



Efficacy of Organic Manure and age of Seedling on Growth and Yield of Hybrid Cabbage (*Brassica oleracea var. capitata*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was carried out to assess the Efficacy of organic manure and age of seedling on growth, yield and quality of hybrid cabbage (*Brassica oleracea var capitata*) at the Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj, during winter season of 2020-2021 and 2021-2022. The

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experiment was laid out in randomized block design with factorial concept three replicated three times the result of the present investigation highlighted that incorporation of and Age of seedling T₁₈(Farm yard manure 15 (t/ha) + Vermicompost 15 (t/ha) + 35 Days age of seedling) in response to Number of leaves plant⁻¹, Plant height (cm), Stem diameter (cm), Leaf area (cm²), Net head weight (g), Polar diameter (cm), Equatorial diameter (cm), Whole plant fresh weight in (kg), Gross head yield (t ha⁻¹) and Net head yield (t ha⁻¹). Could able to cause beneficial response on the above attributes. The treatment combination comprised of FYM 15 t /ha + Vermicompost 15 t/ha+35 DAT (F₂VC₂D₂) recorded highest gross return (Rs. 59922.00), maximum net return (Rs. 59922.00) and also benefit: cost ratio (B:C ratio 1:5.76). The highest benefit: cost ratio (B:C ratio 1:6.17) was observed by the treatment comprising of FYM 15 t /ha + Vermicompost 15 t/ha+ 25DAT (F₂VC₂D₁).

Keywords: Cabbage; B:C ratio; vermicompost; FYM; age of seedling; growth; yield.

1. INTRODUCTION

“Cabbage (*Brassica oleracea* var. *capitata* L.) a member of family Cruciferae and genus Brassica and is a leafy vegetable, which is widely cultivated throughout the globe, which is consumed fresh as well as in processed form in different countries of the world” [1]. “The Food and Agriculture organization has identified cabbage among one of the top twenty vegetables” (Olaniyi J. O. and Akanbi W B, 2008). “In India the area under cabbage cultivation is around 4 lac hectare with 9039000 MT production” [2]. “Punjab produces 87.19 thousand tonnes from an area of 4.95 thousand ha with an average yield of 17.61 thousand MT/ha” [2]. “Major cabbage producing districts include Amritsar, Patiala, Jalandhar and Ludhiana. The climatic conditions of Punjab are suitable for cabbage for getting higher yield. Nutrient management plays a crucial role for the improvement of cabbage yield and production. A remarkable effect on the physiological attributes especially in the form of vermicompost, farmyard manure, poultry manure and biofertilizer has been noticed in various vegetables. Apparently, inorganic fertilizers impair the crop health due to of residual effect but such kinds of issues are not evident in case of organic fertilizer” [3]. “Despite of the balanced use of sole chemical fertilizer, high yield level could not be attained over years due to deterioration in soil physical, chemical and biological properties” [4]. “However, some studies have suggested that excessive use of those agrochemicals may actually aggravate pest problem in the long run” [5]. “There is a need to minimize the consumption of inorganic fertilizers in agriculture. Thus, strategy of nutrient management is very important in recent days considering the harmful effects of indiscriminate use of chemical fertilizer. Keeping these aspects,

the present investigation was planned to find out a suitable alternative of inorganic fertilizers” [6].

2. MATERIALS AND METHODS

The field experiment was conducted at an experimental farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj during winter season of 2020-2021 and 2021-2022. Prayagraj has subtropical climate, which prevails in the South East part of U.P., with the both extremes of temperature i.e. the winters and the summers. In fairly cold winters (during Oct-Feb), the temperature falls to 3-4°C, sometimes below -1°C. During summer (March-June), the temperature rises upto 45°C, sometimes 47-48°C with low relative humidity (20%) and dust laden winds. During monsoon (June-Sept) 85% of average rainfall of 1100mm with fall in temperature 40-45°C on rainy days. In order to ascertain the influence of various source of organic manures for obtaining higher head yield of cabbage. The soil of an experimental plot was sandy loam in texture with pH 7.40, organic carbon (0.40-0.75%), medium in available N (0.28%), available P (16 kg/ha) and available K (175 kg/ha). The experiment was laid in a randomized block design with three replications having 11 treatments comprising different combinations of organic sources viz. (FYM – Farm Yard Manure, VC – Vermicompost, D₁ -25 days Age of seedling, D₂ – 35 days age of seedling). T₁:FYM 0 t/ha + VC 0 t/ha D₁ 25th, T₂:FYM 0 t/ha + VC 10 t/ha D₁ 25th, FYM 0 t/ha + VC 15 t/ha D₁ 25th, T₄:FYM 10 t/ha + VC 0 t/ha D₁ 25th, T₅:FYM 10 t/ha + VC10 t/ha D₁ 25th, T₆:FYM 10 t/ha + VC 15 t/ha D₁ 25th, T₇:FYM 15 t/ha + VC 0 t/ha D₁ 25th, T₈:FYM 15 t/ha + VC 10 t/ha D₁ 25th, T₉:FYM 15t/ha + VC15 t/ha D₁ 25th, T₁₀:FYM 0 t/ha + VC 0 t/ha D₂ 35th, T₁₁:FYM 0 t/ha + VC10 t/ha D₂ 35th T₁₂:FYM 0 t/ha + VC

15t/ha D₂ 35th, T₁₃:FYM 10t/ha + VC 0 t/ha D₂ 35th, T₁₄:FYM 10 t/ha + VC10 t/ha D₂ 35th, T₁₅:FYM10 t/ha + VC15 t/ha D₂ 35th, T₁₆:FYM 15 t/ha + VC 0 t/ha D₂ 35th, T₁₇:FYM 15 t/ha + VC 10 t/ha D₂ 35th and T₁₈:FYM 15t/ha + VC 15 t/ha D₂ 35thDAT. Cabbage (Pusa Hybrid -1) was transplanted at 60 × 45 cm spacing done of October and harvested at fully matured stage. “Selected and tagged plants were left in the field for head production during winter. All other cultural practices were followed as per standard recommendations. The economics of different cultural practices, input and returns for cabbage variety Pusa haybrid -1 under each treatment combination was worked out to find the most effective and economical treatment. The benefit :cost ratio was calculated with the help of following formula: B: C ratio=Gross return÷ Total cost of cultivation The data were analyzed as per the standard procedure for Analysis of Variance (ANOVA). The difference in the treatment mean was evaluated by using critical difference (CD) at 5% level of probability” [6].

3. RESULTS AND DISCUSSION

3.1 Yield and Yield Attributes

Critical analysis of data portrayed in Table 1 due to combine use of FxVCxD proved to be significantly effective in number of leaves per plant, Plant height at (cm), Stem diameter (cm), Leaf area(cm²), Net head weight (g), Polar diameter (cm), Equatorial diameter (cm), Whole plant fresh weight in (kg) and Gross head yield (t ha⁻¹) Net head yield (t ha⁻¹) . Further it was highlighted that maximum values i.e. (12.58, 18.02, 2.99, 164.39, 1458.32, 14.78, 15.17, 2.05, 66.58 and 48.61) was found in treatment T₁₈ F₂VC₂D₂: FYM 15 t /ha + Vermicompost 15 t/ha+35 DAT and T₆ F₁VC₂D₁: FYM 10 t /ha + Vermicompost 15 t/ha+25DAT. Where as the minimum number of leaves per plant (11.31, 15.87, 2.38, 132.59, 846.67, 11.92, 12.30, 1.50, 48.56 and 28.22) was obtained in treatment T₁:F₀VC₀D₁: FYM 0 t /ha + Vermicompost 0 t/ha+25 DAT. “Application of organic manures increased the physical and chemical properties of the soil thereby helping the crop to produce good vegetative growth. This investigation revealed that integrated application of nutrients by adding organic manures helps in increasing the growth of the crop as well as contributing to soil health properties. The results are similar with the findings of Gupta and Samnotra [7], Yadav et al. [8] and Singh and Singh [9] in cabbage where up to 25 per cent inorganic fertilizers can be

saved without affecting the yield of the crop while at the same time reduced the harmful effects of chemical fertilizers on soil health” [6]. “This may be due to the young seedlings resume their growth faster after transplanting than advanced seedlings, as the impact of the transplant shock on them is less compared to seedlings grown at the age of 25 days, and that the speed of cell division and root renewal for these seedlings is faster compared to advanced seedlings” McKee, J. M. T.(1981). “While the old seedlings stayed for a long time inside the seedling tray before being transferred to the open field, which led to the stop of root growth and the seedlings became more woody and lost their ability to grow quickly when transplanted on the field which negatively affected the vegetative growth”. Thompson, H.C. and Kelly, W.C. [10] In this connection, Obaid, F.I. [11] Compared to “cabbage seedlings planted at age of 25, those planted at 35 days showed a considerable improvement in vegetative development characteristics (number of leaves, leaf area dry, weight of the vegetative growth, fresh weight of the plant, and dry weight of the plant)”.

The data from Table 1 reveal that significant variation was observed in Net head weight (g) of cabbage due to application of different treatments comprising of organic manures. Maximum Net head weight (g) of 1458.32g was recorded in T₁₈ (F₂VC₂D₂: FYM 15 t /ha + Vermicompost 15 t/ha+35 DAT) which was statistically at par with T₁₇ (F₂VC₁D₂: FYM 15 t /ha + Vermicompost 10 t/ha+35 DAT). However, the lowest head length was recorded in control treatment (T₁) with 846.67g. these finding are in close conformity with the finding of Moyin-jesu (2015) in their study regarding use of different organic fertilizers in cabbage. Higher Net head weight (g) in T₁₈ i.e. F₂VC₂D₂: FYM 15 t /ha + Vermicompost 15 t/ha+35 DAT can be attributed to the rapid availability of nutrients by inorganic sources which promoted rapid growth, increased leaf size and quality. The results summarized above in respect to Net head weight (g) are closely in consonance with findings reported earlier by Parmar et al., [12] and Jha et al., [13]. Table 1 first evident that the highest value for Equatorial diameter (cm) of cabbage i.e. 15.17 cm was obtained in T₁₈ (F₂VC₂D₂: FYM 15 t /ha + Vermicompost 15 t/ha+35 DAT) which remained statistically at par with T₁₇ (F₂VC₁D₂: FYM 15 t /ha + Vermicompost 10 t/ha+35 DAT). Whereas, the lowest head diameter 12.30 cm was observed in T₁ i.e. (F₀VC₀D₁: FYM 0 t /ha + Vermicompost 0 t/ha+25DAT). The results in

Table 1. Interaction effect between FYM, vermicompost and age of seedling on growth and yield of cabbage (*Brassica oleracea var. capitata*)

Treatments	Number of leaves plant ⁻¹	Plant height at (cm)	Stem diameter (cm)	Leaf area (cm ²)	Net head weight (g)	Polar diameter (cm)	Equatorial diameter (cm)	Whole plant fresh weight in (kg)	Gross head yield (t ha ⁻¹)	Net head yield (t ha ⁻¹)
T ₁	11.31	15.87	2.38	132.59	846.67	11.92	12.30	1.50	48.56	28.22
T ₂	11.38	16.30	2.38	132.89	978.41	12.27	12.64	1.61	52.23	32.61
T ₃	11.83	16.50	2.59	139.29	1043.33	12.34	12.74	1.67	54.19	34.78
T ₄	11.90	16.88	2.59	139.79	1156.02	12.36	12.76	1.78	57.81	38.53
T ₅	12.25	17.15	2.84	151.29	1388.04	13.89	14.27	2.00	65.32	46.27
T ₆	12.40	16.32	2.84	151.59	1384.95	13.98	14.36	2.00	65.15	46.16
T ₇	11.90	16.65	2.43	139.89	1094.71	12.62	13.00	1.71	55.43	36.49
T ₈	12.03	16.55	2.43	139.89	1155.24	12.83	13.25	1.76	57.36	38.51
T ₉	12.22	17.07	2.84	140.39	1289.56	13.45	13.85	1.90	61.80	42.98
T ₁₀	11.82	17.05	2.83	140.39	1307.24	13.56	13.94	1.91	62.33	43.57
T ₁₁	12.33	17.23	2.96	152.79	1404.04	14.12	14.52	2.01	65.52	46.80
T ₁₂	12.38	15.13	2.98	153.39	1417.38	14.21	14.60	2.03	65.93	47.25
T ₁₃	12.00	16.80	2.61	140.09	1211.92	12.91	13.31	1.81	59.01	40.40
T ₁₄	12.08	17.03	2.61	140.09	1283.84	13.30	13.68	1.88	61.22	42.79
T ₁₅	11.75	16.95	2.83	145.29	1336.35	13.62	14.00	1.93	62.93	44.54
T ₁₆	12.15	17.57	2.83	145.59	1396.06	13.75	14.14	1.99	64.81	46.53
T ₁₇	12.43	17.72	2.98	163.89	1445.34	14.53	14.91	2.04	66.41	48.18
T ₁₈	12.58	18.02	2.99	164.39	1458.32	14.78	15.17	2.05	66.58	48.61
F - test	S	S	S	S	S	S	S	NS	S	S
S. Ed. (±)	0.077	0.107	0.029	0.554	2.529	0.215	0.063	0.069	0.488	0.383
CD=(P=0.05)	0.156	0.218	0.058	1.126	5.139	0.438	0.128	0.141	0.993	0.778

respect of Equatorial diameter (cm) are in complete agreement with the findings of Devi et al [14] in cabbage.

“Generally, the utilization of organic manure not only reduces the need for chemical fertilizers but also provides the necessary supplements and essential nutrients to the plants in addition to increasing the soil properties” [15].

“Head weight is one of the most important characteristics for measuring yield performance. Consistent with this finding, increasing farmyard manure with a certain number of buds increased the head weight of cabbage crops” [16-19].

4. CONCLUSION

Based on the findings of the experiment it is concluded that the variety Pusa Hybrid-1 sown in the Rabi seasons of the year, 2021 and 2022 of Prayagraj agro-climatic conditions was found to be the best along with the interaction effect of FYM, Vermicompost and Age of seedling T₁₈ (Farm yard manure 15 (t/ha) + Vermicompost 15 (t/ha) + 35 Days age of seedling) with respect to Number of leaves per plant, Height of plant, Dry matter of stem, Spread of leaves, Fresh weight of leaves, Length of main root, Fresh weight of root, Head size index, Leaf size index, Number of outer leaves, Number of inner leaves, Head length (cm), Head diameter (cm), Stock length (cm), Stock Diameter (cm), Whole plant fresh weight, Whole plant dry weight, Average Head weight (g), Head weight (q/ha), Grading of head under each treatment grade, Compactness of Head, Specific gravity, Moisture of leaf, Ascorbic acid. Hence Pusa Hybrid-1 is recommended for the farmer's in Prayagraj agro-climatic conditions along with treatment T₁₈.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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