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"Effect of Organic Fertilizer on Growth, Yield and Quality of Cabbage (*Brassica oleracea* var Capitata) cv. Golden Acre"

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ABSTRACT

A experiment was conducted at the vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj (UP) during winter 2021 to study the "Effect of organic fertilizer on growth, yield and quality of cabbage (*Brassica oleracea* var capitata) cv Golden Acre" The Results of investigation, regarding the performance of the 10 treatment and 3 replication revealed that treatment T_9 (Vermicompost + Poultry manure 50% + Gout manure) emerged as superior over all other treatment combination in terms of plant height 36.73 cm, number of leaves 16.27, Days to first head formation (36.93), Days to 50% head formation (40.11), Days to first harvest (62.33), Dimeter head size (20.24cm), Total head weight (1.14 kg), marketable head weight (0.98 kg), net head weight (0.93 kg), marketable head weight yield/Plot (7.10 kg) and marketable yield (49.17 t/ha^{-1}). In term of quality parameters TSS and Ascorbic acid (mg/100 g) analysis showed treatment T_7 (Vermicompost 25% + Goat 75%) (4.56^{o}Brix) and (33.1 mg/100 g) Showed higher B:C ratio (5.8) compared with the other treatments under prayagraj Argo-Climatic conditions.

Keywords Vermicompost, FYM, Goat manure, Poultry manure, Growth.

INTRODUCTION

Cabbage (*Brassica oleracea* var Capitata) is a cole crop that belongs to the family Cruciferae, chromosome number of 2n=2x 18. It is believed to have originated in Western Europe and it is an important vegetable crop of the cole group. Cabbage is a botanical modified leaf. It is growing during the winter season. It covers about 4% of the total area under vegetable. India is the second largest producer of cabbage in the world with a production of 9.039 million tons from an area of 0.400 million hectares (Anon 2014). Cabbage contains goitrogens compound which causes enlargement of the thyroid gland. Flavor in cabbage leaves is due to the glycoside sin grin. Vegetables that are produced by using organic manures are also gaining importance because of less chemical residues and better taste (Patil *et al*. 2016).

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Goat manure is especially suitable for acid soil as it has strong liming effect. It reduces the acidity of the soil and thereby protects crops from aluminum toxicity. Use of organic manure not only reduces the requirement of chemical fertilizers but also supplements of all essential nutrients to the plants besides improving the soil properties and processes (Purakayastha *et al*. 2008).

Poultry manure contains uric acid having 60 % nitrogen, which changes rapidly to ammoniacal form, hence efficiently utilized for better growth and yield of plants (Smith 1950). Earthworms' excreta are a rich nutritive organic fertilizer due to rich in humus, NPK, micronutrients, beneficial soil microbes- 'nitrogen fixing and phosphate solubilizing bacteria' and actinomycetes and growth hormones 'auxins', 'gibberlins and 'cytokinins'. The vermicompost promote growth from 50-100% over conventional compost and 30-40% over chemical fertilizers (Sinha *et al*. 2010).

The vermicomposting process is the biological degradation of organic waste by earthworms and microorganisms to form vermicompost which is of importance for organic agriculture. Slowly and steadily released nutrients by vermicompost into the rhizosphere provide the suitable conditions for plant uptake the application of organic fertilizer takes part in the improvement of soil structure, humus content and water retention capacity, having a great impact upon the beneficial activity of the macro- and microorganisms. Reported that earthworm inoculation decreased the net immobilization in the microbial biomass and increased N availability in the soil. Increase in mineral N release and decrease in net immobilization happened because of the direct and indirect effects of earthworms on microbial community.

MATERIALS AND METHODS

An experiment on cabbage was conducted during September to December 2021, in horticulture Research field, Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture and Technology and Sciences Prayagraj (UP) India. The results of the investigation, regarding the performance of organic fertilizer in the 10 treatments i.e. RDF (100:40:100) kg/ha, T_1 FYM 100%, T_2 Vermicompost (75%) + Poultry manure (25%), T_3 Vermicompost (75%) + Goat manure (25%), T_4 Vermicompost (50%) + Poultry manure (50%), T_5 Vermicompost (50%) + Goat manure (50%), T_6 Vermicompost (25%) + Poultry manure (75%), T_7 Vermicompost (25%)+Goat manure (75%),T_8 (Vermicompost + Poultry manure) (75%) + Goat manure (25%), T_9 Vermicompost + Poultry manure) (50%) + Goat manure (50%), T_{10} (Vermicompost + Poultry manure) (25%) + Goat manure (75%). To find out the best performance in terms of growth, quality and yield. The experiment was conducted in Randomized Block Design, were hybrid replicated thrice. The experimental soil was sandy loam in texture, nearly neutral in soil reaction (pH 7.1). Organic fertilizer was applied in the FYM, Vermicompost, Poultry manure, Goat manure respectively. The field beds were prepared and the seedling have been directly transplanting. The observation regarding yield were after harvesting of crop.

Fertilizers

FYM @ 20 t/ha^{-1}, Vermicompost @ 5 t/ha^{-1}, Poultry manure @ 6 t/ha^{-1}, Gout manure @ 6 t/ha^{-1} before sowing.

RESULTS AND DISCUSSION

Growth and parameter

Data pertaining to growth and earliness parameters which are plant height, Number of leaves per plant, Day to first Head formation, 50% Head formation, Days to first harvesting, Diameter of Head size (cm), Total Head weight (kg), Marketable Head weight (kg), Net weight of Head (kg), Yield per hectare (t/ha^{-1}), Total soluble solids and Ascorbic acid were recorded and tabulated in Table1.

Plant height

The maximum plant height was observed in treatment T_9. It is due to the presence of vermicompost, poultry manure and goat manure which fulfilled the nutrient requirement in cabbage plant. Nitrogen effected the vegetative growth of plant. Hence the maximum plant height was observed in treatment T_9. Similar

Table 1. Effect of organic fertilizer on growth, yield and quality of cabbage.

Treatments	Pant height	No. of leaves /plant	Day to first head formation	50% head formation	Days to first harvesting	Total head weight (kg)
T_1 FYM 100%	26.13	12.37	46.67	49.67	72.40	1.02
T_2 Vermicompost (75%) + Poultry manure (25%)	32.23	13.82	40.47	45.44	70.33	1.05
T_3 Vermicompost (75%) + Goat manure (25%)	32.33	14.20	41.73	46.56	67.87	1.04
T_4 Vermicompost (50%) + Poultry manure (50%)	32.47	14.07	43.13	47.56	69.33	1.03
T_5 Vermicompost (50%) + Goat manure (50%)	32.60	13.07	41.01	44.67	68.40	1.08
T_6 Vermicompost (25%) + Poultry manure (75%)	33.00	14.13	42.60	46.67	70.40	1.04
T_7 Vermicompost (25%) + Goat manure (75%)	33.17	13.27	44.27	47.22	69.89	1.09
T_8 (Vermicompost+ Poultry manure) (75%) + Goat manure (25%)	35.00	15.60	39.38	43.78	64.40	1.14
T_9 (Vermicompost+ Poultry manure) (50%) + Goat manure (50%)	36.73	16.53	36.93	40.11	62.33	1.23
T_{10} (Vermicompost+ Poultry manure) (25%) + Goat manure (75%)	33.93	14.40	38.87	42.11	65.33	1.12
F- Test	S	S	S	S	S	S
SEd ±	1.03	0.55	0.69	0.57	1.27	0.07
CD (P= 0.05%)	2.16	1.16	1.44	1.20	2.68	0.14

Table 1. Continued.

Treatments	Marketable head weight (kg)	Net weight of head (kg)	Yield t/ha^{-1}	Total soluble solid (TSS)	Ascorbic acid (mg/100 g)
T_1 FYM 100%	0.68	0.63	33.83	6.07	44.37
T_2 Vermicompost (75%) + Poultry manure (25%)	0.81	0.76	40.33	5.98	42.79
T_3 Vermicompost (75%) + Goat manure (25%)	0.73	0.68	36.50	4.64	40.01
T_4 Vermicompost (50%) + Poultry manure (50%)	0.77	0.72	38.67	5.15	41.41
T_5 Vermicompost (50%) + Goat manure (50%)	0.82	0.77	41.17	5.84	41.64
T_6 Vermicompost (25%) + Poultry manure (75%)	0.87	0.82	43.33	4.82	42.21
T_7 Vermicompost (25%) + Goat manure (75%)	0.90	0.85	45.17	4.56	33.1
T_8 (Vermicompost+ Poultry manure) (75%) + Goat manure (25%)	0.95	0.90	47.33	5.67	38.05
T_9 (Vermicompost+ Poultry manure) (50%) + Goat manure (50%)	0.98	0.93	49.17	4.98	35.1
T_{10} (Vermicompost+ Poultry manure) (25%) + Goat manure (75%)	0.89	0.84	44.50	5.98	38.99
F- Test	S	S	S	S	S
SEd ±	0.07	0.7	6.50	0.55	0.13
CD (P= 0.05%)	0.14	0.14	13.24	0.63	1.16

report also has been given by Srinivasan *et al*. (2014). Vermicompost is a tea like structure organic fertilizer which is more nutrient rich than the other organic fertilizers and might have improved the soil porosity, structure, water holding capacity and supplied other plant growth promoting substances and hence vermicompost significantly increased plant height. Result was reported by other researchers (Walker and Bernal 2004).

Number of leaves per plant

The maximum number of leaves per plant (16.27 cm) was observed in T_9 (Vermicompost + Poultry 50% + Gout manure 50%) followed by T_8 (Vermicompost + Poultry 75% + Gout manure 25%) (15.30 cm) and minimum number of leaves per plant T_1 FYM 100% (12.37). Organic fertilizers help in constructing the leaves of cabbage to form the cabbage head. The

more the number of leaves, the less the head form of cabbage. From this point of view, vermicompost resulted the best performance in constructing cabbage head than the other organic fertilizers with the same amount of application. Similar result was reported by Walker and Bernal (2004).

Days to first head formation

Significant minimum Days to first head formation is (36.93 days), was recorded in T_9 (Vermicompost + Poultry manure) (50%) + Goat manure (50%), followed by T_{10} (Vermicompost + Poultry manure) (25%) + Goat manure (75%) (38.87 days) whereas maximum days to first head formation was observed in T_1 FYM 100% (46.67 days). The minimum Days to first head formation was observed in treatment T_9. It is due to the presence of vermicompost, poultry manure and gout manure which fulfilled the nutrient requirement in cabbage plant. Nitrogen, Potassium effected in vegetative growth in the plant hence the minimum days to first head formation was observed in treatment T_9. Similar report also has been given by Mohanta *et al*. (2018).

Day to 50% head formation

Significant difference was observed for 50% head initiation, minimum head formation was in (40.11 days), was recorded in T_9 (Vermicompost + Poultry manure) (50%) + Goat manure (50%) followed by T_{10} (Vermicompost + Poultry manure) (25%) + Goat manure (75%) (42.11 days) where maximum time for 50% head formation was observed in T_1 FYM 100% (49.67 days). Nitrogen, potash stimulates the growth of cabbage plant hence the earliest head formation (50%) was maximum observed in treatment T_9. Not only these organic manures stimulate the growth of cabbage plant but also enhanced the plant growth regulations in cabbage plant. That's why earliest 50% head formation was observed in treatment T_9. Similar report regarding this also has been given by Mohanta *et al*. (2018).

Days to first harvesting

Significant difference was observed for minimum days to first harvesting in T_9 (Vermicompost + Poultry manure) (50%) + Goat manure (50%) (62.33 days) followed by T_8 (Vermicompost + Poultry manure) (75%) + Goat manure (25%) (64.40 days) where maximum time for days to first harvest in T_1 FYM 100% (72.40 days). Earliest harvesting was observed in treatment T_9. Similar report regarding this also has been given by Mohanta *et al*. (2018).

Diameter of head Size (cm)

Significantly maximum diameter of head size is (20.24 cm) was observed in T_9 (vermicompost + Poultry) 50% + Gout manure 50%) followed by T_8 (Vermicompost + Poultry) 75% + Gout manure 25%) (19.02 cm) and whereas minimum was observed in diameter of head size T_1 FYM 100% (14.07 cm). This clearly indicate that the application of Vermicompost + Poultry manure along with Goat manure found to be effective increasing diameter of head in compare with sole organic manure. A similar result was found by Blatt (1991).

Total Head weight (kg)

Significant difference was observed due to different organic fertilizer for total Head weight, maximum (1.23 kg), was recorded in T_9 (Vermicompost+ Poultry manure) (50%) + Goat manure (50%) followed by T_8(Vermicompost+ Poultry manure) (75%) + Goat manure (25%) (1.14 kg) whereas minimum total head weight observed in T_1 FYM 100% (1.02 kg). Vermicompost, poultry manure and goat manure more effective to enhance plant growth. It contains trace element (Calcium, magnesium, zinc, copper, iron, manganese). So, the application of organic manures improves the soil environmental and increase the microbial activity might increase the nutrient availability for cabbage production and thus increase the total weight of cabbage as compared to the sole application of chemical fertilizers. Similar report also has been given by Slim Reza *et al*. (2016). Similar observation ware reported Noor *et al*. (2005).

Marketable head weight (kg)

Significant difference was observed due to organic fertilizer for market table Head weight (0.98 kg) was recorded in T_9 (Vermicompost+ Poultry manure)

(50%) + Goat manure (50%) followed by T_8(Vermicompost+ Poultry manure) (75%) + Goat manure (25%) (0.95 kg) whereas minimum marketable head weight observed in T_1 FYM 100 % (0.68 kg). Organic manures improve the soil environmental and increase the microbial activity might increase the nutrient availability for cabbage production and thus increase the total weight of cabbage as compared to the sole application of chemical fertilizers. Similar report also has been given by Reza *et al*. (2016). Similar observation ware reported Noor *et al*. (2005).

Net head weight (kg)

Significant difference was observed due to organic fertilizer for net head weight (0.93 kg) was recorded in T_9 (Vermicompost+ Poultry manure) (50%) + Goat manure (50%) followed by T_8 (0.90 kg) (Vermicompost+ Poultry manure) (75%) + Goat manure (25%) whereas minimum net head weight observed in T_1 (0.63 kg). Vermicompost, poultry manure and goat manure more effective to enhance plant growth. Organic manures improve the soil environmental and increase the microbial activity might increase the nutrient availability for cabbage production and thus increase the total weight of cabbage as compared to the sole application of chemical fertilizers. Similar report also has been given by Reza *et al*. (2016). Similar observation ware reported Noor *et al*. (2005).

Yield (Tonns/ha^{-1})

Significantly maximum weight of head is (49.17 t/ha^{-1}) was observed in T_9 (Vermicompost + Poultry manure) (50%) + Goat manure (50%) followed by T_8 (Vermicompost + Poultry manure) (75%) + Goat manure (25%) (47.33 t/ha) whereas minimum marketable head weight yield/plot was observed in T_1 FYM 100% (33.83 t/ha^{-1})

Ascorbic acid (mg/100 g) and total soluble solid (^{o}Brix)

Significant difference was observed due to organic fertilizer for total soluble solid (^{o}Brix), minimum (4.11 ^{o}Brix), T_7 (Vermicompost (25%) + Goat manure (75%) followed by T_9 (Vermicompost + Poultry manure) (50%) + Goat manure (50%) (6.01 ^{o}Brix) whereas maximum was record in T_1 FYM 100% (7.07 ^{o}Brix). Organic manure provide nutrients to plant, helps in improving the physical, chemical and biological changes in the plant which helps in improving the vegetative growth as well as quality parameters. These results might be due to the application of T_7 Which helped in improving vegetative growth as well as quality parameters. These results are similar to the finding by Singh (2004), Ouda *et al*. (2008) and Shree *et al*. (2014).

CONCLUSION

Based on the above result and discussion, the treatment T_9 (Vermicompost + Poultry manure) (50%) + Goat manure (50%) was found superior and best in the term of growth, yield parameters and in other hand the treatment T_7 (Vermicompost 25% + Goat manure 75%) was found to be most effective on quality parameters of cabbage plant.

REFERENCES

Anonymous (2014) All India area production and productivity of cabbage. *Ind Horticulture*.

Banik P, Sharma RC (2009) Effect of organic and inorganic sources of nutrients on the winter crops- rice based cropping system in sub-humid tropics of India. *Arch Agron Soil Sci* 55: 285–294.

Blatt CR (1991) Comparison of several organic amendments with a chemical fertilizer for vegetable production. *Sci Horticulture* 47: 177–191.

Mohanta R, Nandi AK, Mishra SP, Pattnaik A, Hossain MM, Padhiary AK (2018) Effects of integrated nutrient management on growth, yield, quality and economics of sprouting broccoli. *J Pharmacog Phytochem* 7(1): 2229-2232.

Noor S, Farid ATM, Shil NC, Sultan S (2005) Evaluation of some organic manure on the yield of cabbage under integrated nutrient management system. *Ban J Agric Environ* 1(2): 53-59.

Ouda BA, Mahadeen AY (2008) Effect of fertilizers on growth, yield, yield components, quality and certain nutrient contents in broccoli (*Brassica oleracea*). *Int J Agric Biol* 10(6): 627-632.

Patil, Anand G, Mangesh, Rajkumar M (2016) Integrated nutrient management in carrot (*Daucus carota*) under north eastern transitional track of Karnataka. *The Bioscan* 11: 271-273.

Purakayastha TJ, Rudrappa L, Singh D, Swarup A, Bhaddraray S (2008) Long-term impact of fertilizer on soil organic carbon pools and sequestration rater in maize – wheat- cowpea cropping system. *Geoderma* 144: 370-378.

Reza Slim, Islam Sajjadul AKM, Rahman Asif Md, Miah Yunus

Md, Akhter Sohela, Rahman Mosheur Md (2016) Impact of organic fertilizer on yield and nutrient of cabbage. *Sci Technol Environ Information* 03(02): 231-244. EISSN: 2409-7632.

Shree S, Singh VK, Kumar R (2014) Effect of integrated nutrient management on yield and quality of cauliflower (*Brassica oleracea* var botrytis). *The bioscan* 9(3): 1053-1058.

Singh AK (2004) Effect of nitrogen and phosphorus on growth and curd yield of cauliflower var snowball-16 under cold arid region of ladakh. *Haryana J Horticul Sci* 33(1 and 2): 127-129.

Sinha RK, Agarwal S, Chaudhan K, Valani D (2010) The worder of earthworm and its vermicompost in FYM production: Charles Darwin"s friend of farmers with potential to replace destructive chemical fertilizer from agriculture. *Agric Sci* 1(2): 76-94.

Srinivasan K, Jeevan Rao, Sailaja V, Kalaivanan D (2014) Influence of organic manures and fertilizers on nutrient uptake, yield and quality in cabbage-baby corn cropping sequence. *J Horticulture Sci* 9(1): 48-54.

Walker DJ, Bernal MP (2004) Plant mineral nutrition and growth in a saline Mediterranean soil amended with organic wastes. Commun *Soil Sci Pl Analysis* 35(17-18): 2495–2514. http://dx.doi.org/10.1081/LCSS-200030347.