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Impact of Organic Manures on Growth and Yield of Cabbage (Brassica oleracea L. var. capitata) cv. Pusa Drumhead Under Dehradun District of Uttarakhand

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Abstract

A field experiment was conducted during the year 2021-22 at Horticulture Research Block, Department of Horticulture, School of Agricultural Sciences, SGRR University, Dehradun, Uttarakhand to investigate the "Impact of organic manures on the growth and yield of cabbage *(Brassica oleracea L. var. capitata)* cv. Pusa Drumhead under Dehradun district of Uttarakhand". The experiment was laid out in randomized block design with three replications and six treatments. The treatments comprised following levels of various organic nutrients concentrations viz. Jeevamrutham @500l/ha (T1),Vermicompost @5t/ha (T2), FYM @5t/ha(T3), Vermicompost @2.5t/ha + Jeevamrutham @50% (T4), Jeevamrutham @50% + lukewarm water @50%(T5) and Control (T6). Observations on various attributes of growth and yield were recorded at 30, 40, 60 DAT and at final harvest stages. The result revealed that treatment T4 (Vermicompost @2.5t/ha + Jeevamrutham @50%) was found to be most significant for growth attributes viz., plant height (cm), number of leaves, leaf length (cm), leaf width (cm) and yield attributes such as number of non-wrapper leaves, polar diameter of head (cm), equatorial diameter of head (cm), head weight (g), yield per plot(kg/plot) and yield per hectare (q/ha). Also, from economic point of view, Vermicompost @2.5t/ha + Jeevamrutham @50% was found to be most profitable as compared to other treatments.

Keywords: FYM; Jeevamrutham; Vermicompost; Number of Non-Wrapper Leaves; Head Weight.

INTRODUCTION

Cabbage *(Brassicaoleracea L. var. capitata)* is a member of the genus Brassica and the mustard family, Brassicaceae. Cabbage or known as "Pattagobhi" is one of the most important vegetables grown on a large scale in India, for its head, which is formed by the development of densely over lapped leaves around the growing point. It has chromosome number 2n=18, edible part of cabbage is head.[1] The family Brassicaceae is characterized by 4 petals, standing opposite to each other in square cross, 6 stamens of which 2 are short and 4 long and a special kind of pod called siliqua. They are usually shallow rooted crop. It is originated from wild cabbage *(Brassica oleracea L var. sylvestris)* known as 'cole warts', through mutation, human selection and adoption. The origin of cabbage is to be known as Mediterranean

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region. From Europe, cultivated variants of cabbage spread to Asia and Americas. Cabbage is a small, leafy biennial vegetable crop producing a compact globular mass of smooth or crinkled leaves wrapped over each other known as head. The outer leaves are generally larger than the inner. The stem is short and stout. Plants flower generally after winter. The intensity of flowering depends upon the age of the plants and the period for which they are exposed to low temperature.[2] It is superior source of protein with high biological value and digestibility and also low in calories, fats and carbohydrates, but has a good source of minerals proteins and antioxidants. Cabbage leaves are rich in vitamin A, B1, B2, C and minerals. Scientists have discovered that anti-cancer chemicals are produced in the body when 'cruciferous' vegetables such as cabbage, broccoli and kale is digested. It is thought that eating more of these vegetables could help prevent bowel cancer. The protective action of cruciferous vegetables has been contributed to the presence of antioxidant, phytochemicals, especially antioxidant vitamins including ascorbic acid, α-tocopherol and β-carotene.[3] Organic agriculture has a significant role to play in addressing two of the world's biggest and most urgent issues i.e. climate change and food security. The uninterrupted use of inorganic fertilizers and pesticides in the cultivation of horticulture crops have caused decreased soil fertility as well as physical and chemical properties of soil. These days, use of Organic fertilizer is becoming popular for increasing growth and yield of different vegetable crops. Among several growth methods vermicompost, jeevaamrutham and FYM are very promising and these are being used on large scale in number of vegetable crops. The role of organic farming has been reported to be involved in regulation of growth through cell division and enlargement. Researchers have established the great potentialities for maximizing the growth and yield of vegetables. Maintenance of soil fertility is a prerequisite for long term sustainable crop production and it is certain that organic manure (e.g. bio-slurry) can play a vital role in the sustainability of soil fertility and crop production.[4] Solid and liquid organic manures play a vital role in restoring the soil fertility and stabilizing crop productivity. Therefore, the application of plant nutrients through organic sources like FYM, vermicompost, jeevamrutham remains the alternate choice for maintaining sustainable production. 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.[5] Organic farming is being adopted as to minimize the use of chemical fertilizers and pesticides that is hazardous to the environment. Organic materials such as bio-digested slurry, poultry manure, green leaf manure and FYM can substitute for in organic fertilizers to maintain productivity and environmental quality. Therefore, an experiment was carried out to assess the efficacy of various organic manures in cabbage under sub-tropical conditions of Uttarakhand.

MATERIALS AND METHODS

The present investigation was carried out at Horticulture Research Block, Department of Horticulture, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand during the rabiseason of 2021–22. The experiment was laid out in Randomized Block Design (RBD) with four replications. Total six treatments were tried viz. T1 (Jeevamrutham @500L/ha), T2 (Vermicompost @5t/ha), T3 (FYM @10t/ha), T4 (Vermicompost @2.5t/ha + Jeevamrutham @ 50%), T5 (Jeevamrutham @50% + lukewarm water @50%) and T6 (Control). The soil of the experimental field was sandy loam in texture having pH of 7.12 with available nitrogen (220.04%), available phosphorus (9.1 kg/ha) and available potassium (18.1 kg/ ha). The cabbage cultivar "Pusa Drumhead" was taken for present experiment. The seeds of cabbage were sown in nursery bed on October 2021. All the precautions were taken regarding nursery management till the seedlings were ready for transplanting. The organic manures were incorporated in experimental field as per the treatments at the time of final field preparation. All the cultural practices were done at regular intervals as per the requirement of crop during the course of investigation. During the experimental trial, from each replication, randomly selected five plants were used for recording various observations on growth and yield promoting parameters during whole of the cropping period at 20, 40, 60 days after transplanting and at final harvest stage. The obtained data were statistically analyzed with using standard statistical method.[6]

RESULTS AND DISCUSSION

The various growth as well as yield parameters like plant height, number of leaves, leaf length, leaf

Table 1: Treatment Details

Number of Treatment	Combinations	Concentration
T1	Jeevamrutham	500L/ha-
T2	Vermicompost	5t/ha
T3	FYM	300q/ha
T4	Vermicompost + Jeevamrutham	50%+ 50%
T5	Jeevamrutham + Lukeworm water	50% + 50%
T6	Control	

width and yield attributes such as number of non-wrapper leaves, polar diameter of head, equatorial diameter of head, head weight, yield per plot and yield per hectare were significantly influenced by different doses of organic manures as compared to control during the course of experimentation. The results of the present investigation were recorded and are thoroughly discussed below:

Plant height (cm)

The observation of plant height, recorded at 20, 40 and 60 DAT are presented in Table 2 revealed significant differences among the treatments. At 20 days after transplanting, the maximum plant height was recorded in treatment T2 (20.43 cm) which was at par with T4 (19.42 cm) and T3 (19.00 cm). However, minimum plant height (16.90 cm) was recorded under control (T6). In case of 40 DAT, the maximum plant height was obtained in treatment T4 (26.26 cm) which was at par with treatment T1(25.97 cm) and T3 (25.35 cm). The minimum plant

Table 2: Effect of organic manures on growth attributes of cabbage at different intervals

Treat-ment	Plant height				Leaf length				Leaf width				No. of non-wrapper leaves /plant			
	20 DAT	40 DAT	60 DAT	Mean	20 DAT	40 DAT	60 DAT	Mean	20 DAT	40 DAT	60 DAT	Mean	20 DAT	40 DAT	60 DAT	Mean
T1	18.04	25.97	27.98	23.99	18.44	21.12	23.09	20.89	15.74	18.55	20.89	18.39	16.06	23.82	24.58	21.49
T2	20.43	24.47	28.12	24.34	19.29	21.13	23.33	21.25	15.772	18.46	20.41	18.21	15.67	22.24	24.07	20.66
T3	19	25.32	28.23	24.18	18.58	20.66	23.02	20.75	15.557	18.36	20.69	18.2	16.06	24.08	25.09	21.74
T4	19.42	26.26	28.44	24.71	19.01	21.35	23.98	21.44	16.062	18.48	21.01	18.52	16.77	24.08	25.34	22.06
T5	18.32	24.34	27.29	23.31	18.48	20.69	22.91	20.69	15.742	17.85	20.23	17.94	15.69	23.3	24.33	21.11
T6	16.91	23.23	25.71	21.95	18.17	19.89	21.29	19.79	15.182	16.31	19.59	17.03	15.34	21.69	22.77	19.93
C.D.	1.19				0.64				0.64				0.71			
SE (m)	0.38				0.19				0.2				0.22			
SE (d)	0.53				0.28				0.28				0.31			
C.V.	2.74				1.65				1.93				1.81			

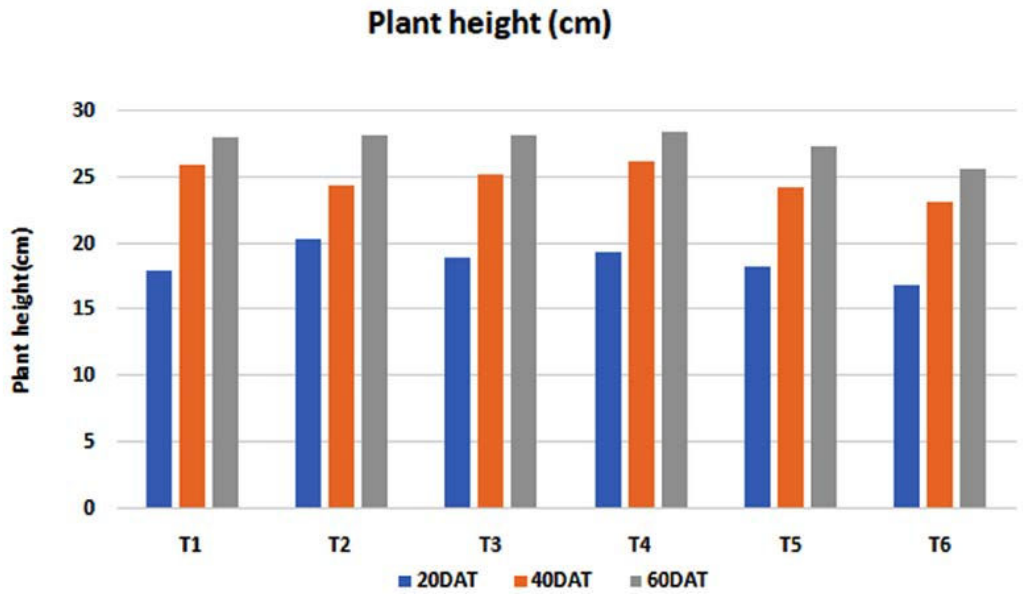

Fig. 1: Plant height (cm) as influenced by organic manure at different harvesting interval in cabbage

height (23.25 cm) was recorded under treatment T6. At 60 DAT, the plant height was maximum in T4 (28.44 cm) which was comparable with T3 (28.23 cm) and T2 (28.12 cm). While, minimum plant height was obtained in T6 (25.71 cm). The notable improvement with respect to plant height with the use of organic manures like FYM, vermicompost and cow urine might be due to the presence of large amount of humic substances in the vermincompost which might have improved the soil properties and increased the microbial activity of the soil and resulted in the release of nutrients.[7]

Leaf length (cm)

Leaf length after 20 days of transplanting was found maximum in T2 (19.29 cm) which was significantly superior over rest of the treatments, whereas, minimum leaf length was recorded in T6 (18.17 cm). In case of 40 days after transplanting, the maximum leaf length was noted in treatment T4 (21.35 cm) which was at par with T2 (21.13 cm) and T1 (21.12 cm). The minimum leaf length was obtained in the treatment T6 (19.89 cm). Similar trend was also observed at 60 DAT and the leaf length was maximum in T4 (23.98 cm) which was at par with T2 (23.33 cm) and T1 (23.09 cm). However, minimum leaf length was obtained in the treatment T6 (21.29 cm). This might be due to the increased up take of available major nutrients of the plant which results in the translocation of nutrients to the plant part and vermicompost influence plant growth directly via the supply of plant growth regulating substances (PGR) which results in the uptake of nutrients. Similar result was also reported in broccoli.[8]

Leaf width (cm)

Leaf width on 20 DAT the maximum was recorded in T4 (16.06 cm) which was statistically at par with T2 (15.77 cm) and T5 (15.74 cm). The minimum leaf width was recorded in the treatment T6 (15.18 cm). In case of 40 days after transplanting, the maximum leaf width was noted in T1 (18.55 cm) which was at par with treatment T4 (18.49 cm) and T2 (18.46 cm). While, minimum leaf width was obtained in the treatment T6 (16.30 cm). Data recorded at 60 DAT showed that the maximum leaf width was recorded in T1 (20.89 cm) which was found at par with treatments T3 (20.69 cm) and T2 (20.40 cm). The minimum leaf width was recorded in treatment T6 (19.59 cm). This might be due to the continuous nutrient availability by the use of organics. The use of organics in cauliflower results in the continuous availability of nutrients to the plants and increased the growth and development.[9]

Number of non-wrapper leaves

Data pertaining to number of non-wrapper leaves at 20 DAT the maximum counted (16.77) in T4 (Vermicompost @50% + Jeevamrutham @50%) and minimum (15.34) in T6 (control). In case of 40 DAT the mean value for number of loose leaves per plant were maximum (24.08) in T3 (FYM) and minimum (21.68) in T6 (control). At 60 DAT the mean value for the number of loose leaves per plant were maximum (25.34) in T4 (Vermicompost @50% + Jeevamrutham @50%) and minimum (22.77) in T6 (control). The greater number of non-wrapper leaves might be due to the fact that combination of organic manures increased the vegetative growth and pushed up the rate of growth which gave a greater number of non-wrappers leaves. Similar finding was also reported in cabbage.[10]

Table 3: Effect of different organic manures on yield attributes of cabbage

Treatment	Polar diameter (cm)	Equatorial diameter (cm)	Weight of head (kg)	Yield (kg/ plot)
T1	20.64	21.35	5.88	28.89
T2	20.84	21.49	6.09	29.6
T3	20.58	21.04	5.92	28.16
T4	20.98	21.82	6.44	30.19
T5	20.41	21.15	5.96	27.74
T6	20.32	20.67	4.96	26.58
C.D.	0.41	0.53	0.37	1.56
SE (m)	0.13	0.18	0.11	0.49
SE (d)	0.18	0.24	0.16	0.69
C.V.	1.09	1.36	3.37	2.96

Polar diameter and Equatorial diameter of head (cm).

At the time of harvest, according to mean values maximum polar diameter of cabbage head was

noted (20.98 cm) in T4 (Vermicompost @50% + Jeevamrutham @50%) and minimum (20.32) in T6 (control). The mean values for equatorial diameter of cabbage head was noted maximum (21.82 cm) in T4 (Vermicompost @50% + Jeevamrutham @50%) and minimum (20.67 cm) in T6 (control). Application of higher amount of organic manure along with reduced levels of in organic nitrogen

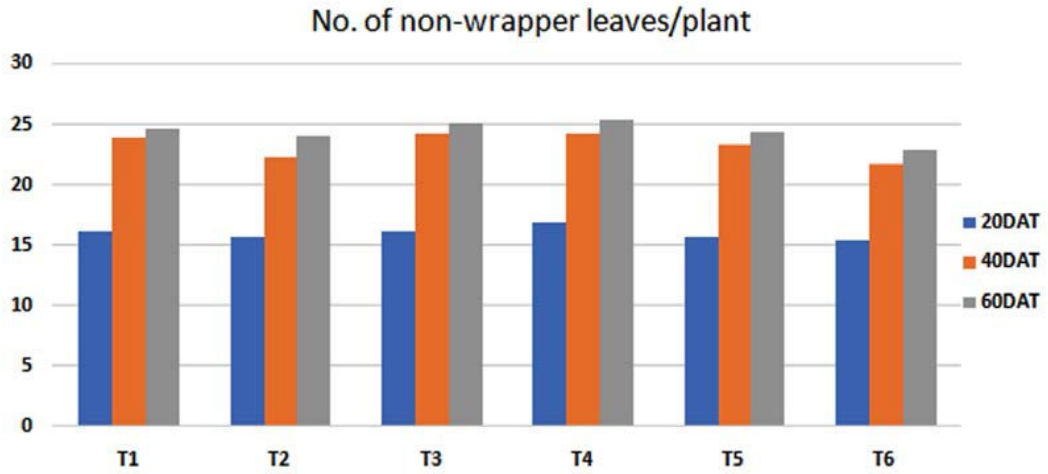

Fig. 2: Number of non-wrapper/plants as influenced by organic manure at different interval in cabbage

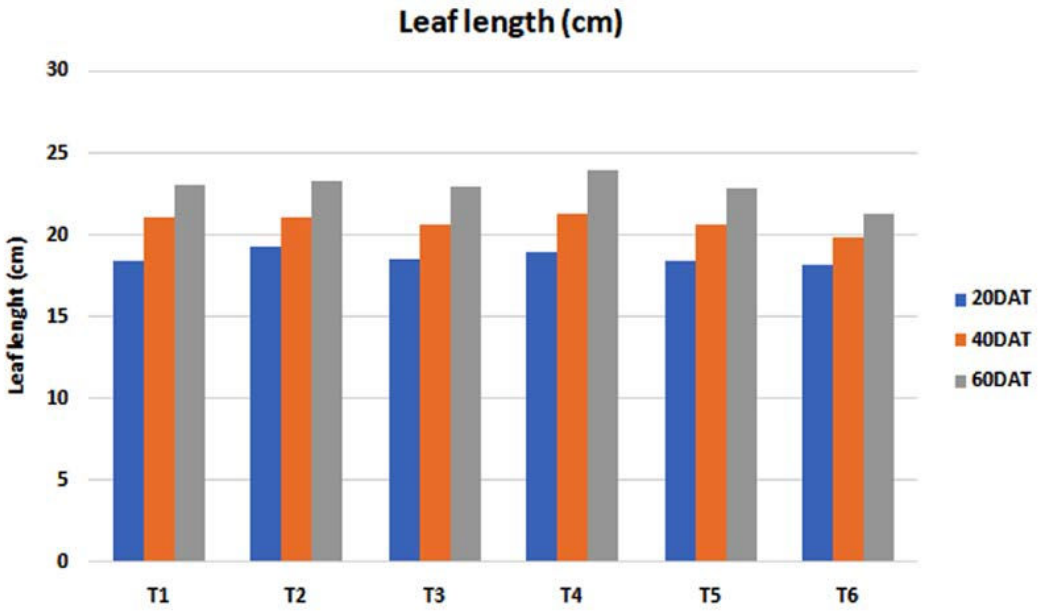

Fig. 3: Leaf length as influenced by organic manures at different interval of time in cabbage

fertilizer can improve the nutritional and keeping quality of cabbage head. Therefore, integrated nutrient management practices will be beneficial for improvement of over all quality of head. Similar finding was also reported.[11]

Weight of head (Kg)

According to the mean values the maximum weight of cabbage head was noted (6.44 kg) in T4 (Vermicompost @50% + Jeevamrutham @50%) which was statistically at par with (6.09 kg) in T2 and minimum (4.96 kg) in T6 (control). Application of higher amount of organic manures along with reduced levels of in organic nitrogen fertilizer can improve the nutritional and keeping quality of cabbage head. Therefore, integrated nutrient management practices will be beneficial for improvement of overall quality of head.

Net head yield (Kg/Plot)

The maximum yield was recorded in treatment T4 (30.19 kg/plot) and minimum in treatment T 6

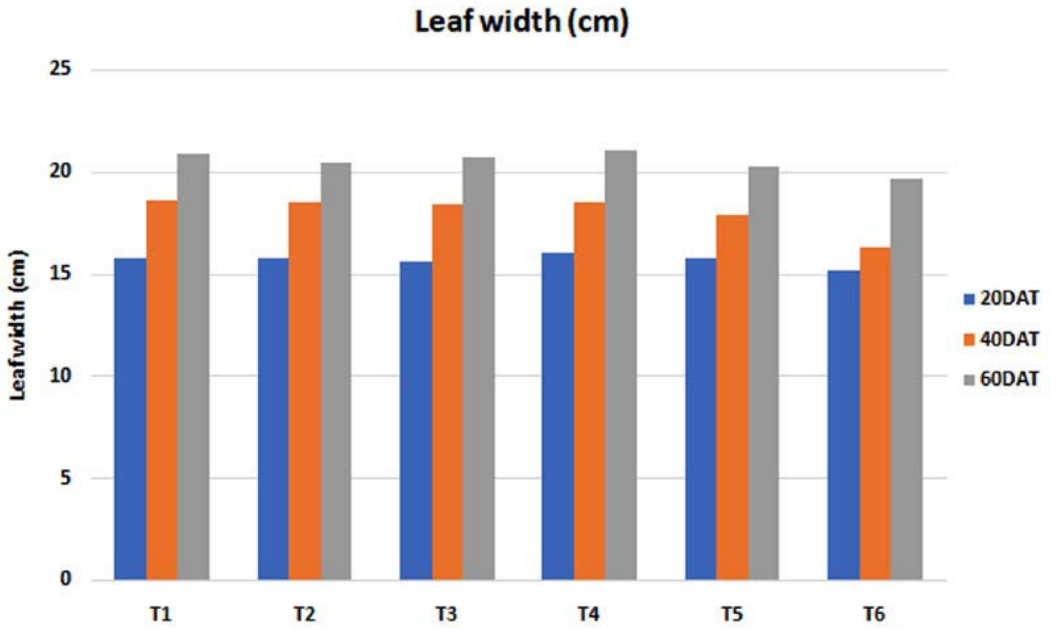

Fig. 4: Leaf width as influenced by organic manures in cabbage

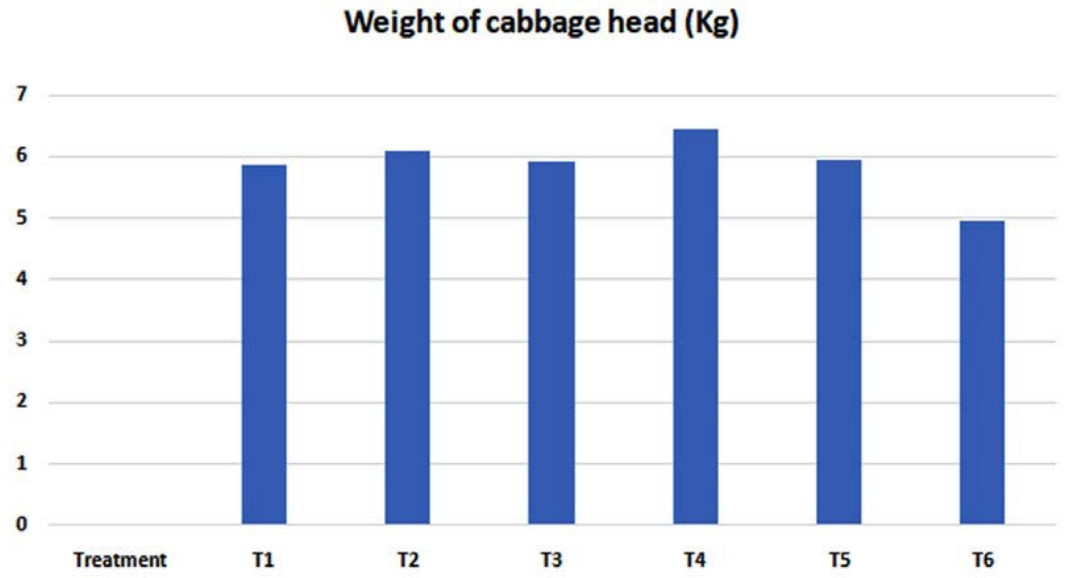

Fig. 5: Weight of head as influenced by organic manure treatments in cabbage

(26.58 kg/plot). The result of present investigation revealed that the maximum gross yield was obtained in the treatment T4. This might be due to a greater number of leaves, a greater number of non-wrapper leaves and highest plant height. Similar finding was obtained by were the water soluble components of vermicompost such as humic acid, growth regulators, vitamins and micronutrients increase the availability of plant nutrients resulting in increased growth, higher yield and better quality produce.

CONCLUSION

On the basis of present research on "Efficacy of Organic fertilizer on the growth and yield attributes of cabbage (*Brassica oleracea L. var. capitata)* at subtropical conditions of Uttarakhand" in cultivar Pusa Drumhead, it can be concluded that among different organic manures treatments, the combination of Vermicompost @2.5t/ha + Jeevamrutham @250L/ha i.e. T4 was found to be

most effective for increasing plant height, number of leaves/plant, leaf length, leaf width, number of non-wrapper leaves, individual head weight, gross and net yield (kg/ha).

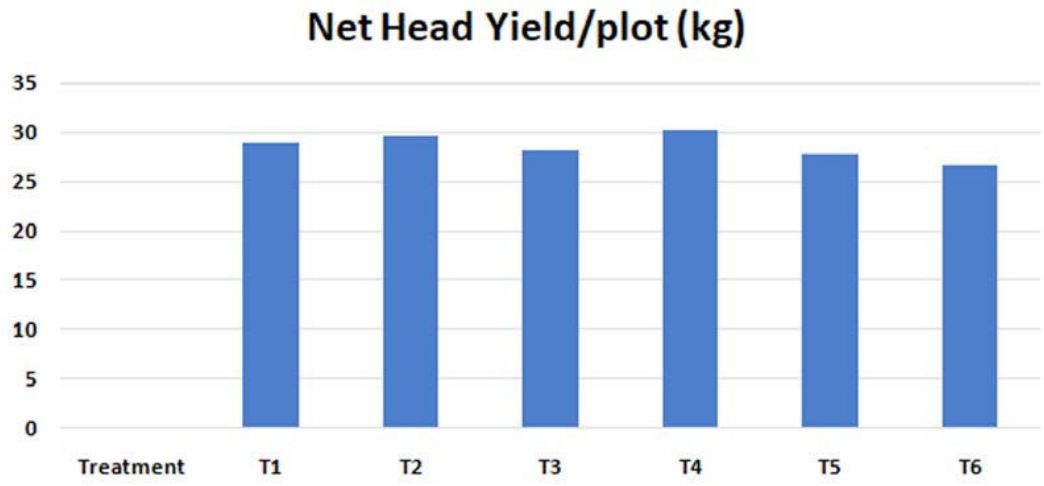

Fig. 6: Net head yield (Kg/plot) of cabbage as influenced by organic manure treatments in cabbage

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