Original Research Article

Influence of Organic Manures and Inorganic Fertilizers on Growth, Yield and Quality of Turnip (*Brassica rapa* L.)

ABSTRACT

An experiment entitled the **Influence of organic manures and Inorganic fertilizers on growth, yield and quality of turnip (*Brassica rapa* L.)** cv. Purple Top white globe was conducted at Department of Horticulture, Naini Agriculture Institute, SHUATS, Prayagraj during, *Rabi* season of 2022. The experiment was laid out in Randomized Block Design with fifteen treatments combination and three replications in which Farmyard manure (FYM), Poultry manure, Vermicompost were used. Among all the treatments, T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) showed significant result in terms of plant height (29.13cm), maximum number of leaves/plant (13.81), higher Shoot weight (166.81g), maximum Root diameter (7.40 cm), average root length (9.04 cm), average fresh weight/ plant (162.59 g), average root yield (55.77 q/ha), ascorbic acid (36.19 mg), TSS (6.08^{o} Brix).

Key words: - *Poultry manure, Vermicompost, Farmyard manure , Growth, Yield, Quality*

INTRODUCTION

"Turnip (*Brassica rapa* L.) is a winter crop but also a popular root vegetable crop. It is botanically herb, but is cultivated as annual root crop for both human and animal consumption. The storage organ is swollen hypocotyl. Turnips are high in Vitamin C, Calcium, Iron and other minerals, the tops (turnip greens) can be used as green vegetable which have high levels of Vitamin A, B, but the crop is generally grown for its roots. Many agronomic factors affect its production but the optimum date of sowing and nitrogen dose are the most important factors affecting the production and productivity of fodder turnip of its short duration and its effect on the crop growth and green fodder and root yield". **(Turk *et al*., (2009) sarhan *et al*., (2003) and Smart *et al*., (2004**). "It is well established in fertile and medium to heavy well drained soils are best suited to grow. Turnip can be grown in slightly acidic to saline soils. However, the optimum soil pH range is 6.0-7.0" (**Choudhary, 2015).**

Inorganic manures like Nitrogen, which is an essential macronutrient needed by all plants to thrive. It is an important component of many structural, genetic and metabolic compounds in plant cells. Increasing the levels of nitrogen during the vegetative stage can strengthen and support plant roots, enabling plants to take in more water and nutrients; and allows a plant to grow more rapidly and produce large amounts of succulent, green foliage, which in turn can generate bigger yields, tastier vegetables, and a crop that is more resistant to pests, diseases, and other adverse conditions.

"Organic manures like FYM which, provides both macro and micronutrients to plants. It supplies nitrogen, phosphorus, potassium and micronutrients like Fe, S, Mo, Zn etc. in available from to the plants through biological decomposition and improves physical-chemical properties of soil such as aggregation, aeration, permeability, water holding capacity, slow release of nutrients, increasing in cation exchange capacity, stimulation of soil flora and fauna etc. A well decomposed FYM contains 0.5%N, 0.2% P_2O_5 and 0.5% K_2O"[17] . Similarly, Vermicompost accelerated biological degradation of organic wastes by earthworms and microorganisms. Earthworms consume and fragment the organic wastes into finer particles by passing them through a grinding gizzard and derive their nourishment from micro-organisms that grow upon them. The process accelerates the rates of decomposition of the organic matter, alter the physical and chemical properties of the material, leading to a humification effect in which the unstable organic matter is fully oxidized and stabilized vermicompost are finely

divided peat-like materials with high porosity, aeration, drainage, water-holding capacity.

“The effect of the application of organic manures and inorganic has been shown to change the physiological and developmental processes including plant vegetative growth expression yield components Turnip. Organic manures improve the physical, biological and chemical properties of soil but the nutrients may not be as readily available to the plants. However, inorganic fertilizer is usually immediately and fast containing all necessary nutrients that are ready for plants” [17]. The organic manures are used to improve the turnip growth i.e., increasing root biomass or root area and increasing the nutrient uptake capacity of the plant. The experiment entitled Influence of organic manures and inorganic fertilizers on growth, yield and quality of Turnip was conducted to check out the effect of different combinations of organic and inorganic source of nutrients on growth, yield and quality of turnip under the conditions of Prayagraj.

1. Materials and Methods

The field experiment was conducted during *Rabi* season of 2022 at Horticulture Research feild, Department of Horticulture, Naini Agriculture Institute, SHUATS, to study the Influence of Organic Manures and Inorganic Fertilizers on Growth, Yield and Quality of Turnip variety (Purple Top white globe), grown under irrigated conditions. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.40 %), available N (60 kg/ha), available P (30 kg/ha) and available K (20 kg/ha). The variable combinations are (FYM-40%, 20%, 13.3%, 19% and 6.6%), (Vermicompost-40%, 20%, 13.3%, 19% and 6.6%) and (Poultry Manure-40%, 20%, 13.3%, 19% and 6.6%) along with a combination of inorganic fertilizers (Nitrogen- 60% and 80%). The experiment was laid out in Randomized Block Design with Fifteen treatments in Three replications. The treatment combinations are T_0 [control 60:40:40 NPK+FYM 25 t/ha], T_1 [60% Nitrogen + 40% FYM], T_2 [60% Nitrogen + 40% Vermicompost], T_3 [60% Nitrogen + 40% Poultry manure], T_4 [60% Nitrogen + 20% FYM + 20% Vermicompost], T_5 [60% Nitrogen + 20% Vermicompost + 20% Poultry manure], T_6 [60% Nitrogen + 20% FYM + 20% Poultry manure], T_7 [60% Nitrogen + 13.3% Vermicompost + 13.3% FYM + 13.3% Poultry manure], T_8 [80% Nitrogen + 20% FYM], T_9 [80% Nitrogen + 20% Vermicompost], T_{10} [80% Nitrogen + 20% Poultry manure], T_{11} [80% Nitrogen + 10% FYM + 10% Vermicompost], T_{12} [80% Nitrogen + 10% Vermicompost + 10% Poultry manure], T_{13} [80% Nitrogen + 10% FYM + 10% Poultry manure], T_{14} [80% Nitrogen + 6.6% FYM +

6.6% Vermicompost + 6.6% Poultry manure]. The quality parameters of freshly harvested turnip were determined at horticultural maturity. Soil samples were collected for estimation of pH, EC and organic C. The turnip quality attributes such as total soluble solids (TSS) content was determined with ERMA hand refractometer (0-32°Brix) and ascorbic acid content and the total and reducing sugar contents were estimated following standard procedures. Growth parameters, yield attributes, quality parameters and economics was recorded. The Data recorded on different aspects of crop, such as, growth parameters, yield attributes and quality parameters were subjected to statistically analysis by analysis of variance method **(Gomez and Gomez, 1976)**.

2. RESULT AND DISCUSSION

3.1 Growth Parameters of Turnip

Days to germination

The data revealed that, significant and minimum days to germination (6.34 days) was observed with treatment T13 (80% Nitrogen+ 10% FYM + 10% Poultry manure) followed by T8 (80% Nitrogen+ 20% Farm yard manure) with 6.34 days.

Plant Height (cm)

The data revealed that, significant and higher plant height of Turnip (*Brassica rapa* L.) was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 29.13 cm. The mean value of plant height was found significant at different levels of NPK, Vermicompost, and FYM. The positive influence of the nutrients on plant height clearly supports the fact that higher application of nitrogen has a vital role in betterment of plant physiological process such as cell division, cell elongation along with timely metabolic processes and also favoured the greater assimilation of photosynthates. Similar findings were reported by **Satari *et al.*, (2020).** These results are in conformity with the findings of **Baloch *et al.*, (2014)** in radish.

Number of Leaves/plant

The data revealed that, significant and maximum Number of leaves per plant of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 6.85, 9.70 and 13.81cm in 15, 30 and 45 DAS. There was a linear increase in number of leaves per plant with advancement of growth stage. "The significant differences thereafter could be attributed to the requirement of developing plants for more quantum of carbohydrates, which might have forced the plants of these varieties to produce more number of leaves" **Dongarwar *et al.* (2018)**. The variation in number of leaves among different varieties was also reported by **Bhattarai *et al.* (2015)** in

turnip.

Leaf Length (cm)

The data revealed that, significant and maximum Leaf length of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 29.30 cm in 45 DAS. These variations in leaf area between varieties of turnip might be attributed to their inherent characters. "Further, the growth characters of the plants greatly depend on the genetic makeup of the variety. Leaf area might be helpful for more photosynthesis and making food for better yield potential character of plant growth and produce maximum yield" **Dongarwar *et al*., (2018).** Fertility levels had showed significant influence on leaf area in turnip. Similar results have been reported by **Sulfab *et al*., (2017).**

3.2 Yield Attributes and Quality Parameters of Turnip

Shoot weight (g)

The data revealed that, significant and maximum Shoot Weight of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 166.81 in 45 DAS. "The factors influencing the weight of leaves are leaf length and leaf size or even the nutrient content in the leaves. So, the phenotypic and genotypic features of leaf are an important feature in determining the weight of the leaves among different genotypes" **Semba *et al.*, (2019)**. Similar findings have been reported by **Pervez *et al.*, (2003)**. Organic and Inorganic played a pivotal role in improving shoot weight of Turnip. Similar findings have been reported by **Pimpini *et al*., (1992).**

Root diameter (cm)

The data revealed that, significant and maximum Root Diameter of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 7.40cm in 45 DAS. Root diameter depends upon environmental factors, soil conditions and genetic makeup **(Pervez *et al*., 2003).** It increases the photosynthetic activity and higher nutrients uptake that results the increasing the root diameter similar finding have been reported by **Manivannan *et al*., (2004).**

Root Length (cm)

The data revealed that, significant and maximum Root Length of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 9.04 in 45 DAS. Environmental and genetic factors strongly effect on root length. So, cultivars with more number of leaves have more root length **Pervez *et al*., (2003)** "Also, up take of more nutrients and rate of photosynthesis was higher than other plants so that vegetative growth was increased and the carrot roots were rich in carbohydrate" **Ladumor *et al.*, (2020)**.

The present findings are in conformity with the work done by **Dongarwar *et al.*, (2018)** on radish crop. Increase in root length may be due to more organic matter added in the soil would be helped better penetration roots in the soil and thereby better root length.

Root weight of Plant (g)

The data revealed that, significant and maximum root Yield plant of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 162.59 g in 45 DAS. It is well understood that yield is a parameter that is highly and positively affected by length, size, weight of root and total number of survived plants per plot **(Baloch *et al.*, 2014)**. Similar findings have been reported by **Sadia *et al.* ,(2013a&b)** and **Khetran *et al.*, (2016)** in turnip. The higher root weight and root yield may also be attributed to the readily availability of organic manures and inorganic fertilizers to the plant.

Shoot and Root weight (g)

The data revealed that, significant and maximum root yield plant of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 164.72 g in 45 DAS. It is well understood that yield is a parameter that is highly and positively affected by length, size, weight of root and total number of survived plants per plot (Baloch et al., 2014). Similar findings have been reported by **Sadia *et al.*, (2013)** and **Khetran *et al.*, (2016)** in turnip. The higher root weight and root yield may also be attributed to the readily availability of organic manures and bio-fertilizers to the plant.

Root Yield (q/ha)

The data revealed that, significant and maximum root Yield hectare of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 55.77 q/ha in 45 DAS. The higher root weight and root yield may also be attributed to the readily availability of organic manures and Inorganic fertilizers to the plant. It is well understood that yield is a parameter that is highly and positively affected by length, size, weight of root and total number of survived plants per plot **(Baloch *et al.*, 2014)**. Similar findings have been reported by **Sadia *et al.*,(2013 a&b)** and **Khetran *et al*,. (2016)** in turnip.

Ascorbic acid (mg/100g)

The data revealed that, significant and maximum root Ascorbic acid of Turnip was found in T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 36.19 (mg/100g) in 45 DAS.

Total soluble solids (°Brix)

The data revealed that, significant and maximum TSS (°Brix) of Turnip was found in

T_{11} (80% Nitrogen + 10% FYM + 10% Vermicompost) which was 6.08 in 45 DAS. The variation in the TSS content in root, might be due to the genetic make-up of varieties and it also might be due to the effect of soil and climatic conditions wherein that variety grown (**Dongarwar *et al.*, 2017).** The treatment with high as well as low content of total nutrient resulted in significantly lower TSS and soluble carbohydrates. Whereas higher sugar content was obtained with application of higher dose of nutrient and vermicompost.

Table 1 Influence of Organic Manures and Inorganic Fertilizers on Growth Parameters of Turnip

S. No.	Treatment Combinations		Growth Parameters			
			Days to germination	Plant Height (cm) 45 DAS	Number of leaves 45 DAS	Leaf Length 45 DAS
T_0	RDN (control 60:40:40 NPK+FYM 25 t/ha)		4.97	22.72	10.22	23.22
T_1	60% Nitrogen +40% FYM		4.18	25.32	11.42	26.15
T_2	60% Nitrogen +40% Vermicompost		5.44	25.12	11.37	25.41
T_3	60% Nitrogen +40% Poultry Manure		5.81	24.11	11.02	24.67
T_4	60% Nitrogen + 20% FYM +20% Vermicompost		4.17	27.34	13.23	27.50
T_5	60% Nitrogen + 20% Vermicompost + 20% Poultry Manure		4.45	26.14	12.29	26.21
T_6	60% Nitrogen + 20% FYM + 20% Poultry Manure		6.00	27.41	13.32	28.25
T_7	60% Nitrogen + 13.3% Vermicompost 13.3 % FYM + 13.3 Poultry Manure		4.87	26.43	13.16	27.40
T_8	80% Nitrogen + 20% FYM		6.23	26.19	12.32	26.53
T_9	80% Nitrogen + 20% Vermicompost		4.50	28.19	13.62	28.53
T_{10}	80% Nitrogen + 20% Poultry Manure		5.20	24.10	10.31	24.29
T_{11}	80% Nitrogen + 10% FYM + 10% Vermicompost		5.83	29.13	13.81	29.30
T_{12}	80% Nitrogen + 10% Vermicompost + 10% Poultry Manure		4.90	26.41	12.37	27.35
T_{13}	80% Nitrogen + 10% FYM + 10% Poultry Manure		6.34	24.43	11.22	25.41
T_{14}	80% Nitrogen + 6.6% FYM + 6.6% Vermicompost + 6.6% Poultry Manure		5.34	26.10	12.27	26.16
		F-Test	NS	S	S	S
		SE(d) ±		0.14	0.20	0.41
		CD (p=0.05%)		0.29	0.41	0.86
		CV		0.66	2.03	1.76

Table 2 Influence of Organic Manures and Inorganic Fertilizers on Yield attributes and Quality parameters of Turnip

		Yield attributes and Quality parameters								
S. No.	**Treatment Combinations**	Shoot weight (g)	Root Diameter(cm)	Root and Shoot weight (g)	Root Length (cm)	Root Weight (g)	Root Yield (q/ha)	Ascorbic acid(mg/100)	TSS(°Brix)	B:C ratio
T_0	RDN (control 60:40:40 NPK+FYM 25 t/ha)	**113.71**	**5.11**	**225.11**	**5.06**	**112.19**	**35.32**	**30.45**	**4.36**	**1.07**
T_1	60% Nitrogen +40% FYM	**128.13**	**6.15**	**269.11**	**6.44**	**141.37**	**46.77**	**32.44**	**5.70**	1.69
T_2	60% Nitrogen +40% Vermicompost	**124.02**	**6.04**	**264.25**	**6.42**	**140.73**	**45.99**	**31.47**	**5.73**	1.07
T_3	60% Nitrogen +40% Poultry Manure	**119.62**	**5.37**	**257.11**	**5.81**	**138.07**	**45.66**	**31.31**	5.48	1.02
T_4	60% Nitrogen + 20% FYM +20% Vermicompost	**163.14**	**6.18**	**319.12**	**7.63**	**156.11**	**51.88**	**34.49**	**5.88**	1.21
T_5	60% Nitrogen + 20% Vermicompost + 20% Poultry Manure	**152.15**	**6.31**	**302.05**	**6.84**	**150.43**	**48.77**	**32.54**	**5.11**	1.18
T_6	60% Nitrogen + 20% FYM + 20% Poultry Manure	**163.81**	**6.26**	**321.15**	**8.22**	**158.17**	**52.45**	**35.45**	**5.67**	1.21
T_7	60% Nitrogen + 13.3% Vermicompost 13.3 % FYM + 13.3 Poultry Manure	**160.11**	**6.39**	**314.20**	**7.26**	**154.91**	**50.88**	**34.28**	**5.59**	1.20
T_8	80% Nitrogen + 20% FYM	**156.85**	**5.70**	**306.15**	**7.09**	**150.70**	**50.10**	**33.58**	**5.47**	1.40
T_9	80% Nitrogen + 20% Vermicompost	**164.81**	**7.28**	**326.15**	**8.28**	**162.59**	**53.20**	**35.55**	**5.87**	1.71
T_{10}	80% Nitrogen + 20% Poultry Manure	**118.18**	**5.24**	**253.41**	**5.54**	**135.70**	**45.10**	**31.28**	**5.34**	1.28
T_{11}	80% Nitrogen + 10% FYM + 10% Vermicompost	**166.81**	**7.40**	**330.44**	**9.04**	**164.72**	**55.77**	**36.19**	**6.08**	**1.75**
T_{12}	80% Nitrogen + 10% Vermicompost + 10% Poultry Manure	**157.29**	**6.24**	**310.11**	**7.11**	**153.06**	**50.10**	**33.66**	**5.74**	1.55
T_{13}	80% Nitrogen + 10% FYM + 10% Poultry Manure	**121.26**	**5.68**	**295.41**	**6.15**	**138.40**	**45.77**	**31.45**	**5.69**	1.25
T_{14}	80% Nitrogen + 6.6% FYM + 6.6% Vermicompost + 6.6% Poultry Manure	**147.70**	**6.27**	**293.30**	**6.77**	**146.93**	**46.99**	**32.53**	**5.56**	1.30
	F-Test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	
	SE(d) ±	**2.51**	**0.19**	**10.49**	**0.41**	**10.76**	**3.60**	**0.46**	**0.36**	
	CD (p=0.05%)	**5.15**	**0.40**	**21.47**	**0.86**	**22.05**	**7.38**	**0.95**	**7.99**	
	CV	**2.14**	**3.88**	**4.43**	**1.76**	**8.97**	**9.04**	**1.70**	**0.74**	

CONCLUSION

From the present investigation, it is concluded that the influence of organic manures and inorganic fertilizers with different combination rendered their significant effect on growth, yield and quality of turnip. Treatment T11 (80% Nitrogen + 10% FYM + 10% Vermicompost) was found best in plant height, number of leaves, leaf length, shoot weight, root diameter, root length, root weight of plant, shoot and root weight, root yield, vitamin-c, TSS, net return of 1,67,310.00 Rs/ha with cost benefit ratio of 1.75.

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