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Effect of Organic Manures on Nutrient Uptake of Beet Root Cv. Crimson Globe

Chitti Jagadeesh*, M. Madhavi, M. Siva Prasad and V.V. Padmaja

Department of Vegetable Science, College of Horticulture, Dr.Y.S.R. Horticultural University, Mojerla, Mahabubnagar, India

**Corresponding author*

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A B S T R A C T

Beetroot (*Beta vulgaris* L.), also called as garden beet or table beet, is one of the major root vegetable. It is grown in almost all states of India but in small scale only. It produces green tops and a swollen root used both as vegetable and salad. It is highly productive and usually free from pests and diseases (Ado, 1999). A field experiment was conducted during *rabi*, 2014 in alkali soils. The experiment was laid out in a randomized block design with three replicated 11 treatments *viz*., T_1: FYM (100%), T_2: Vermicompost (100%), T_3: Neem cake (100%), T_4: Poultry manure (100%), T_5: Green manure (100%), T_6: FYM (50%) + Vermicompost (50%), T_7: FYM (50%) + Neem cake (50%), T_8: FYM (50%) + Poultry manure (50%), T_9: FYM (50%) + Green manure (50%), T_{10}: RDF, T_{11}: Control. The data were recorded on NPK uptake (kg ha^{-1}) by the crop. The highest N uptake in plant was recorded with FYM (50%) + vermicompost (50%). The highest P and K uptake in plant was recorded with poultry manure (100%).

Introduction

Beetroot (*Beta vulgaris* L.), also called as garden beet or table beet, is one of the major root vegetable belongs to the family Chenopodiaceae along with spinach, palak, swiss chard, parsley, celery and it has chromosome number of 2n=18. Beet originated in Western Europe and North Africa where they were grown to feed both humans and livestock. This crop is a biennial grown as a cool season annual. It is grown in northern and southern parts of India. It is grown in almost all states of India but in small scale only. It produces green tops and a swollen root used both as vegetable and salad. It is highly productive and usually free from pests and diseases (Ado, 1999). It is a rich source of protein, carbohydrate, calcium, phosphorous and vitamin C, hence it is an ideal vegetable for health conscious people (Deuter and Grundy, 2004). Red color of roots is due to presence of betanine pigment.

Vermicompost provides vital macronutrients (N, P, K, Ca and Mg) and micronutrients (Fe, Mo, Zn and Cu). Vermicompost besides being a rich source of micronutrients, also acts as chelating agent and regulates the availability of metallic micronutrients to the plants and

increase the plant growth and yield by providing nutrients in the available form. Neem cake is a main product of neem seed kernel and has adequate quantity of NPK in organic form for plant growth. Being totally botanical product it contains 100% natural NPK content and other essential micro nutrients. Poultry manure is an extremely rich source of nitrogen and organic matter. Poultry manures contain 1.0-1.8 percent of nitrogen, 1.4-1.8 percent of phosphorus and 0.8-0.9 percent of potassium. Green manuring has a positive influence on the physical and chemical properties of the soil, builds up soil structure and improves tilth, fertility improvement of soils and amelioration of soil problems. The present study is proposed in problematic highly alkaline soils which require enrichment with different sources of organic manures rather than inorganic fertilizers. The alkaline soils are low in organic Carbon, Nitrogen, Phosphorus, medium in available Potassium content.

Among the many constraints to increase productivity in beet root, inorganic nutrition is the main limiting factor especially in alkaline soils. The continuous use of inorganic fertilizers is adversely affecting the sustainability of production besides causing environmental pollution. In view of increased awareness about organic manuring , increased availability of organic inputs and sustainability in the farm, investigation on these aspects have thus become imperative to study and assess their effect on nutrient uptake there by increasing the growth, yield, quality and shelflife of beet root. Hence, this investigation is planned to identify effect of organic manures on nutrient uptake of beet root grown in alkali soils.

Materials and Methods

A field experiment was conducted during *rabi*, 2014 in alkali soils, at college farm, College of Horticulture, Dr. Y.S.R. Horticultural University, Mojerla, Mahabubnagar(Dt). The experiment was laid out in a randomized block design with three replicated 11 treatments *viz*., T_1: FYM (100%), T_2: Vermicompost (100%), T_3: Neem cake (100%), T_4: Poultry manure (100%), T_5: Green manure (100%), T_6: FYM (50%) + Vermicompost (50%), T_7: FYM (50%) + Neem cake (50%), T_8: FYM (50%) + Poultry manure (50%), T_9: FYM (50%) + Green manure (50%), T_{10}: RDF, T_{11}: Control. The data were recorded on NPK uptake (kg ha^{-1}) by the crop.

Nutrient uptake by the plant (kg ha^{-1})

The leaves and roots of beetroot were separately estimated for their nitrogen, phosphorus and potassium using Microkjeldhal method (AOAC, 1969), Vanado Molybdophosphoric yellow colour method, and Elico-Flame Photometer method (Piper, 1966) respectively.

Drying and powdering

The beetroot samples were collected at harvesting time, oven dried for 20 days and were powdered in a grinding mill. The fine powder used for the estimation of mineral nutrients.

Estimation of NPK in plant material

Total nitrogen in plant samples was determined by Kjeldahl method. The di-acid digestion was followed for the determination of phosphorus and potassium. It was carried out using a 9:4 mixture of HNO_3 : $HClO_4$ and the detailed procedure is as follows (Piper, 1966).

Estimation of available N, P and K in soil sample

The procedure involves distilling the soil with alkaline potassium permanganate solution and determining the ammonia liberated (Piper,

1966).For determining plant available P in soil the olsen's method was used. The reagents used in this method are. Available was K or exchangeable K was usually determined in neutral normal ammonium acetate (NH_4OCH_3) extract of soil. The extraction was carried out by shaking followed by filtration or centrifugation and K was estimated by using a flame photometer (Piper, 1966).

Results and Discussion

The effect of different organic manures viz, FYM, vermicompost, poultry manure, neem cake and green manure at various stages of crop growth in Beetroot with respect to nutrient uptake is studied. The results of the present investigation on the above aspect are presented here under.

Nutrient uptake

The N, P and K uptake by the Beet root crop was significantly affected by the application of FYM, vermicompost, neem cake, poultry manure and green manure. The results are presented in Table 1.

Nitrogen uptake (kg ha^{-1})

The highest nitrogen uptake (292.0) was recorded in T_6 with the application of FYM (50%) + vermicompost (50%) which was at par with T_4 (275.0) with poultry manure (100%) and T_8 (274.99). RDF @ 70 kg N; 110 kg P_2O_5; 70 kg K_2O recorded nitrogen uptake of 248.33 and the lowest was recorded in T_{11} (201.66) with control.The increased N uptake could be due to increased and prolonged availability of N to the plants in these treatments and also due to increased dry matter yield. Nutrient uptake is a positive function of dry matter yield (Ramakal *et al.*, 1998). This is in consonance with the findings of Chalapathi *et al.,* (1997) and Mallangouda *et al.,* (1995) in onion and garlic.

Phosphorus uptake (kg ha^{-1})

The highest phosphorus uptake (144.28) was recorded in T_4 with the application of poultry manure (100%) which was at par (139.30) with T_6 with FYM (50%) + vermi compost (50%), (132.65) T_2 with vermicompost (100%), (128.26) with T_1 FYM (100%) and (131.86) T_8 which were significantly superior to all other treatments. RDF @ 70 kg N; 110 kg P_2O_5; 70 kg K_2O recorded a phosphorus uptake of 92.93 and the lowest was recorded (85.59) in T_{11} with control.

Normally phosphorus is said to be in fixed form and its absorption is a slow process or sometimes not available. Interestingly, in the present study plants supplied with these organic manures have recorded larger uptake of phosphorus. This could be attributed to their chelating action in making ions available and maintaining soil physical condition. It could also be due to the increased availability of P due to the solubility effect of organic acids which were produced from the decomposing organic manures. Further vermicompost might also reduced the fixation of P and thus might have increased the availability of P in soil solution for its better absorption resulting in increased uptake of P in beetroot.

Potassium uptake (kg ha^{-1})

The highest potassium uptake (715.25 kg ha^{-1}) was recorded in T_4 with the application of poultry manure (100%) which was at par with organic sources applied treatments T_2 vermicompost (100%), T_3 neem cake (100%), T_6 FYM (50%) + vermicompost (50%) and T_1 FYM (100%) but significantly superior to all other treatments. RDF recorded a potassium uptake of 595.0 and the lowest was recorded in T_{11} (592.0) with control.

Table.1 Effect of different organic manures on N, P and K uptake (kg ha^{-1}) of Beetroot at harvest

Treatments	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
T_1 : **FYM (100%)**	230.00	128.26	660.52
T_2 : **Vermicompost (100%)**	254.00	132.65	710.52
T_3 : **Neem cake (100%)**	241.33	119.68	673.00
T_4 : **Poultry Manure (100%)**	275.00	144.28	715.25
T_5 : **Green Manure (100%)**	220.00	103.79	611.35
T_6 : **FYM (50%) + Vermicompost (50%)**	292.00	139.30	667.66
T_7 : **FYM (50%) + Neem cake (50%)**	262.67	109.92	648.00
T_8 : **FYM (50%) + Poultry Manure (50%)**	274.99	131.86	661.33
T_9 : **FYM (50%) + Green Manure (50%)**	227.33	113.25	663.60
T_{10}: **RDF @ 70 kg N; 110 kg P_2O_5; 70 kg K_2O**	248.33	92.93	595.00
T_{11}: **Control**	201.66	85.59	592.00
CD at 5%	23.14	17.765	71.66
SE(m) ±	7.79	5.98	24.13

Nitrogen possibly might have influenced the potassium uptake by virtue of its complementary action with potassium. The increase in K uptake was due to the increased availability of nutrients from the native, as well as from the mineralized organic manures which might have increased the concentration of K in soil solution making it readily available for absorption.

Potash likely to be maintained in exchangeable form in soil treated with organic manures, which in turn might have restricted the K^+ ions getting fixed by inorganic clay particles in soil. The increased uptake of NPK due to addition of organic manure is due to the action of organic acids which form organic matter complex. Some of which in addition to influencing pH, form stable complexes or chelated compounds with cations responsible for phosphate fixation (Prabhu *et al*., 2002). The application of FYM in combination with vermicompost significantly increased yield, improved the chemical properties of the soil, increased the nutrient availability and there by lead to increased nutrient uptake by beetroot. The salinity in soil cause imbalance in ions and nutrient uptake, along with these environmental factors and soil microbial activities play same role in increasing of NPK from intial content of nutrients to final plant nutrient uptake.

In conclusion, the nutrient uptake (N, P, K), net returns and benefit cost ratio were significantly affected with various organic manures. The uptake of N (292.0 kg ha^{-1}) was maximum with farmyard manure (50%) + vermicompost (50%) followed by poultry manure (100%), and the uptake of P (144.28 kg ha^{-1}) and K (715.25 kg ha^{-1}) were

maximum with poultry manure (100%).

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