IMPACT OF DIFFERENT ORGANIC MANURES AND NPK APPLICATION ON THE GROWTH AND YIELD OF TURNIP (*BRASSICA RAPA* L)

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ABSTRACT: A pot experiment was carried out to check the impact of different organic manures and inorganic fertilizers on the growth and yield of turnip, at Horticulture Departmental experimental area, Faculty of Agriculture, Gomal University, D.I. Khan, during 2012-13. The experiment was laid out in RCD with seven treatments replicated three times. Treatments contained control (no fertilizer added), FYM @ 25 t/hec, Poultry manure @ 10 t/hec, Goat manure @ 15 t/hec, Press mud @ 20 t/hec, Sewage sludge @ 20 t/hec and NPK @ 120-65-100 kg/hec. Data on leaves per plant, leaf length (cm), fresh leaf weight per plant (g), dry leaf weight per plant (g), root length (cm), root diameter (cm), fresh root weight per plant (g), dry root weight per plant (g), total biomass per plant (g), root yield per pot (g) and root yield (ton per ha) was recorded and analyzed statistically. The results revealed that all growth and yield parameters were significantly enhanced by the application of organic manures and NPK. Maximum values were recorded in NPK treated plants, as compared to all the treatments under studied, by producing 13.22 leaves per plant, 29.90 cm long leaf, fresh leaf weight per plant (52.83 g), dry leaf weight per plant (11.15 g), root length (7.07 cm), root diameter (7.23 cm), fresh root weight per plant (241.20 g), dry root weight per plant (22.25 g), total biomass per plant (313.37 g), root yield per pot (382.40 g) and 382.40 root yield (382.40 ton per hectare). It was also confirmed that poultry manure exhibited superiority as compared to other organic manures

Key words: Turnip (*Brassica rapa* L), Organic manures (FYM, PM, GM, PrM, SS), Inorganic fertilizers (NPK), Growth parameters, Yield.

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INTRODUCTION

Turnip (*Brassica rapa* L.) belonging to the Cruciferae family is a root vegetable commonly grown in temperate climates worldwide for its purple or yellow, bulbous taproot. As a root crop, turnip grows best in cool weather but hot temperatures cause the roots to become woody and bad-tasting. Turnip can be grown on a wide variety of soil type, but well drained; rich in organic matter, deep and friable soil is preferable. Turnip is used in a variety of culinary preparations since ancient times. In Pakistan, during 2013, it occupied an area of 15,766 ha with 2,76,471 tones production and an average yield of 17.5359 t/ha, while in KPK province, it was cultivated over an area of 2997 ha with total production of 42,082 tones and an average yield of 14.0413 t/ha (Anonymous, 2013). The average yield in Pakistan and particularly in KPK province is quite low compared to the average yields 24.30 t/ha and 26.74 t/ha of Asia and world respectively (FAO, 2003). It's production, in Pakistan can be increased by increasing per hectare yield This goal can be achieved by adopting many agronomic practices, one of the most important of these, is the judicoius application of different manures and fertilizers. Significant responses of vegetables to manuring and fertilization have been reported by several workers. Nutrient supply to plants greatly affects their growth, production and plant constituents. Due to an increasing demand of leaf vegetables, and their economic importance in the tropics, it is very common that excessive fertilizer N rate is applied to vegetable gardens and fields to attain high yield (Baitilwake *et al.,* 2011). For obtaining higher yield in vegetable crops excessive amounts of inorganic fertilizers are applied (Stewart *et al.* 2005). Fertilizer is a material that is added to the soil to supply one or more elements required for plant growth and development (Masarirambi *et al.,* 2012 and Ginindza *et al.,* 2015). Chemical fertilizers are inorganic fertilizers which are formulated in appropriate concentrations and combinations which supply three main nutrients: nitrogen, phosphorus and potassium (N.P.K) for various crops and growing conditions. Nitrogen (N) promotes leaf growth and forms proteins and chlorophyll. Phosphorus (P) contributes to root, flower and fruit development. Potassium (K) contributes to stem and root growth and the synthesis of proteins (Ginindza *et al.,* 2015). Nitrogen functions in plants by being part of chlorophyll which is responsible for photosynthesis, helps plants with rapid growth, and improves the plant height. Moniruzzaman *et al.,* (2013) reported that application of different levels of nitrogen significantly influenced plant height at 45, 60, 75 and 90 days after

sowing. Ali *et al.,* (2006) found significant increase in number of leaves of carrots due to increase in N rate. Mehedi *et al.,* (2012) revealed that the maximum fresh weight of roots and maximum length of root was achieved with the application of 150 kg N ha^{-1}. El-Sherbeny *et al.,* (2012) reported that the use of NPK @ 100:100:50 enhanced number of leaves/ plant (17.2), fresh weight of leaves (106.4 g/plant), dry weight of leaves (6.0 g/plant), length of roots (21.8 cm), fresh weight of roots (115.3 g/plant)and dry weight of roots (6.0 g/plant), in turnip. Application of chemical fertilizers makes the soil fertile and increases productivity of crops, while introducing the adverse effects on soil and environment (Attanayake *et al.,* 2010). Kiran *et al.,* (2016 a) also reported that maximum leaves plant, leaf length (cm), fresh leaf weight plant (g), dry leaf weight plant (g), root length (cm), root diameter (cm), fresh root weight plant (g), dry root weight plant (g), total biomass plant (g), root yield pot (g) and root yield (t ha^{-1}) was recorded in NPK treated plants in radish. Amongst the manures, poultry manure (PM) and goat manure (GM) showed far better results for carrot growth and yield parameters, followed by sewage sludge (SS) and pressmud (PrM) and FYM, respectively. Khetran *et al.,* (2017) reported that an increased in NPK Level (140-100-60 kg NPK/ha) has increased green pod yield/plant, number of seeds/pod and seed yield/hac in Okra. Dubey *et al.,* (2017) reported that application of optimum doses of NPK was found highly beneficial for plant growth, yield and quality of capsicum. Therefore, it is needed that fertility and productivity of the soil be restored, using organic fertilizers in combination (Khan *et al.,* 2009). Carl and Allan (2007) observed that organic manures can improve yield of crops and soil quality similar to inorganic source while, Olle and Williams (2009) observed that organically grown vegetables had better nutritional value than conventionally grown one and nitrate levels were lower in with organic cultivation. In such farming system, organic wastes, like cow dung, poultry manure, pressmud and crop residues, are locally available and relatively cheap, therefore, increasingly being applied to meet crop nutrient demand (Ahmad *et al.,* 2012). Entesharil *et al.,* (2012) on turnip plants reported that using organic compost reduces the negative effects of chemical fertilizer and increase soil fertility. Aisha *et al.,* (2014) also reported that adding organic compost manure at high rates had a significant effect on growth characters, i.e. plant length, number of leaves/plant, fresh and dry weight/plant as well as root fresh and dry weight and its components (root length and diameter) in turnip. Gajewski *et al.,* (2010) also stated that the application of poultry manure leads to ease of root penetration, erosion resistance and good soil moisture properties such as available water holding capacity and permeability, combined with adequate aeration. Addition of organic manure leads to soil physical properties including soil moisture retention capacity, ensures stability of soil structure and increased nutrient uptake (Zaman *et al.,* 2013 and Islam *et al.,* 2014). There is worldwide consensus that sole dependence on chemical input based agriculture is not suitable in the long run due to their adverse effects on soil health. Combining manure and mineral fertilizers appears to be a reasonable management approach for improving fruit yield and maintaining optimal soil fertility (Liu *et al.,* 2013). Sharma *et al.,* (2012) revealed that integrated use of nutrient source is superior in application to chemical fertilizers alone. The combined effect of poultry manure along with NPK was found suitable for achieving sustainable vegetable crop yield as well as for sustenance of soil health at homestead area (Islam *et al.,* 2011). Akagwu (2010) observed that the effectiveness of the combination of NPK 15:15:15 and poultry droppings is greater than the effectiveness of NPK 15:15:15 alone on the yield of tomato plants. Yanthan *et al.,* (2012) illustrated that the application of different fertilizers and organic manures either alone or in combination significantly increased the growth and yield of turnip as compared to control. However, the benefits of organic nutrient sources on soil physical, chemical and biological properties are clearly evident from the literature. Thus present project was undertaken to study the effect of organic manures including farm yard manure (FYM), poultry manure (PM), goat manure (GM), pressmud (PrM) and sewage sludge (SS) and inorganic fertilizers (NPK) on the growth and yield of turnip.

MATERIALS AND METHODS

A pot experiment was conducted to evaluate the effect of sole application of different organic manures and NPK on the growth and yield of turnip, at Department of Horticulture, Faculty of Agriculture, Gomal University, D.I. Khan. The experiment was laid out in CRD with seven treatments repeated five times. The treatments included Control (No Fertilizer added), FYM @ 25 t/ha, PM @ 10 t/ha, GM @ 15 t/ha, PrM @ 20 t/ha, SS @ 20 t/ha and NPK @ 120-65-100 kg/ha. All pots were filled with equal and uniform amount (20 kg) river soil along with the calculated amount of pre assigned organic manure FYM @ 250g/pot, PM @ 100g/pot, GM @ 150g/pot, PrM @ 200g/pot, SS @ 200g/pot, and NPK (2.609 g urea+3.421 g SSP+2.00 g SOP pot). A set of pots without any additives (manures and fertilizers) served as control. The required amounts of manures were applied well before sowing of seeds (10 days), mineral fertilizers (Phosphorus and potash) were applied in the form of SSP and SOP, respectively, at the time of sowing, whereas Nitrogen was applied in the form of urea in two split doses, first at the time of seed sowing and second after one month of seed sowing. Five seeds of turnip (purple top) were sown on 20th October, in

the pot (35 cm dia) and then were thinned to two plants at equidistance to avoid plant competition. Pots were irrigated manually and all the cultural practices were conducted as usual. Data regarding leaves/plant, leaf length (cm), fresh leaf weight/plant (g), dry leaf weight/plant (g), root length (cm), root diameter (cm), fresh root weight/plant (g), dry root weight/plant (g), total biomass/plant (g), root yield/pot (g) and root yield (t/ha) were recorded and analyzed statistically by computing analysis of variance technique (ANOVA) and means were compared by Duncan's multiple range (DMR) test (Steel *et al.,* (1997).

RESULT AND DISCUSSION

Leaves/plant: Significant variation existed in number of leaves plant^{-1} of turnip due to the application of different organic manures and inorganic fertilizers (Table-1). The significantly highest number of leaves/plant (13.22) was found in plants receiving NPK, which was significantly different from all other treatments. Amongst the organic manures PM surpassed in enhancing number of leaves/ plant of turnip (10.75), followed by GM, SS and FYM with 10.40, 10.15 and 9.92 leaves/plant, whereas, all the four treatments were statistically similar. Likewise, SS and FYM were also significantly akin to PrM with 9.33 leaves/plant. The plants from control treatment contained statistically least number of leaves/plant (7.03). The results indicated that the alone incorporation of manures as well as NPK considerably increased the number of leaves/plant of turnip. It might be due to the fact that chemical fertilizers and manures supplied the major and micro nutrients to plants, which resulted in additional leaves production. Commercial fertilizers were more productive due to readily available nutrients as compared to organic manures, as the presence of higher amount of N in NPK favored the vegetative growth of the plant. Similar results were reported by Zaman *et al.,* (2013) stating that the application of nitrogen @130 kg/ha increased the number of leaves/plant in carrot. However, manured plants were also superior to control regarding number of leaves/plant. The enhancement in number of leaves/plant due to application of FYM, PM, GM, PrM, SS and NPK was 41.01%, 52.37%, 47.87%, 32.70%, 44.32% and 87.93, respectively against the control. In accordance with these results Ali *et al.,* (2006); Yanthan *et al*., (2012) and Kiran *et al.,* (2016 a) noticed more number of leaves/plant with singular application of chemical fertilizers in root crops.

Leaf length (cm): The application of organic manures and commercial fertilizers significantly enhanced the leaf length of turnip (Table 1). The significantly lengthiest leaves (29.90 cm) were found in NPK, which differed significantly from all other treatments. It was followed by PM, GM, SS, FYM and PrM possessing 20.65, 19.05, 16.43, 14.65 and 12.82 cm long leaves, respectively. The shortest leaves (9.25 cm) were observed in control plants. However, all treatments differed significantly from each other. The results indicated that leaf length of turnip was considerably increased with the application of NPK. It might be due to the fact that NPK fertilizers released nutrients quickly and supplied adequate plant nutrients for better vegetative growth of turnip plants. The use of NPK, FYM, PM, GM, PrM and SS increased leaf length by 223.24%, 58.38%, 123.24%, 105.58%, 38.55%, and 77.65%, respectively over control. The higher plant height might be due to abundant supply of nitrogen and phosphorus which helped the plants in better photosynthesis to attain vigor. These findings are in conformity with the results reported by Balliu *et al.,* (2007); Abdelaziz *et al.,* (2008); Yasuor (2013) and Dubey *et al.,* (2017). Similar results were reported by Kiran *et al.,* (2016 a & b) who also reported that the application of NPK had produced the maximum number of leaves in root crops.

Fresh leaves weight/plant (g): Sole application of organic manures and NPK significantly affected the fresh leaves weight/ plant of turnip (Table-1). The highest leaves weight/plant (52.83 g) was recorded in NPK that differed significantly from all other treatments. It was followed by PM and GM with leaves weight of 18.83 and 18.416 g/plant, respectively; however, both treatments were statistically identical. The plants amended with full doses of SS, FYM and PrM produced leaves of 16.62, 13.87 and 12.17 g, respectively, which varied significantly from each other. The lowest leaves weight/plant (10.13 g) was observed in control, which differed statistically from all other treatments. This may due to readily availability of macro from NPK fertilizer while the release of macro and micro nutrients from organic manures was slow. The variation in leaves weight/plant due to application of different manures can be attributed to the fact that manures differed in nutrients contents and their efficiency in boosting leaves weight. These results are in agreement with findings of Murthy *et al.,* (2016) and Kiran *et al.,* (2016 a & b) who all recorded remarkable increase in leaves weight due to application of NPK in different root crops. Whereas, Alisha *et al.,* (2014) reported an increase in fresh leaf weight/ plant when higher levels of organic manure were added in turnip.

Dry leaves weight/plant (g): Significantly greatest dry leaves weight/plant (11.15 g) was observed in NPK treated plants that varied statistically from all other treatments, followed by PM and GM with dry leaves/plant of 5.63 and 5.31 g and both treatments differed significantly. These were succeeded by statistically different from SS, PrM and FYM with dry leaves/plant of 4.60 and 3.53 g, respectively. The results indicated that dry leaves weight/plant of turnip was

substantially enhanced by sole application of full doses of NPK and organic manures. The NPK amended plants excelled all organic manures. Amongst organic manures, PM and GM amended plants contained highest dry leaves weight/plant that differed significantly from other manures, followed by SS, FYM and PrM. These results are in line with the previous work done by Alisha *et al.,* (2014) and Murthy *et al.,* (2016) who reported significant increase in the weight of leaves/plant with the application of manures and chemical fertilizers in root crops.

Root length (cm): Significant variation existed in length of roots of turnip due to application of different organic manures and NPK (Table 1). Longest roots (7.07 cm) were recorded in plants amended with NPK that varied significantly from all other treatments. It was followed by PM and GM possessing 4.92 and 4.70 cm long roots, respectively and both these treatments showed non-significant behavior against each other. Statistically similar results were recorded in SS and PrM with 4.37 and 4.30 cm long roots, accordingly. Amongst manures, FYM produced the shortest roots of 3.47 cm. The significantly shortest roots (2.97 cm) were observed in control plants, which varied from all other treatments. The results showed that application of organic manures and inorganic fertilizers substantially improved the root length of turnip. The response of NPK was more pronounced than organic manures, which may be due to readily available nutrients as compared to slow release of nutrients from organic manures. The increased in root length was 16.62%, 65.44%, 58.14%, 44.68% and 46.54% with FYM, PM, GM, PrM and SS, respectively over control whereas the increment in root length with NPK was 137.75%. Amongst the organic manures, poultry manure produced longer roots as compared to the other organic manures used in the study. Similar findings were reported by Sylvestre *et al.,* (2015) stating maximum root length in carrot when poultry manure was used alone as soil media. The previous findings reported by Islam *et al.,* (2011); Yanthan *et al*., (2012); Mehedi *et al.,* (2012) and Murthy *et al.,* (2016) correspond to these results regarding enlargement of roots by the application of NPK.

Root diameter (cm): The data indicated that significantly greatest root diameter (7.23 cm) was recorded in plants added with NPK, which differed significantly from all other treatments (Table-1). It was followed by PM and GM producing 4.83 and 4.73 cm root diameter, respectively and both these treatments were statistically at par, to each other. Similarly, SS and (PrM) were also statistically at par producing 4.37 and 4.30 cm thick roots, respectively. Among manures, FYM treated plants possessed the lowest root diameter (3.42 cm) that differed significantly from other manures. The plants from check pots contained significantly lowest root diameter (2.17 cm) among all treatments. The results showed that root diameter of turnip was considerably increased by the application of organic manures and inorganic fertilizes. Inorganic fertilizers proved more effective as compared to organic manures. The use of FYM, PM, GM, PrM, SS and NPK enhanced root diameter by 57.75%, 123.13%, 118.51%, 94.64%, 100.97%, and 233.93%, respectively over control. Amongst manures, PM surpassed others followed by GM, SS and PrM while FYM was least efficient. It may be due to low nutrient contents and their slow release, probably for delayed decomposition. Our results get support from the previous work done by Kapourchal *et al*., (2009); Alisha *et al.,* (2014) and Murthy *et al.,* (2016) who also reported considerable increase in diameter of roots due to addition of organic manures and inorganic fertilizers.

Fresh root weight/plant (g): Root weight/plant of turnip as affected by sole application of full doses of different organic manures and mineral fertilizers NPK indicated significant variations amongst the treatments (Table-2). The highest root weight/plant (241.20 g) was recorded in NPK, which differed significantly from all other treatments. It was followed by PM, GM, PrM and FYM with root weight/plant of 149.25, 146.30, 111.39, 86.35 and 74.35 g, respectively. The lowest root weight (58.61 g) was recorded in control. All treatments differed significantly from each other, suggesting that application of manures and NPK profoundly increased the root weight/plant of turnip. The NPK excelled all organic manures. This might be due to greater and readily available nutrients in inorganic fertilizers and their uptake which might have contributed to weight of roots. Similarly, Sherbeny *et al.,* (2012) also reported maximum fresh root weight with the use of NPK. The variation in root weight/plant due to different manures indicated that manures differed in nutrients contents and their efficiency in enhancing root weight of turnip. The manures containing greater nutrients especially nitrogen content, resulted greater root weight. Among different manures, PM proved superior, because poultry manure was also rich from nitrogen content than other organic manure, followed by, GM, SS, PrM and FYM. These results collaborate with the findings of Rani and Mallareddy (2007); Mehedi *et al.,* (2012) and Murthy *et al.,* (2016) who reported that the increasing rate of NPK fertilizers had significantly increased fresh root weight /plant of carrot root.

Dry root weight/plant (g): The data illustrated in table-2 indicated that significant variations existed in dry root weight/plant among the treatments due to singular incorporation of 100% of organic manures and 100% RDF. Significantly highest dry root weight/plant (22.25 g) was registered in plants supplied with full dose of NPK that differed significantly from all other treatments. It was followed by the plants treated with GM and PM

producing 12.98 and 12.93 g dry root weight/plant, respectively and both the treatments were statistically at par. Immediate results for dry root weight/plant were also recorded in plants receiving SS and PrM with 12.43 and 11.78 g, respectively. Amongst the manures, the least response was registered in FYM, producing 9.05 g dry root weight/plant. Control plots gave the least result by producing 5.20 g dry root weight/plant. The results showed significant increase in dry root weight/plant of turnip by sole application of full dose of manures and fertilizers. Our results are supported by the previous findings of El-Sherbeny *et al.,* (2012) and Yanthan *et al*., (2012) stating maximum value for dry root weight of turnip when NPK was used.

Total biomass/plant (g): Total biomass weight/plant of turnip was significantly influenced by the use of organic manures as well as NPK in (table-2). The significantly highest biomass/plant (313.37 g) was recorded in plants amended with NPK that differed significantly from all other treatments. It was succeeded by PM, GM, SS, PrM and FYM with biomass weight/plant of 168.08, 164.72, 128.00, 98.55 and 88.55 g, respectively. The lowest biomass (68.75 g/plant) was observed in control plants. However, all treatments differed significantly from each other. The effectiveness of NPK was obvious due to greater nutrients content and their readily availability. Poultry Manure addition was remarkable among the manures, followed by GM, SS, PrM and FYM suggesting that PM and GM contained greater amount of N, P, K as compared to FYM. Similar results were quoted by Dawuda *et al.* (2011) stating maximum carrot yield with Poultry manure. More over due to bulky and waxy nature of FYM, the availability of nutrients was slow and the short season crops cannot get full benefit from this organic source. Sewage Sludge and PrM also contained good amount of N, P, K but the potential hazard of toxic metals in SS should be taken into consideration. Incorporation of FYM, PM, FM, PrM and SS increased 28.82%, 144.53%, 139.63%, 43.32% and 86.21% biomass weight/plant against control plant while sole application of NPK increased 138.11% biomass over control. These results are in collaboration with the finding of Rani and Mallareddy (2007) who also reported an increase in total plant fresh weight in carrot with increasing fertilizer application rates.

Root yield/pot (g): Root yield/pot of turnip was significantly enhanced by the application of NPK with incorporation of organic manures substantially increased the root yield/pot (382.40 g) that varied significantly from all other treatments (Table-2). It was succeeded by PM and GM yielding 298.50 and 292.93 g root yield/pot and both treatments were statistically akin. These were followed by SS, PrM and FYM with root yields of 222.95, 212.70 and 199.03 g roots/pot, respectively. However, all the three treatments differed significantly from all each other. The lowest root yield/pot (199.03 g) was recorded in control pots that were significantly inferior from all other treatments. The results suggested the root yield/pot of turnip was profoundly improved by organic manures and NPK. The application of NPK, FYM, PM, GM, PrM and SS enhanced root yield/pot by 176.01%, 43.74%, 115.58%, 111.56%, 53.62 and 61.01%, respectively over control. The PM and GM superseded all manures in enhancing root yield/pot but highest yield was achieved from NPK treated pots, which may be due to their greater and easily available nutrients. Manures contained lesser amount of nutrients as compared to NPK, moreover the release of nutrients from organic manures is also slow due to decomposition. Amongst the manures, PM and GM superseded all the other manures in enhancing root yield/pot. Similar results were quoted by Islam *et al.,* (2014) who reported an increase in yield upto 6.28 fold with the application of Poultry manure as compared to the control. Similarly, higher yields of turnip were also recorded by El-Sherbeny *et al.,* (2012) and Yanthan *et al*., (2012) due to application of manures and inorganic fertilizers.

Root yield (t/ha): Significant variations existed in root yield/ha of turnip due to application of organic manures and NPK (table-2). The statistically highest root yield (38.24 t/ha) was obtained from plants amended with NPK, succeeded by PM, GM, SS, PrM and FYM with root yields of 29.85, 29.29, 22.20, 21.27 and 19.90 t/ha, respectively. The lowest root yield (13.85 t/ha) was recorded in control. However, all the treatments differed significantly from each other. The results indicated that root yield (t/ha) of turnip was substantially enhanced by the use of organic manures and NPK. The increment in root yield due to sole application of FYM, PM, GM, PrM, SS and NPK was 43.74%, 115.58%, 111.56%, 53.62%, 61.01% and 176.01%, respectively over control. The NPK performed better in improving turnip root yield as compared to organic manures. Similar results were reported by Rani and Mallareddy (2007) stating that high rate of nitrogen and phosphorus increased the root yield of carrot. This might be due to the increased and readily available nutrients than organic sources. Among manures, PM surpassed all manures in enhancing root yield, followed by GM. Our results get support from the previous findings of Sylvestre *et al.,* (2015) who reported maximum root yield (31.66 t/ha) in carrot when PM was used as a sole media. Somewhat analogous results have been reported by Yanthan *et al*., (2012); Islam *et al.,* (2014); Murthy *et al.,* (2016) and Kiran *et al.,* (2016 a & b) suggesting sole application of inorganic fertilizers for increased yields of root vegetables.

Table 1: Leaves/plant, leaf length (cm), fresh leaf weight/plant (g), dry leaves weight/ plant (g), root length (cm) and root diameter (cm) of turnip as affected by different organic manures and NPK.

Treatments	Leaves/ plant	Leaf length (cm)	Fresh leaf wt/ plant (g)	Dry leaf wt/plant (g)	Root length (cm)	Root dia (cm)
T_1: Control	7.03 d	9.25 g	10.13 f	1.57 f	2.97 e	2.17 f
T_2: FYM @ 25 t/ha	9.92 bc	14.65 e	13.87 d	3.58 d	3.47 d	3.42 e
T_3: PM @ 10 t/ha	10.72 b	20.65 b	18.83 b	5.63 b	4. 92 b	4.83 b
T_4: GM @ 15 t/ha	10.40 b	19.02 c	18.42 b	5.32 b	4.70 bc	4.73 bc
T_5: PrM @ 20 t/ha	9.33 c	12.82 f	12.17 e	2.82 e	4.30 c	4.22 d
T_6: SS @ 20 t/ha	10.15 bc	16.43 d	16.62 c	4.77 c	4.37 c	4.35 cd
T_7: NPK @ 120-65-100 kg/ha	13.22 a	29.90 a	52.83 a	11.15 a	7.07 a	7.23 a
LSD Value @0.05	**0.84**	**0.72**	**1.22**	**0.31**	**0.45**	**0.30**

Means followed by similar letter(s) do not differ significantly at 5% level of significance

Control = Check treatment FYM = Farm yard manure
PM = Poultry manure GM = Goat manure
PrM = Press mud SS = Sewage sludge
NPK = 120 kg N + 65 kg P + 100 kg K

Table 2: Fresh root weight/plant (g), dry root weight/plant (g), total biomass/plant (g), root yield/pot (g) and root yield (t/ha) of turnip as affected by different organic manures and NPK.

Treatments	Fresh root wt/plant (g)	Dry root wt/plant (g)	Total biomass/ plant (g)	Root yield/ pot (g)	Root yield (t/ha)
T_1: Control	58.61 g	5.20 f	68.74 g	138.47 f	13.85 g
T_2: FYM @ 25 t/ha	74.35 f	9.05 e	88.55 f	199.03 e	19.90 f
T_3: PM @ 10 t/ha	149.25 b	12.93 bc	168.08 b	298.50 b	29.85 b
T_4: GM @ 15 t/ha	146.30 c	12.98 b	164.72 c	292.93 b	29.29 c
T_5: PrM @ 20 t/ha	86.35 e	11.78 d	98.52 e	212.70 d	21.27 e
T_6: SS @ 20 t/ha	111.39 d	12.43 c	128.00 d	222.95 c	22.20 d
T_7: NPK @ 120-65-100 kg/ha	241.20 a	22.25 a	313.37 a	382.40 a	38.24 a
LSD Value @0.05	2.56	0.53	2.30	6.41	0.59

Means followed by similar letter(s) do not differ significantly at 5% level of significance

Control = Check treatment FYM = Farm yard manure
PM = Poultry manure GM = Goat manure
PrM = Press mud SS = Sewage sludge
NPK = 120 kg N + 65 kg P + 100 kg K

Conclusion: This study concluded that the application of inorganic fertilizers (NPK) has significantly encouraged all the growth and yield parameters as compared to other organic manures used. However, amongst the different organic manures used, poultry and goat manure produced far better results as compared to sewage sludge, pressmud and FYM for turnip growth and yield.

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