



Research Article

RESPONSE OF CHRYSANTHEMUM CULTIVAR DOLLY WHITE TO DIFFERENT SOURCES AND COMBINATIONS OF ORGANIC MANURES UNDER THE MID HILL REGIONS OF UTTARAKHAND

PREMKUMAR A.¹, PUNETHA PARUL^{2*}, BOHRA MAMTA³, UPADHYAY SANDEEP⁴ AND NAUTIYAL B.P.⁵

^{1,2,3}Department of Floriculture and Landscape Architecture, College of Horticulture, VCSG Uttarakhand University of Horticulture and Forestry, Pauri Garhwal, 246123

⁴Department of Soil Science, College of Horticulture VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, 246123

⁵Department of Medicinal & Aromatic Plants, College of Horticulture VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, 246123

*Corresponding Author: Email-parulpunetha@gmail.com

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Abstract- The present investigation was conducted to find out suitable organic manures for quality flower production of Chrysanthemum cv. Dolly white. The experiment was laid out in Randomized Complete Block Design with 3 replications and 11 treatments. This included viz; control, FYM, Vermicompost, Forest litter, Goat manure, FYM + Vermicompost, FYM + Forest litter, FYM + Goat manure, Vermicompost + Forest litter, Vermicompost + Goat manure and Forest litter + Goat manure. The results of the study revealed that the treatment T₁₀ Vermicompost (2 t/ ha) and Goat manure (25 t/ ha) significantly recorded maximum Plant height (95.46 cm), Number of primary (5.93) and secondary (24.00) branches, earliest Number of days taken to bud initiation (81.63), Days taken to 1st opening of flower (15.63), Number of days taken to 50% (31.60), 100% (45.16) flowering, maximum number of ray florets (186.40) and Flower weight (1.68). The treatment T₁₀ Vermicompost (20t/ha) and Goat manure (25t/ha) also recorded the highest number of flowers/ plant (70.93), highest number of flowers/ plot (638.37) and highest number of flowers/ hectare (6384000) and highest C: B ratio (1:6.61). Thus, it can be concluded from the findings that application of Vermicompost (2 t/ ha) and Goat manure (25 t/ ha) can be recommended for commercial cultivation of chrysanthemum cv. Dolly white.

Keywords- Chrysanthemum, Farm yard manure, Vermicompost, Forest litter and Goat manure.

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Introduction

Flowers are nature's best gift, which is used in our day to day life and is upcoming as a fast emerging business. It has superimposed the traditional field crop cultivation due to increased units per return. Among the various flower crops chrysanthemum (*Dendranthema grandiflora*) is an important cut and loose flower crop having a pivotal place in both domestic and international market. It is different from other flower crops due to the different flower colour and forms of it. There are two types of chrysanthemum viz., spray type and standard type. Standard type of chrysanthemum is mostly grown for cut flower production and as potted flowering plant for exhibition and decoration. The spray type of chrysanthemums has genetic potentiality and mostly grown for loose flower production. Flowers of spray type varieties are highly suitable for making garlands, *venis*, and bracelets, as well as for worship purpose.

After the industrial revolution widespread introduction of inorganic fertilizers, led to a decline in the use of organic material in the cropping systems [1] and also the indiscriminate use of fertilizers have adversely affected the soil fertility, crop productivity and particularly the environment. Flower cultivation is no longer exception to this. The continuous uses of chemical fertilizers have affected the soil health and ultimately the flower quality. We have a lot of organic sources, which are cheap and easily available, but needs to be explored for their long-term benefit on soil and our produce [2]. The studies pertaining to these locally available organic sources under the hilly conditions are few. Therefore, present study was conducted to ascertain the use of organic manures and their combinations on chrysanthemum.

Materials and Methods

The present investigation was carried out at Floriculture and Landscaping Block, College of Horticulture, VCSG Uttarakhand University of Horticulture & Forestry Bharsar. Experimental area is situated at an altitude of 1900m above MSL.

Geographically the area is located between 29° 20'-29° 75' N latitude and 78° 10'-78° 80' E longitude. In general, the climate of the Bharsar represents the mild summer, higher precipitation and colder or severe cold prolonged winter. The experiment was laid out in Randomized Complete Block Design with 3 replications and 11 treatments. This included viz; control, FYM (25 t/ ha), Vermicompost (2 t/ ha), Forest litter (25 t/ ha), Goat manure (25 t/ ha), FYM(25 t/ ha) + Vermicompost (2 t/ ha), FYM(25 t/ ha) + Forest litter(25 t/ ha), FYM(25 t/ ha) + Goat manure(2.5 t/ ha), Vermicompost(2 t/ ha) + Forest litter(25 t/ ha), Vermicompost (2 t/ ha) + Goat manure (25 t/ ha) and Forest litter(25 t/ ha) and Goat manure(25 t/ ha). Organic manures were applied in experimental plots on the day of planting as per the treatment combination. One month old rooted cuttings of chrysanthemum of uniform size were transplanted at a spacing of 30 x 30 cm² with nine plants in each plot. The soil was well drained, sandy loamy in texture having pH 5.5. All the cultural practices were kept uniform for all the treatments and standard practices were followed. Observations on growth, flowering, yield and post harvest attributes were recorded from five randomly selected plants of each replication using standard procedure. Data collected was subjected to analysis of variance as per the methods of [3].

Results and Discussion

Maximum plant height (95.46) was obtained in the treatment T₁₀ that were treated with Vermicompost and Goat manure and the treatments T₈ (94.63), T₆ (94.59) and T₉ (93.70) was found to be statistically at par with T₁₀. Maximum primary branches/ plant (5.93) found in the treatment T₁₀ and treatment T₆ (5.70) is statistically at par with the T₁₀ and highest no. of secondary branches/plant (24.00) was obtained in plants that were treated with Vermicompost and Goat manure (T₁₀), the treatment T₆ (FYM + Vermicompost) produced maximum plant spread (36.96) and the treatments T₁₀ (34.18) and T₉ (33.83) were found to be statistically at par and maximum no. of leaves (104.93) was obtained in plants that were treated with FYM and Vermicompost (T₆) and it was found that treatments revealed T₁₀ (103.61) and T₉ (99.96) are statistically and all these parameters were found minimum in control.

The plant height was influenced significantly by different levels of nutrients. Maximum plant height was recorded by the application of Vermicompost + Goat manure than all other treatments applied. This might be due to the application of vermicompost, which supplies macronutrients, enzymes, and growth hormones and provides micronutrients such as Zn, Fe, Cu, Mn in an optimum level and Goat manure consists of high levels of Nitrogen. Similar findings were reported by Srivastava *et al.*, [4] in Tuberose.

Higher number of primary branches and secondary branches were obtained due to the application of vermicompost which is considered as an excellent product as it is homogenous and has desirable properties, reduced level of contaminants, higher level of soil enzymes, plant growth hormones, greater microbial population and holds more nutrients over a longer period without adversely impacting the environment. Goat manure retains more nitrogen, and promotes healthier plant growth. The above results are also corroborated with the findings of Nethra *et al.*, [5] in China aster and Kusuma, [6] in Golden Rod.

Maximum no. of leaves/ plant & plant spread was obtained in plants that were treated with FYM and Vermicompost. This might be due to fact that after proper decomposition and mineralization of organic fertilizer such as vermicompost, the micro and macro nutrient were made easily available to plants and also helped in solubilising the fix form of nutrient in the soil. Greater plant spread can also be attributed to production of more number of leaves. Production of leaves leads to photosynthesis and translocation of photosynthates to other parts of plants thereby, resulting in better plant spread and above mentioned parameters were observed to be minimum in control. These results are in conformity with the findings of Singh *et al.*, [7] in Gladiolus, Kale *et al.*, [8] and Kumar and Singh, [9] in China aster.

Table-1 Effect of organic manures on vegetative parameters in *Chrysanthemum* cv. Dolly white

| S. No. | Plant height (cm) | Primary branches/ plant | Secondary branches/ plant | No. of leaves/ plant | Plant spread (cm) | Leaf area (cm ²) |
|--------|-------------------|-------------------------|---------------------------|----------------------|-------------------|------------------------------|
| T1 | 85.02 | 4.57 | 13.73 | 90.79 | 17.37 | 19.08 |
| T2 | 88.27 | 4.60 | 17.37 | 92.74 | 20.97 | 21.06 |
| T3 | 90.76 | 5.30 | 18.93 | 93.36 | 25.77 | 21.66 |
| T4 | 86.01 | 5.07 | 17.13 | 90.99 | 20.53 | 20.54 |
| T5 | 88.31 | 5.07 | 18.10 | 92.83 | 22.07 | 21.29 |
| T6 | 94.59 | 5.70 | 20.03 | 104.93 | 36.96 | 22.34 |
| T7 | 91.96 | 5.30 | 17.80 | 95.36 | 26.88 | 22.23 |
| T8 | 94.63 | 5.00 | 18.93 | 95.63 | 32.26 | 22.75 |
| T9 | 93.70 | 5.40 | 19.73 | 99.96 | 33.83 | 21.05 |
| T10 | 95.46 | 5.93 | 24.00 | 103.61 | 34.18 | 22.55 |
| T11 | 92.33 | 5.21 | 16.43 | 95.10 | 32.05 | 20.61 |
| S.E.m± | 0.74 | 0.17 | 1.07 | 1.75 | 1.50 | 0.76 |
| CDat5% | 2.19 | 0.49 | 3.17 | 5.17 | 4.43 | 2.23(ns) |

The treatment T₁₀ which is a combination of Vermicompost + Goat manure produced the earliest bud initiation (81.63) and the treatments T₄ (87.29), T₅ (86.99), T₇ (83.16), T₈ (84.01), T₉ (84.05), T₁₁ (83.76) are statistically significant. The combination of Vermicompost and Goat manure (T₁₀) took minimum (31.60) number of days for 50% flowering and the treatments T₆ (31.90), T₁₁ (32.09), T₈ (32.23) and T₉ (32.62) were found to be statistically significant & application of Vermicompost + Goat manure took minimum number of days for 100% flowering (45.16) and was statistically significant with the treatment T₁₁ (48.09) and days

taken to 1st opening of flower was found to be earliest with the treatment T₁₀ (15.63) which is the combination of Vermicompost and Goat manure and the treatment T₁₀ T₆ (16.05), T₁₁ (16.76), T₅ (16.83) and T₉ (17.13) are statistically significant.

Maximum flower weight (1.68) is attained in the treatment T₁₀ which is the combination of Vermicompost and Goat manure and was statistically significant with the treatments T₆ (1.67), T₈ (1.19), & T₉ (1.60). Maximum (186.40) number of ray florets is obtained in the treatment T₁₀ and the treatments T₆ (181.76) and T₉ (179.73) is statistically at par with T₁₀. Maximum stalk length (7.26) was obtained in the treatment T₆ which was the combination of FYM and Vermicompost and the treatments T₁₀ (7.20), T₇ (7.12), T₉ (7.10), T₁₁ (7.05) T₃ (6.95), T₈ (6.84). Maximum vase life (22.20) was attained in the treatment T₆ and the treatments T₉ (21.58), T₃ (20.96), T₈ (20.64), T₁₁ (20.30), T₁₀ (20.19) and T₂ (18.93) are statistically significant with T₁₀. Treatment T₆ produced maximum shelf life (13.53) and is statistically significant with the treatment T₈ (13.50), T₁₀ (13.33), T₉ (12.63), T₇ (12.16) and T₁₁ (12.06) and all these parameters observed minimum in control, stalk length minimum (6.21) value observed in T₂ i.e., FYM.

Earlier no. of days taken to bud initiation, 50% & 100% flowering and minimum no. of days taken to 1st opening of flower was due to the effect of Vermicompost contain enzymes like amylase, lipase, cellulase and chitinase, which continue to break down organic matter in the soil (to release the nutrients and make it available to the plant roots) even after they have been excreted. They also increase the levels of some important soil enzymes like dehydrogenase, acid and alkaline phosphatases and urease.

Urease, an important soil enzyme increased by the application of vermicompost as it plays a key role in N-cycle because it hydrolyses urea and enzyme phosphatase bio-converts soil phosphorus into bio-available form for plants. This increase might also be due to the presence of gibberellins in vermicompost, which are associated with the regulation of flowering. Further decomposed goat manure will release organic matter, N, P, K, Ca and Mg. These findings are in corroboration with the work of Vetal *et al.* [10] in liliun, Shashidhara and Gopinath, [11] in *Calendula officinalis* cv. Red Orange, Yagi *et al.*, [12] in Zinnia, Bhalla *et al.*, [13] in Carnation and Awodun *et al.*, [14] in Pepper.

Maximum flower weight, ray florets and highest vase & shelf life due to that Vermicompost is rich in humus, which contains essential plant nutrients and rich in vitamins, beneficial microorganism, antibiotics, enzymes, etc., which are available for long term nutritional needs of plant growth [15]. FYM helps in improving soil health and it ensures proper aeration in soil and improves water holding capacity of soil. These findings are in conformity with the findings of Hemavathy [16] in chrysanthemum, Haripriya *et al.* [17] in rose (*Rosa centifolia*) cv. Andhra Red, Godse *et al.* [18] in gladiolus, Thane *et al.* [19] in gerbera, Bohra and Kumar [20] in Chrysanthemum cv. Little Darling. Treatment T₁₀ maximum number of flowers per plant (70.93) and it is statistically significant with the treatment T₆ (69.27). Treatment T₁₀ (638.37), which is combination of Vermicompost and Goat manure and is statistically significant with the treatments T₆ (623.4) and T₉ (590.7) per plot (638.37) and treatment T₁₀ which is the combination of Vermicompost and Goat manure produced maximum number of flowers per hectare (6384000.00) and it is revealed with the treatment T₆ (6234000.00) are statistically significant and minimum results of these parameters were observed in control. The increase in number of flowers may be due to fast release of nutrients and the addition of manure, vermi compost increase moisture content of the soil and retained it for quite some time it also improved physical, chemical and microbial properties of soil and there by its productivity [21]. While the Goat manure does not attract flies or breed maggots and it doesn't really smell. These factors increased plant growth and by which more photosynthates were produced and resulted in production of more flowers. This finding is also correlated with observation made by Raha, [22] in *Chrysanthemum coronarium* L. cv. Kasturba Gandhi.

Effect of organic manures on economics

Maximum yield (107.25) & C: B ratio (1: 6.61) was obtained in the treatment T₁₀ that were treated with Vermicompost + Goat manure. Minimum yield (44.39) and C: B ratio (1: 1.88) was obtained in the treatment T₁ i.e., in control. The increase in yield is might be due to the effect of Vermicompost, which supplies macro

nutrients, enzymes, and growth hormones and provides micro nutrients such as Zn, Fe, Cu, Mn in an optimum level and Goat manure which consists of high levels of nitrogen.

Table-2 Effect of organic manures on yield attributes in *Chrysanthemum* cv. Dolly white

| S.No. | Number of flowers/ plant | Number of flowers/ plot | Number of flowers/ hectare |
|-------|--------------------------|-------------------------|----------------------------|
| T1 | 56.69 | 510.24 | 5102400 |
| T2 | 58.73 | 528.60 | 5286000 |

| | | | |
|----------|-------|--------|-----------|
| T3 | 60.93 | 548.40 | 5484000 |
| T4 | 58.27 | 524.40 | 5244000 |
| T5 | 62.89 | 566.01 | 5660100 |
| T6 | 69.27 | 623.40 | 6234000 |
| T7 | 62.79 | 565.14 | 5651400 |
| T8 | 64.47 | 580.20 | 5802000 |
| T9 | 65.63 | 590.70 | 5907000 |
| T10 | 70.93 | 638.37 | 6384000 |
| T11 | 63.27 | 569.40 | 5694000 |
| S.E.m± | 1.77 | 15.94 | 159421.37 |
| CD at 5% | 5.23 | 47.03 | 470292.68 |

Table-3 Effect of organic manures on floral attributes in *Chrysanthemum* cv. Dolly white

| S. No. | Number of days taken to bud initiation | Number of days taken to 50% flowering | Number of days taken to 100% flowering | Days taken to 1 st opening of flower | Flower weight (g) | Number of ray florets | Stalk length (cm) | Flower diameter (cm) | Vase life | Shelf life |
|--------|--|---------------------------------------|--|---|-------------------|-----------------------|-------------------|----------------------|-----------|------------|
| T1 | 88.50 | 36.87 | 53.62 | 20.73 | 0.87 | 144.05 | 6.29 | 3.19 | 15.67 | 6.63 |
| T2 | 85.73 | 35.22 | 51.76 | 19.02 | 1.03 | 155.75 | 6.21 | 2.87 | 18.93 | 10.53 |
| T3 | 86.60 | 33.63 | 51.29 | 18.60 | 1.15 | 165.88 | 6.95 | 2.85 | 20.97 | 8.93 |
| T4 | 87.29 | 35.30 | 51.57 | 18.63 | 1.00 | 152.33 | 6.37 | 3.16 | 15.87 | 8.87 |
| T5 | 86.99 | 33.49 | 51.50 | 16.83 | 0.97 | 152.610 | 6.60 | 2.77 | 18.10 | 9.86 |
| T6 | 84.80 | 31.90 | 48.83 | 16.05 | 1.67 | 181.76 | 7.26 | 3.51 | 22.20 | 13.53 |
| T7 | 83.16 | 33.53 | 50.53 | 18.20 | 1.28 | 166.50 | 7.12 | 2.93 | 18.40 | 12.17 |
| T8 | 84.01 | 32.23 | 49.22 | 16.89 | 1.49 | 173.24 | 6.84 | 2.91 | 20.64 | 13.50 |
| T9 | 84.05 | 32.62 | 49.23 | 17.13 | 1.60 | 179.73 | 7.10 | 3.14 | 21.58 | 12.63 |
| T10 | 81.63 | 31.60 | 45.16 | 15.63 | 1.68 | 186.40 | 7.20 | 3.23 | 20.19 | 13.33 |
| T11 | 83.76 | 32.09 | 48.09 | 16.76 | 1.20 | 170.93 | 7.05 | 3.16 | 20.30 | 12.07 |
| S.E.m± | 1.04 | 0.51 | 1.16 | 0.81 | 0.09 | 3.58 | 0.16 | 0.19 | 1.18 | 0.90 |
| CDat5% | 3.07 | 1.49 | 3.43 | 2.39 | 0.27 | 10.57 | 0.48 | 0.57 (ns) | 3.48 | 2.66 |

Table-4 Effect of organic manures on economics of *Chrysanthemum* cv. Dolly white

| Treatments | Estimated Yield (q/ ha) | Cost of cultivation | Gross returns | Net returns | Cost : Benefit ratio |
|------------|-------------------------|---------------------|---------------|-------------|----------------------|
| T1 | 44.39 | 278742 | 803908 | 525166 | 1 : 1.88 |
| T2 | 54.45 | 331042 | 1444458 | 1113416 | 1 : 3.36 |
| T3 | 63.07 | 441042 | 2070660 | 1629618 | 1 : 3.69 |
| T4 | 52.44 | 356042 | 1244400 | 888358 | 1 : 2.49 |
| T5 | 54.90 | 406042 | 1629029 | 1222987 | 1 : 3.01 |
| T6 | 104.10 | 491042 | 3561078 | 3070036 | 1 : 6.25 |
| T7 | 72.34 | 406042 | 2343379 | 1937337 | 1 : 4.77 |
| T8 | 86.45 | 456042 | 3204498 | 2748456 | 1 : 6.02 |
| T9 | 94.512 | 516042 | 2925120 | 2409078 | 1 : 4.66 |
| T10 | 107.25 | 566042 | 4312512 | 3786470 | 1 : 6.61 |
| T11 | 68.32 | 481042 | 2483280 | 2002238 | 1 : 4.16 |

Sale rate of *Chrysanthemum* = Rs. 100/ kg.

Cost of FYM = Rs. 50000/ ha

Cost of Vermicompost = Rs. 160000/ ha

Cost of Forest litter = Rs. 75000/ ha

Cost of Goat manure = Rs. 125000/ ha

Conclusion

Results obtained from the present investigation revealed that organic manures have a lot of benefits, apart from the increased yield and returns, it improves the soil structure and texture, reduces pollution of soil due to reduced fertilizer application which is beneficial for the present problems of high cost of fertilizers and environmental pollution. Therefore, it may be concluded that the use of Vermicompost (2 t/ ha) + Goat manure (25 t/ ha) have a profound effect for various important parameters followed by the use of FYM + Vermicompost (T₆).

Thus the use of FYM, Vermicompost and Goat manure can be used to get good returns in *chrysanthemum*.

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Abbreviations: FYM= Farm yard manure, CD= critical difference, g= gram, cm= centimetre, t= tonnes, ha= hectare

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