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RESEARCH ARTICLE

ORGANIC LIQUID MANURES AS FOLIAR NUTRIENT SUPPLEMENT IN AMARANTHUS

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ABSTRACT

Field experiment was conducted to assess the efficiency of selected organic liquid manures on growth and yield of amaranthus. The liquid manures were prepared by soaking composite organic manures in water (1:5 ratio), collecting the extract seven days after soaking and enriching the same with PGPR addition. Among the combinations, the extracts of composite manure prepared by mixing groundnut cake, neem cake and poultry manure (in 1:0.5:0.5 ratio), groundnut cake, vermicompost and poultry manure (in 1:0.5:0.5 ratio), and groundnut cake and poultry manure (in 1:1 ratio) recorded high nitrogen content (0.56-0.78%). Foliar application of these liquid manures as substitute to nitrogen for top dressing in amaranthus enhanced plant height, number of leaves per plant, crop yield and vitamin C content.

INTRODUCTION

Organic manures play a key role in sustaining crop growth and productivity and this is very important in vegetable cultivation. Among the organic manures, groundnut cake, vermicompost, neem cake, poultry manure and compost are considered to be viable choice in crop production on account of their high nutrient content. Use of foliar formulations is gaining importance in crop production owing to its quick response in plant growth (Linda, 2007). Foliar feeding has proved to be the fastest way of curing nutrient deficiencies and boosting plant performances at specific physiological stages. Besides nutrients, organic liquid manures contain several beneficial microbes which help to increase yield, impart resistance to diseases and insect pests, improve drought tolerance and enhance crop quality (Lalitha *et al*, 2000). Organic liquid fertilization is considered as a viable means for enhancing crop production both in conventional and modern production system. In this context an experiment was undertaken to assess the influence foliar application of organic liquid manures prepared on the growth, yield and quality of amaranthus.

MATERIALS AND METHODS

The experiment was conducted at the Instructional Farm attached to College of Agriculture, Vellayani, Kerala during 2010-2012. The experiment was laid out in Randomised Block Design design with six treatments and four replications during the period from November 2011 to January 2012. The treatments details are given below

- T_1 – Liquid manure of the composite manure of ground nut cake +poultry manure (1:1)
- T_2 - Liquid manure of the composite manure of ground nut cake + poultry manure +vermi compost (1:0.5:0.5)
- T_3 - Liquid manure of the composite manure of ground nut cake +neem cake+ poultry manure (1:0.5:0.5)
- T_4 – Urea 2%
- T_5 – Commercial formulation (*Nutrich – Z*- 0.3%)
- T_6 – Control (POP recommendation of amaranthus – Farmyard manure – 50 t, 100 kg N, 50 kg P_2O_5, 50kg K_2O ha^{-1}) .

The basal application of farmyard manure along with full P and &K and half nitrogen was applied uniformly for all treatments. Organic liquid manures (T_1 to T_3) were prepared by mixing composite manures with five times water and the liquid extract was collected after seven days. These extracts were mixed with PGPR mix 2 @ 2% concentration and applied to the crop as foliar sprays to substitute the fertilizers used for top dressing. After each harvest a foliar spray was given. Four harvests could be obtained from the crop. Observation on growth characters like plant height, number of leaves, total dry

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matter production and yield and quality attribute like Vitamin C were recorded.

RESULTS AND DISCUSSION

Growth characters

Plant height

The data presented in Table 2 showed the effect of different treatments on plant height of amaranthus prior to each harvest. The different treatments significantly influenced plant height at each harvest. T_3 recorded maximum plant height and was significantly superior to all other treatments. Treatments T_1, T_5 and T_6 were on par and followed by T_3 at first harvest. The lowest plant height was recorded by T_4 at first and second harvests (30.84 and 28.27 cm respectively). T_5 registered the lowest height at third and fourth harvests.

Table 1 Nutrient content of composite organic manures without PGPR and with PGPR addition (%)

Nutrient content(without PGPR)				Nutrient content(with PGPR)		
Treatments	N	P	K	N	P	K
T_1 (ground nut cake +poultry manure)	0.32	0.03	0.15	0.56	0.07	0.16
T_2 (ground nut cake + poultry manure +vermi compost)	0.29	0.06	0.15	0.64	0.09	0.17
T_3 (ground nut cake +neem cake+ poultry manure)	0.26	0.08	0.16	0.78	0.07	0.17

Table 2 Effect of foliar nutrition on plant height (cm) and number of leaves plant^{-1} prior to each harvest

Treatments	1st harvest		2nd harvest		3rd harvest		4th harvest	
	Plant height	No. of leaves	Plant height	No. of leaves	Plant height	No. of leaves	Plant height	No. of leaves
T_1	42.34	24.83	31.32	28.31	38.41	33.16	35.72	32.17
T_2	31.73	23.99	29.72	25.89	36.27	31.82	34.00	30.24
T_3	55.99	34.66	36.35	36.77	43.95	42.80	41.98	40.72
T_4	30.84	25.66	28.27	27.35	32.94	30.73	29.89	29.16
T_5	40.32	28.08	30.09	29.54	29.03	28.36	28.80	26.75
T_6	42.17	29.33	31.18	32.00	32.66	32.66	31.70	29.59
SE	0.71	0.43	0.39	0.50	0.42	0.35	0.31	0.34
CD (0.05)	2.146	1.325	1.192	1.528	1.281	1.062	0.95	1.04

Number of leaves plant^{-1}

Data furnished in Table 2 indicated significant variation in leaf number plant^{-1} due to treatments. T_3 recorded maximum number of leaves prior to each harvest and it was significantly superior to all other treatments. T_6 followed T_3 prior to first and second harvests. The lowest number of leaves was recorded by T_2 at first two harvests (23.99 and 25.89 respectively), and T_5 at last two harvests (28.36 and 26.75 respectively).

Table 3 Effect of foliar nutrition on yield of amaranthus (t ha^{-1})

Treatments	Yield at each harvest				Total yield
	1st harvest	2nd harvest	3rd harvest	4th harvest	
T_1	2.60	1.21	2.23	2.1	8.15
T_2	3.44	1.18	2.16	2.11	8.90
T_3	4.75	1.32	3.08	3.08	12.24
T_4	3.94	1.20	1.38	1.72	8.24
T_5	5.92	1.06	1.13	1.08	9.20
T_6	4.59	1.18	1.98	1.21	8.97
SE	0.046	0.007	0.085	0.006	0.123
CD (0.05)	0.140	0.023	0.257	0.020	0.372

Total dry matter production

Total dry matter production (Table 4) was significantly influenced by treatments. Maximum dry matter production was observed in T_3 (367.27 kg ha^{-1}) followed by T_5, T_2 and T_6 which were on par. The lowest production was noticed by T_1 (244.48 kg ha^{-1}) which was on par with T_4. The results of the study are in conformity with the finding where increased plant height, leaf number and yield resulted in high dry matter production in T_3.

Table 4 Effect of foliar nutrition on total dry matter production (kg ha^{-1}) and vitamin C content (mg 100 g^{-1})

Treatments	Total dry matter production	*Vitamin C content
T_1	244.48	26.10
T_2	267.15	28.21
T_3	367.27	28.43
T_4	247.42	23.08
T_5	276.15	28.21
T_6	269.17	24.26
SE	3.700	
CD (0.05)	11.175	

* Data not statistically analysed

Yield

Yield of amaranthus (Table 3) was significantly influenced by different foliar nutrient sources. The highest yield of 5.92 t ha^{-1} was obtained for T_5 at first harvest which was significantly superior to all other treatments. In subsequent harvests (second, third and fourth) T_3 registered the highest yields of 1.32, 3.08 and 3.08 t ha^{-1} respectively. The total yield was found to be the highest in T_3 (12.24 t ha^{-1}) and was significantly superior to all other treatments. This was followed by T_5, T_6 and T_2 which were on par. The total yield was the lowest in T_1 (8.15 t ha^{-1}).

Being a leafy vegetable crop, yield of amaranthus can be considered as a function of growth characters. The highest yield in T_3 is the product of increased plant height and better leaf production registered in that treatment. The enhanced nutrient content in T_3 along with its ready availability benefitted the plant growth. Improvement in yield of amaranthus with increase in plant height and leaf number was observed by Niranjana (1998).

Quality attribute

Vitamin C content

The data on vitamin C content of amaranthus estimated prior to first harvest is presented in Table 4. The highest content was observed in T_3 (28.43 mg100 g^{-1} tissue) followed by T_2 and T_5 (28.21 mg 100 g^{-1} tissue) and the lowest was recorded in the treatment T_4 (23.08 mg /100g tissue). The significance of organic N nutrition in enhancing the vitamin C content of amaranthus was earlier reported by Niranjana (1998) and Vipitha (2011). Though the N content of the best liquid manure T_3 is lesser than 2% foliar applied urea, the presence of invitro beneficial microorganisms might have enhanced the biological efficiency of the crop plants resulting in improved crop quality.

CONCLUSIONS

The results of field study revealed that foliar application of organic liquid manure T_3 (ground nut cake +neem cake+ poultry manure enhancedin1:0.5:0.5 ratio) can be used as a substitute to top dressing of nitrogen in amaranthus. This organic liquid manureenhanced the growth parameters of amaranthus like plant height, number of leaves prior to harvest leading to high dry matter production.

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