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Response of different organic sources on growth and yield of sweet potato (*Ipomoea batatas* L.) cv. NDSP-65

Avadh Bihari Singh, Chandra Deo, Sriom, Sharvan Kumar, Akshay Jain and Rajneesh Shukla

Abstract
A field experiment was conducted at Main Experiment Station, Department of Vegetable Science, Narendra Deva, University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during the *Rabi* season of 2015-16 to access the Response of different organic sources on growth and yield of sweet potato (*Ipomoea batatas* L.) cv. NDSP-65.The experiment was conducted with randomized block design replicated three times with eleven treatments viz. T_1 FYM @ 20 t/ha,T_2Poultry manure @ 5t/ha,T_3 Neem cake @ 4t/ha + Azospirillum5kg/ha + PSB5kg/ha, T_4 Vermicompost @ 5t/ha + Azospirillum5 kg/ha + PSB5kg/ha, T_5FYM @ 10t/ha + Vermicompost 2.5t/ha + Azospirillum5 kg/ha + PSB5kg/ha, T_6FYM @ 10 t / ha + Neem cake @ 1t/ha + Azospirillum(5 kg/ha)+PSB5kg/ha, T_7FYM @ 10t / ha + Poultry manure @ 2.5t/ha + Azospirillum5 kg/ha + PSB5kg/ha,T_8 Vermicompost @ 2.5t/ha + Neem cake @ 1t/ha + Azospirillum5 kg/ha + PSB5kg/ha,T_9 Vermicompost @ 2.5t/ha + Poultry manure 2.5t/ha + Azospirillum5 kg/ha + PSB5kg/ha,T_{10} 1/2 Recommended dose of Fertilizers + Azospirillum2.5 kg/ha + PSB2.5kg/ha,T_{11} Recommended dose of FYM and NPK 10t/ha & 50:25:50, The experimental results revealed that the use of T_{11} Recommended dose of FYM and NPK 10t/ha & 50:25:50 was found better with respect to all the growth parameters like number of vine per plant, inter nodel length (cm).
The yield contributing characters such as number of tuber plant^{-1}, weight of tuber plant^{-1} and yield ha^{-1} (q) of sweet potato crop were significantly higher by use of T_{11} Recommended dose of FYM and NPK 10t/ha & 50:25:50.The maximum net return Rs. (Rs 222343.5) and benefit: cost ratio 3.6 were recorded under Recommended dose of FYM and NPK (10t/ha & 50:25:50 This was found suitable remunerative treatment and help in taking decision for successful crop production of sweet potato from farmer's point of view.

Keywords: sweet potato (*Ipomoea batatas* L.), NDSP-65, organic manures, growth, Yield

1. Introduction
The sweet potato [*Ipomoea batatas* (L.) Lam] belongs to family convolvulaceae, is one of the important tuber crops of tropical and sub-tropical regions of the world. Sweet potato is considered to be native of South America. In India, it is mainly cultivated in Bihar, Orissa, Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka and approximately 80% of the world sweet potato is grown in Asia, 15% in Africa and about 5% in rest of the world.
The total area in India under sweet potato is estimated to be 0.111 M ha with the production of 1.45 million tonnes and the productivity of 13.06 tonnes per hectare respectively (Anonymous, 2015) [6]. The sweet potato constitutes the staple diet of tribal population due to hardiness and adaptability into diversified farming system. Sweet potato is used both for direct human consumption and manufacturing of industrial products such as starch, glucose pectin, sugar and alcohol etc. It is a rich source of carotene, ascorbic acid, thiamine, riboflavin, protein and energy.
It is a major source of carbohydrate for millions of people, especially in developing countries and consumed either as fresh vegetable or boiled or baked products. The yellow or orange fleshed varieties of sweet potato contain high level of *β*-carotene a precursor of vitamin A. and it is reported that weekly intake of 100g orange fleshed sweet potato could help in overcoming vitamin A deficiency in children, pregnant women and lactating mothers. This nutritional and economic importance of sweet potato shows importance to increase yield and quality. The plant is grown for its edible tuberous roots that contain about 27% carbohydrate and high concentrations of Vitamin A, Vitamin C, calcium and iron. Fresh sweet potatoes provide about 50% more calories than Irish potatoes. The leaves are used as leaf vegetable as well as good fodder value and much more industrial value.
The balance availability of all plant nutrients is essential for good yield and better quality of

product.

As no single source is capable to supply the required quantity of plant nutrients, integration of all sources is must to ensure the balance supply of nutrients to plants, with aim to increase the yield, quality, farm income, correction of inherent soil nutrients deficiencies and restoring fertility and productivity that have been degraded by wrong and over exploitative activities of the past. There is large number of organic and inorganic sources of plant nutrients such as farm yard manure, town compost, horse manure, sewage sludge, press mud, goat and sheep manure, cattle manure and vermi-compost along with the chemical fertilizers that could be used to reduce the total cost of cultivation and to supplement the essential nutrients for better growth and development of the plants. Although farm yard manure is bulky in nature and contains small quantities of different plant nutrients however, its application in soil improves physico-chemical as well as biological properties of the soil, which improves the soil fertility and productivity. It also improves the soil structure, porosity, aeration, drainage, water retention capacity and prevents the soil degradation which helps to plants directly or indirectly.

Farm yard manure (FYM) influences the physico-chemical as well as biological properties of the soil, which in turn improves the soil fertility and productivity. It also improves the soil structure, porosity, aeration, drainage, water retention capacity and prevents the soil degradation.

Similarly neem cake has a higher lime nutrient content (7.8% total) as compared to farm yard manure (1.2% total). It is also used for controlling nematodes and other soil borne organism and boost up the crop yield. It contains 5.22% N_2, 1.08% P_2O_5 and 1.48% K_2O.

Nitrogen is the most limiting factor in Indian soils. It is known that about 4,000 million tonnes of nitrogen is present in atmosphere which comes about seventy seven thousand tonnes over an area of one hectare of land. Phosphorus is the next most important major primary nutrient after nitrogen from plant. However, examination of Indian soil indicated that low to medium in available phosphorus and not more than 30 per cent of applied phosphate is available to current crop, remaining part gets converted into relatively unavailable form (Marwaha, 1995) [14]. Potassium is also one of the limiting nutrients of the soil of plain. Besides, nutritional effects, potassium improve the sweet potato yield by increasing resistance in the plant again stresses and diseases.

Bio-fertilizers contain agriculturally important beneficial viable-organisms which have ability to mobilize nutritionally important elements from non- usable to usable form through biological process. *Azospirillum* is considered to be an important growth promotive rhizobacteria that can improve the growth and yield of several plant including economically important cereals, vegetables and grasses. *Azospirillum* plant association leads to the enhanced development and increase yield of different host plant under appropriate condition (Singh, *et al.*2010). *Azospirillum* is known to be a very active nitrogen fixer under laboratory as well as soil condition providing fast growth, better health of the plant and higher yield (Kannan and Ponmurugan, 2010) [11], organic fertilizer derived from animal matter, human excreta or vegetable matter (e.g. compost, manure) (Dittmar *et al.,* 2009). The bacteria induce the plant roots to secrete mucilage, which creates low oxygen environment and helps to fix atmospheric nitrogen in the soil. It fixes 10-40 kg/ha/season N_2 in many vegetable crops. Fertilizers cost is increasing day by day, therefore, the farmers are looking for an alternate source which reduces the cost of cultivation along with maintaining the fertility status of soil. The response of organic sources with or without chemical fertilizers on a large number of crops have been reported by several workers, however meager information is available on the sweet potato crop in this regard.

Material and method

The experiment was carried out during 2015-2016, at Main Experiment Station, Department of Vegetable Science, N.D.U.A. & T., Faizabad (U.P) India. The experimental site falls under sub-humid, subtropical climate and is located at 26.470 N latitude and 82.120 E longitudes on an elevation of 113 meters above mean sea level in the Indo-gangetic alluvial plains of eastern Uttar Pradesh. Maximum rainfall in this area is received from mid-June to end of September. The weekly maximum and minimum temperatures during the crop growth period ranged from 36.6 and 20.1 and 25.8 to 5.2, respectively. The total rainfall recorded during the crop period was 15.2 mm.

A well prepared manured nursery having good drainage helps in producing better planting materials. Planting in nursery is done 3 months before ahead of planting in main field. The selected tubers are planted 5-10 cm deep at a spacing of 30 cm in rows, 60 cm a part. The sprouts are often cut after 40-45 days and planted in secondary planted nursery for further growth. The vine cutting, 20-30 cm in length, the cuttings are made and planted in the field, with a spacing of 60 cm x 30 cm. All the recommended agronomic package of practices and plant protection measures were followed to raise a good crop. The crop was harvested on 4th and 5th February during the year 2015-2016.

The recommended dose of NPK was 50:25:50 kg/ha and 25:12.5:25 kg/ha. Nitrogen fertilizers were applied as per treatments under study at the last ploughing; the whole quantity of organic manure, vermicompost and biofertilizer was incorporated in the soil as per treatment under study. The different treatments are given in table 1 with the details of doses.

Observations recorded on five randomly selected plants from each genotype in each replication for growth and yield along with related characters *viz.,* days to initiation of buds, number of leaves per plant, leaf area, foliage weight per plant, number of vine per plant, inter nodal length, tuber weight, number of tubers per plant, fresh weight of tuber per plant, length of tubers, diameter of tubers and yield per hectare. The collected data were averaged to get mean values of the respective characters that has been affected by various treatments integrated nutrient managements in sweet potato.

The data were subjected to the analysis of variance (ANOVA) appropriate the design and test of significance of the treatment difference was done on the basis of F test (Gomez and Gomez, 1984) [9]. The treatments were compared with the help of critical difference, following the techniques described by (Panse and Sukhatme, 1967) [24] and results were evaluated at 5% level of significance.

Table 1: Different integrated organic treatments with their respective doses

Treatment	Doses
T_1	FYM @ 20 t/ha
T_2	Poultry manure @ 5t/ha
T_3	Neem cake @ 4 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)
T_4	Vermicompost @5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)
T_5	FYM @ 10 t/ha + Vermicompost 2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)
T_6	FYM @ 10 t/ha + Neem cake @1 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)
T_7	FYM @ 10 t/ha + Poultry manure @2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)
T_8	Vermicompost @ 2.5 t/ha + Neem cake @ 1 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)
T_9	Vermicompost @ 2.5 t/ha + Poultry manure 2.5 t/ha + Azospirillum (5 kg/ha) + PSB (5 kg/ha)
T_{10}	1/2 Recommended dose of Fertilizers + Azospirillum (2.5 kg/ha) + PSB (2.5 kg/ha)
T11	Recommended dose of FYM and NPK (10 t/ha and 50:25:50 kg NPK/ha)

Result and Discussion

Growth parameters

The observation assembled on account of number of vine per plant as influenced by various organic treatments have been presented in Table 4.5 and graphically presented in Fig. 6. within from the table that treatment T_{11} Recommended dose of FYM and NPK (10t/ha & 50:25:50 kg NPK/ha) recorded maximum number of branches (10.68) and this treatment was statically at par with T_7 (FYM @ 10 t / ha + Poultry manure @ 2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB 5 kg/ha) and significantly superior over the rest of treatments minimum value recorded under T_4.

It is clearly evident from the table that maximum inter nodal length was found with the application of T_{11} which was statistically at par with treatment T_6 and T_7. However, the minimum inter nodal length was found with the application of T_2.

Table 2: Effect of different organic treatments on growth

Treatments	Number of vine plant^{-1}	Inter nodal length (cm)
T_1 = FYM @ 20 t/ha	8.13	3.43
T_2= Poultry manure @ 5 t/ha	6.52	3.01
T_3= Neem cake @ 4 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	7.86	3.36
T_4=Vermicompost @ 5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	5.73	3.14
T_5 = FYM @ 10 t/ha + Vermicompost 2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	9.20	3.71
T_6 = FYM @ 10 t / ha + Neem cake @1t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	9.61	3.83
T_7 = FYM @ 10t / ha + Poultry manure @ 2.5t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	10.01	3.92
T_8 = Vermicompost @ 2.5t/ha + Neem cake @ 1t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	7.60	3.29
T_9 = Vermicompost @ 2.5t/ha + Poultry manure 2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	7.19	3.19
T_{10}= 1/2 Recommended dose of Fertilizers + *Azospirillum* (2.5 kg/ha) + PSB (2.5 kg/ha)	8.67	3.57
T_{11}= Recommended dose of FYM and NPK (10 t/ha and 50:25:50 kg NPK/ha)	10.68	4.10
SEm	0.599	0.15
CD at 5%	1.760	0.45

Among all the treatments leaf area, number of leaves, inter nodal length, foliage weight was significantly improved by the use of recommended dose of FYM and NPK (10t/ha & 50:25:50 kg NPK/ha). While in case of all organic sources of treatment use ofFYM @ 10t/ha + Poultry manure @ 2.5t/ha + *Azospirillum* 5 kg/ha + PSB 5kg/ha shows significant effect on leaf area, number of leaves, inter nodal length, foliage weight.

The increase in growth parameters are might be because of better photosynthesis activity in large photosynthesis area. Since, nitrogen is one of the basic minerals associated with synthesis of protoplasm and in primary synthesis of amino acids. It increases meristematic activity at faster rate under higher dose which cause better plant growth and intermodal length. It is also an established fact that plant supplied with abundant nitrogen and phosphorus would assimilate higher photosynthesis and better translocation resulting higher in vegetative growth. Production hormones by biofertilizers and inhibition of pathogen which cause rotting of tubers may be the cause of higher emergence. The finding gets full support from the observations Patel and Mehta (1984) [23], Sidorenko *et al.* (1996), Kumar and Mangal (1977), Ghosh and Das (1998) [8] and Sood and Sharma (2001) [27].

Various organic sources of nutrients markedly increased the plant height and number of leaves and number of veins per plant. Application of of T_7 (FYM @ 10t/ha + Poultry manure @ 2.5t/ha + *Azospirillum* 5kg/ha + PSB 5kg/ha) give maximum plant height and number of leaves per plant. The clearly indicated that higher levels of nutrients and a helped in cell elongation of stem due to development of cell and rapid cell division and cell elongation in meristmatic region of plant. Similar findings have also been reported by Panigrahi and Behera (1993) [21], El Gamal (1996) [7], Sidorenko *et al.* (1996), Kumar Mangal (1997), Ghosh and Das (1998) [8] and Sood and Sharma (2001) [27].

Yield Parameters

It is evident from the data that different treatments have their significant impact of number of tubers per plant. The maximum number of tubers (4.0/plant) were noted under T_{11} recommended dose of FYM and NPK (10 t/ha & 50:25:50 kg NPK/ha) and T_6 FYM @ 10 t / ha + Neem cake @1 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha) treatment which was at par with T_7. It is obvious from the table that minimum value was noted under T_2 (Poultry manure @ 5 t/ha).

Obviously maximum weight of tuber per plant recorded (409.50 g) in T_{11} recommended dose of FYM and NPK (10

t/ha and 50:25:50 kg NPK/ha). Which was statistically at par with T_7, and significantly superior over the rest of treatments and minimum value *i.e*. 301 was observed with the treatment T_2 (Poultry manure @ 5t/ha) during the period of investigation.

Despite, minimum tuber yield per hectare *i.e.* 176.73q was recorded under T_2 treatments.

Table 3: Effect of different organic treatments on Yield

Treatments	Number of tuber plant^{-1}	Weight of tuber plant^{-1} (g)	Yield per hectare (q)
T_1 = FYM @ 20 t/ha	3.50	343.00	201.39
T_2= Poultry manure @ 5 t/ha	3.00	301.00	176.73
T_3= Neem cake @ 4 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	3.40	336.00	197.28
T_4=Vermicompost @ 5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	3.15	311.50	182.90
T_5 = FYM @ 10 t/ha + Vermicompost 2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	3.40	371.00	217.83
T_6 = FYM @ 10 t / ha + Neem cake @1t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	4.00	381.50	224.00
T_7 = FYM @ 10t / ha + Poultry manure @ 2.5t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	3.60	392.00	230.16
T_8 = Vermicompost @ 2.5t/ha + Neem cake @ 1t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	3.20	329.00	193.17
T_9 = Vermicompost @ 2.5t/ha + Poultry manure 2.5 t/ha + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha)	3.00	318.50	187.01
T_{10}= 1/2 Recommended dose of Fertilizers + *Azospirillum* (2.5 kg/ha) + PSB (2.5 kg/ha)	3.50	357.00	209.68
T_{11}= Recommended dose of FYM and NPK (10 t/ha and 50:25:50 kg NPK/ha)	4.00	409.50	240.44
SEm	0.12	12.89	9.26
CD at 5%	0.369	38.00	27.31

Among all the treatment number of tuber and yield of tubers were significantly improved by the use of recommended dose of FYM and NPK (10t/ha & 50:25:50 kg NPK/ha). While in case of all organic sources of treatment use of FYM @ 10t/ha + Poultry manure @ 2.5t/ha + *Azospirillum* 5 kg/ha + PSB 5kg/ha shows significantly effect on number of tuber and yield of tubers. T_2 gives minimum number and yield of tuber per plant and per hectare. These results are conformity with the findings of Imam and Badawy (1978) [10].

The number of tubers and per hectare (q) were affected significantly under the influenced by various organic sources of nutrients and treatment T_7 (FYM @ 10 t/ha + Poultry manure @ 2.5t/ha + *Azospirillum* 5 kg/ha + PSB 5kg/ha) produced significantly more number of tubers, yield per plot (kg) and per hectare (q) followed by T_6 (FYM @ 10t/ha + Neem cake @1t/ha + *Azospirillum* 5 kg/ha+ PSB 5kg/ha). Increased in number and yield of tubers and total tuber yield in treatment T_7 (FYM @ 10 t/ha + Poultry manure @ 2.5t/ha + *Azospirillum* 5kg/ha + PSB 5kg/ha) may be due to balanced supply of nitrogen, phosphorus and potassium through biofertilizers and major micronutrients from vermicompost, which might have improved the number and yield of and total yield of tubers. The above findings are also supported by Patel and Mehta (1984) [23], Singh and Sood (1996), Yadav *et al.* (2003) [29], Raghav and Kamal (2009) [25], Zaman (2011) [31] and Kumar *et al.* (2013).

Summery and conclusion

Present investigation entitled "Response of different organic sources on growth and yield of sweet potato [*Ipomoea batatas* (L.) Lam] cv. NDSP-65" was conducted at Main Experiment Station, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during the time of investigation. To find out the best treatment under different organic sources for optimum growth, yield and quality and also economic returns along with fertilizer economy by the use of organic treatments. Eleven treatments *viz*., T_1 (FYM @ 20 t/ha, T_2 Poultry manure @ 5 t/ha), T_3 (Neem cake @ 4 t/ha + *Azospirillum* 5 kg/ha + PSB 5kg/ha), T_4 (Vermicompost @ 5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha), T_5 (FYM @ 10 t/ha + Vermicompost 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha), T_6 (FYM @ 10t/ha + Neem cake @ 1 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha), T_7 (FYM @ 10 t/ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha), T_8 (Vermicompost @ 2.5 t/ha + Neem cake @ 1 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha), T_9 (Vermicompost @ 2.5 t/ha + Poultry manure 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha), T_{10} (1/2 Recommended dose of Fertilizers + *Azospirillum* 2.5 kg/ha + PSB 2.5 kg/ha), T_{11} (Recommended dose of FYM and NPK 10 t/ha & 50:25:50 kg) were arranged in randomized block design with three replications. The recommended dose of NPK was 50:25:50 kg/ha FYM 10 t/ha, nitrogen were applied as per T_{10} and T_{11} treatments. At the last ploughing, the whole quantity of organic manures FYM, Neem cake, Vermicompost poultry manure, Bio-fertilizer was incorporated in the soil as per treatments under study. In fertilizer treatments half quantity of nitrogen and full quantity of phosphorus and potassium were applied in row about 5cm apart from Vine planting and remaining quantity of nitrogen was top dressed in furrows of the time of earthling up in T_{10} and T_{11} treatments. Vine was planted in the field at spacing of 60 cm x 30 cm on September 15th, 2016 respectively. All the cultural and plant protection measures were made as and when required. The response of sweet potato to various organic treatment was measured in term of quantitative expression *i.e*. days to initiation of buds, inter nodal length (cm), number of leaves per plant, leaf area (cm^2), number of branches per vine, foliage weight of vines per plant (g) and yield attributes *i.e.* length of tubers (cm), diameter of tuber (cm), number of tuber per plant, yield per plant (g), yield per hectare (q), quality parameters *i.e*. TSS, moisture content (%), dry matter content (%), the crop. Economics of the all treatments were also worked out. Important findings derived

from the experiment are summarized in subsequent paragraphs.

1. All the growth parameter *viz*. Inter nodal length (cm), number of leaves per plant, leaf area (cm^2), number of branches per vine, foliage weight of vines per plant (g) influenced significantly by the use of various organic treatments. It is quick clear from findings that all growth parameters were found maximum among the all treatments, by the use of recommended dose of FYM and NPK 10 t/ha & 50:25:50 kg, while in the case of organic treatments growth parameters were found maximum by use of FYM @ 10 t/ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha, during period of investigation.
2. Various yield attributes *viz.* Length of tubers (cm), diameter of tubers (cm), number of tubers per plant, weight per tubers were also influenced significantly among the all treatments by the use of recommended dose of FYM and NPK 10t/ha & 50:25:50 kg, while in case of organic treatment were found maximum FYM @ 10 t/ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha during the period of investigation.
3. Yield per plant (g) and yield per hectare (q) in the all treatment were found significantly superior by the use of recommended dose of FYM and NPK (10t/ha & 50:25:50 kg), while in case of organic treatments significantly superior by the use of FYM @ 10t / ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha during the period of investigation.
4. TSS, Moisture content (%), and dry matter content (%) were also found by significantly superior the use of recommended dose of FYM and NPK 10t/ha & 50:25:50 kg), while in case of organic treatments were found by significantly superior the use of FYM @ 1 t/ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha during the period of investigation.
5. Highest benefit: cost ratio was recorded by the use of **T_{11}** (3.36) followed by **T_{10}** (3.19), respectively, while in the case of organic treatments highest benefit: cost ratio was recorded by the use of T_7 (2.87) followed by T_5 (2.56) during the period of investigation.

Conclusions

Thus, the experimental evidences warrant the following specific conclusion, which may be, in general, adopted for profitable cultivation of sweet potato.

- On the basis of observations recorded during period of investigation it could be concluded that T_{11} recommended dose of FYM and NPK 10t/ha & 50:25:50 kg, while in case of the organic treatments FYM @ 10 t/ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha was found effective for all growth yield and quality attributes of sweet potato.
- On the basis of economic returns, it may be referred that treatment T_{11} recommended dose of FYM and NPK 10 t/ha & 50:25:50 kg, while in case of the organic treatments FYM @ 10 t/ha + Poultry manure @ 2.5 t/ha + *Azospirillum* 5 kg/ha + PSB 5 kg/ha was more beneficial from farmer's point of view which helps in taking decision for successful crop production of sweet potato.

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