table 2). No significant differences were noted among the three varieties and in the interactions between nitrogen sources and varieties.

Analysis of variance revealed that F_1 has a total tuber yield of only 6.4 t/ha. This was significantly lower than the yield of plants (9.4 t/ha) in F_1. Highest yield was obtained from F_2 (12.0 t/ha).

The increase in the yield of plants treated with N could be due to the increase in the number and weight of marketable tubers. Moreover, plants treated with N had more vigorous growth as shown by the increase in length and weight of vines. Based on this observation, it could be speculated that plants which grew more vigorously had faster rates of photosynthesis and therefore had increased translocation of photosynthesis to the storage organ. This ultimately led to the increase in number and weight of marketable tubers that developed per plant.

Despite the equal rate of N fertilizer applied (60 kg/ha each). ammonium sulfate had more significant effect in tuber yield than ipil-ipil leaves as sources of N. It is apparent that the available nitrogen released by the two sources caused the difference. Probably, the N present in ipil-ipil leaves was still not available for plant utilization even after two weeks of incorporation into the soil. On the other hand, N from ammonium sulfate was readily available few days after its application. Furthermore, it was suspected that the release of available N from organic fertilizer (ipil-ipil leaves) was slow and gradual, while that from inorganic fertilizer (ammonium sulfate) was fast and immediate.

Percent dry matter of tuber. Highest percentage of dry matter (30.18%) was obtained from F_0 followed by F_1 (28.66%), and F_2 (27.39%). As mentioned earlier, the weight of marketable tubers was heavier in plants fertilized with N than in unfertilized plants. However, plants with the highest tuber weight had the lowest percent dry matter, while the control, with the lowest weight of marketable tubers, had the highest percent dry matter. This observation suggests that tubers obtained from plants treated with N contain more water than those from untreated plants. This result agrees with the findings of Nissen (1963) in his study on Irish potato where he noted that the dry matter content of tuber is a linear function of its weight of water with N application. This shows that as tuber weight increases due to N application, the moisture content also increases, resulting in the decreased matter content.

Harvest index (HI). In sweet potato, higher HI values can be obtained provided that lesser amount of vines is produced in proportion to the amount of tubers that develop. In this study, HI of the three varieties ranged from 0.14 to 0.20. However, yield trials of sweet potato clones from Taiwan conducted in Philippine Root Crop Research and Training Center (PRCRTC) experimental areas showed a low HI compared to the high HI obtained from the PRCRTC study. This may be attributed to varietal characteristics and varying environmental conditions.

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