RESPONSE OF CAPSICUM TO APPLICATION OF SHEEP MANURE

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ABSTRACT

A field trial was conducted from January to May 1995 at Ginitoka village near Goroka in the Eastern Highlands to evaluate capsicum (Capsicum annuum) *response to application of sheep manure. The treatments included four rates of sheep manure)0, 5, 10 and 15 tonne/ha) and two NPK inorganic fertilizer applied at the normal recommended rate (1 tonne/ha) and one and a half times the recommended rate (1.5 tonne/ha) of application.*

Key words: *Capsicum, central highlands, inorganic fertilizer, sheep manure.*

INTRODUCTION

A sheep can produce approximately 0.8 tonnes of manure/year which can be a good source of organic fertilizer for crop production (Thiagalingam and Bourke, 1982). Yield responses to application of sheep manure by potato, maize and cassava have already been reported (Sivasupiramaniam *et al.*, 1996; Sivasupiramaniam 1989).

Farmers in the central highlands use either little or no inorganic fertilizers for vegetable production. Major reasons are lack of initial capital, high transport cost and low price, hence smaller profit margin, and uncertain market. Under these circumstances locally available sheep (or goat) manure can be a good and cheap source of organic fertilizer for vegetable production. Although some farmers have successfully used sheep manure for vegetable production no studies have been undertaken to evaluate its potential use as a source of fertilizer for vegetable production.

This paper reports the results of a field trial conducted to evaluate the use of sheep manure for capsicum production.

MATERIALS AND METHODS

The trial was conducted at Ginitoka village near Goroka in Eastern Highlands Province from January to May 1995. The soil was a gently sloping dark cracking clay (Vertisol) and its chemical composition data are presented in Table 1.

The site was an old garden under grass fallow for three years. The trial was laid out using a randomized complete block design (RCBD) with 3 replicates. The plot size was 2.5 x 2 m^2. There were six treatments which included:

1. Control
2. 5 tonnes sheep manure/ha
3. 10 tonnes sheep manure/ha
4. 15 tonnes sheep manure/ha
5. NPK inorganic fertilizer at normal recommended rate (Anon., 1995)
6. NPK inorganic fertilizer at one and half times the normal recommended rate.

Chemical composition of the sheep manure used is presented in Table 2. The manure was old and relatively dry at the time of application.The manure was applied in trenches, 15 cm deep and 20 cm wide and 75 cm apart, and mixed thoroughly with the soil that was dug out and put back into the trenches.

The NPK fertilizer was a mixture of two parts of 12:12:17 + 2 ($N:P_2O_5:K_2O_5$ + MgO) NPK compound fertilizer and one part of triple superphosphate (TSP - 48% P_2O_5) applied at 800 kg/ha as basal followed by a split dose of 200 kg urea as side dressing one and two months after planting. The manure was applied in trenches, 15 cm deep and 20 cm wide and 75

Table 1: Chemical composition of soil sample (0-15 cm) from the experimental site

Elements	Value	Interpretation
pH (1:25; soil:distilled water)	6.2	Weakly acidic
Olsen Available P (mg/kg)	8.3	Very low
Potassium (K) (meq/100g)	0.63	Medium
Calcium (Ca) (meq/100g)	18.00	High
Magnesium (Mg) (meq/100g)	4.93	Medium
Sodium (Na) (meq/100g)	0.05	Very low
Cation Exchange Capacity (CEC)	28.10	Medium
Organic Matter (%)	9.10	Medium
Total Nitrogen (%)	0.30	Medium
Phosphate Retention (%)	54	Medium
PSDA (%): Sand	19	
Silt	28	Clay Texture
Clay	53	

Table 2: Chemical Composition of the Sheep Manure

ELEMENT	VALUE
Moisture (%)	10.7
Nitrogen (% on dry matter basis)	1.64
Phosphorus (% on dry matter basis)	0.64
Potassium (% on dry matter basis)	3.09
Calcium (% on dry matter basis)	1.31
Magnesium (% on dry matter basis)	0.71
Iron (microgram/gram)	1270
Zinc (microgram/gram)	63
Copper (microgram/gram)	34

cm apart, and mixed thoroughly with the soil that was dug out and put back into the trenches.The NPK fertilizer was a mixture of two parts of 12:12:17 + 2 ($N:P_2O_5:K_2O_5$ + MgO) NPK compound fertilizer and one part of triple superphosphate (TSP - 48% P_2O_5) applied at 800 kg/ha as basal followed by a split dose of 200 kg urea as side dressing one and two months after planting. For the higher rate the amounts were increased by 50% (1200 kg of NPK/TSP mixture as basal and 300 kg urea as side dressing later).

Seedlings of *Capsicum annuum* cv. Californian Wonder (5 weeks old) were planted at 75 cm x 40 cm giving a plant density of 33,333 plants/ha. There were 3 rows with 6 plants per row in each plot. Normal cultural and plant protection practices were imposed as required. Two months after transplanting the upper fully developed leaves were sampled for the determination of N, P and K nutrients in these leaves.

Capsicum fruits from the four plants at the centre of the middle row were harvested when they reached marketable stage. The total fresh fruit yield and numbers were recorded. There were three rounds of harvests at 2 weeks interval commencing 3 months after planting.

RESULTS AND DISCUSSIONS

The total fresh fruit yield, mean weight of individual fruit and the total number of fruits for different treatments are given in Table 3.

The 5 t/ha manure application did not affect either the fruit yield or fruit size or fruit number significantly whereas 10 t/ha manure application significantly (P<0.01) increased the fruit yield, size and number. A similar significant (P<0.01) increase was also observed with NPK fertilizer at the normal rate of application. Increasing NPK rate by 50% failed to have any significant effect on fruit yield, size and number. On the other hand, increasing manure rate from 10 t/ha to 15 t/ha increased fruit yield and size significantly (P<0.01) but had no effect on fruit number indicating that the further increase in yield at 15 t/ha manure rate have been achieved through increased fruit size.
N, P and K concentrations in the upper fully

Table 3: Fresh yield, mean weight and number of capsicum fruits

Fertilizer	Rate (t/ha)	Fruit yield (kg/ha)	Mean fruit weight (g)	Number of fruits/ha
None (control)	0	3097 (100)*	82 (100)	37,766 (100)
Sheep manure	5	2573 (83)	74 (89)	34,760 (92)
Sheep manure	10	6413 (207)	99 (121)	64,738 (171)
NPK	1 (normal)	6250 (202)	96 (117)	65,087 (172)
NPK	1.5 (high)	7043 (227)	106 (127)	66,940 (177)
LSD - 5% level		1452	12.7	12,784
- 1% level		2065	18.1	18,183
CV (%)		4.3	7.2	12.6

** Figures in parenthesis represents data expressed relative to that of the control treatment (= 100%)*

Table 4: Nitrogen, Phosphorus and potassium contents (% dry matter) of the upper fully developed leaf

Treatment	Nitrogen	Phosphorus	Potassium
None (control)	5.35	0.39	3.82
5 t/ha manure	4.72	0.41	4.54
10 t/ha manure	5.06	0.48	4.64
15 t/ha manure	4.78	0.44	4.10
NPK inorganic fertilizer (normal)	5.16	0.39	3.70
NPK inorganic fertilizer (high)	5.15	0.35	3.8
LSD - 5% level	0.55	0.09	0.74
- 1% level	0.78	0.13	1.05
CV (%)	8.7	10.8	7.2

Table 5: Total N, P and K nutrients supplied by different treatments

Treatments	Nitrogen	Phosphorus	Potassium
Sheep manure - 5 tonnes/ha	73.0	28.5	136.5
Sheep manure - 10 tonnes/ha	146.0	57.0	273.0
Sheep manure - 15 tonnes/ha	219.0	85.5	409.5
NPK fertilizer - 1 tonnes/ha	150.0	84.0	74.0
NPK fertilizer - 1.5 tonnes/ha	230.0	126.0	111.0

developed leaf showed sufficiency levels of these nutrients in the leaf for all the treatments (Table 4) although the plants in the control and the 5 t/ha manure treatments were smaller. A possible explanation to this may be that the shoot growth had been restricted to enhance root growth for greater exploration of the soil.

The total N, P and K nutrients provided by each of the treatment is presented in Table 5. Both N and P supply in the inorganic fertilizer treatments are either equal or more than that were supplied in the 10 and 15 tonnes manure treatments. Although the K supply was substantially higher in the manure treatments there is no evidence to suggest that the yield responses have been influenced by this additional K in the manurial treatments. Further, lack of significant increase in fruit yield when there was a 50% increase in the supply of inorganic fertilizers suggests other factors such as provision of organic matter or supply of micronutrients may have been involved in the manure treatments.

The practical implications are that a minimum amount of sheep manure should be applied to achieve a significant increase in crop yield which will be influenced by the soil type and the crop grown. In the case of capsicum, higher manure levels would give higher yields with larger fruits. If marketing of very large fruits is difficult such high rates should be avoided.

The cost of the NPK and urea fertilizers at the normal rate of application (1 t/ha) was K620.00 which gave an yield equal to that of 10 tonnes of sheep manure. Accordingly the fertilizer value of 10 tonnes of sheep manure is K620.00 or K62.00 per tonne. The long term beneficial effects of sheep manure under local condition have been demonstrated (Sivasupiramaniam *et al.*, 1995) indicating that the fertilizer value of the sheep manure must be considerably higher than that of the inorganic fertilizer.

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