Assessing varying growing media on growth, flowering, yield and economics of African Marigold (*Tegetes erecta* L.) cv. Pusa Basanti under Foothills of Uttarakhand

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Abstract

Present field experiment was planned and conducted during 2022-23 at Horticulture Research Block, School of Agriculture Sciences, SGRRU, Dehradun, Uttarakhand to investigate the "Effect of varying growth media on growth, flowering, yield and economics of marigold (*Tegetes erecta* L.) cv. Pusa Basanti under Foothills of Uttarakhand". The experiment was laid out in randomized block design with three replications and nine treatments. The treatments comprised following levels of different organic growing media with different concentrations viz. T_1 (control), T_2 (Vermicompost+soil), T_3 (FYM+soil), T_4 (Cocopeat+soil), T_5 (Leafcompost+soil),T_6(Cowurine+soil),T_7(Vermicompost+FYM+Cocopeat+soil),T_8(Vermicompost+FYM+Cow Urine+soil),T_9 (Vermicompost+FYM+Leaf compost+soil) and T_{10} (Vermicompost+FYM+Leaf Compost+Cow Urine+Coco Peat+Soil). The sowing of african marigold cultivar "Pusa Basanti" was done on 31/03/2022 and final harvest at 28/08/2022. Observations on various attributes *viz.* growth, flowering, yield and economics were recorded at regular intervals. The results revealed that treatment T_{10} (Vermicompost+FYM+Leaf Compost+Cow Urine+Coco Peat+Soil) was found to be most effective in terms of vegetative characters such as Plant height (103.03cm), Internodal length (11.17cm), Plant spread (70.31cm), Number of primary branches (35.77), Number of leaves (297.71), Stem diameter (2.22cm). Whereas, flowering characters such as Flower stalk length (10.84 cm), Flower stalk girth (9.93cm), Duration of flowering (71.22 days), Number of flowers (107.35), Number of florets (139.53), Average fresh weight (7.68gram), Average dry weight (3.18gram), Longevity of flowers(11.83 days) and yield attributes *viz.* yield per plant (558.81 gram), yield per hectare (145.56 q) and net profit (Rs 89,384) was maximum in T_9 (Vermi compost + FYM + Leaf compost + Soil) and maximum B: C ratio (1:6.69) was recorded in T_6 (Cowurine+soil).

Keywords: Organic, growing media, vermicompost, cowurine, cocopeat

Introduction

Marigold (*Tegetes* sp.). It is also known as *Gendha* in Hindi and also known as 'friendship flower' in United States of America. It belongs to the family Asteraceae or Compositae and consist a chromosome number (2n = 24). Marigold is one of the most important annual flowers cultivated in India. It is widely popular amongst the flower dealers and gardeners because of the various positive features, such as – easy to cultivate and has wide adaptability, wide range of its shape, size and colour along with its good keeping quality. Attractive and brightly coloured flowers are the most valuable and economic part of the plant and is mostly used for making bouquets, religious offerings, exhibitions, decorations etc.[1]. Besides of being grown as an ornamental flower it also consists of medicinal properties and the essential oil of the flower

contains antioxidants. Healing properties of *Tegetes* species have been implemented by folk medicine for centuries. Marigold is also commonly used in the poultry industry as a food additive to brighten the egg yolk and poultry skin[2,29]. Marigold is a native to India. The genes Tegetes is a genus containing about 50 species of annual or perennial herbaceous plant but only few of them are majorly important and are grown regularly. Some of the important Tegetes varieties are: African or American Marigold (*Tegetes erecta*): These plants are tall, erect-growing, they grow up to a three feet in height. The flowers are globular in shape and relatively large in size and can measure up to 5 inches across. African marigolds are good for bedding purposes, its flowers are yellow to orange in colour and it takes a longer time to flower. French Marigold (*Tegetes patula*): These marigold cultivars grow from 5 inches to 18 inches, have the flower's colours are yellow, red and orange and a bi-colour pattern of red and orange is also seen on the flowers and the size of the flowers is 2 inches across. French marigold is ideal for edging the flower bed and also in mass planting. A report shows the anti-bacterial activity of different solvents of marigold flower against *Alcaligens faecalis, Bacillus cereus, Campylobacter coli, Escherchia coli* etc. The flavonoid possesses antibacterial activity against all the tested strains [3,30]. The Flavonoid- Patulitrin is one of the potential elements for its anti-bacterial activity. In the report of anti microbial activity in 19 plants used in Colombian traditional medicine for cutaneous infections, were screened against *Neisseria gonorrhoeae* by disc susceptibility assay. In all 71% of the crude extracts exhibited antibacterial activity against the antibiotic susceptible NG strain GCI – 182. The *Tegetes erecta* flower parts showed maximum inhibitory action against NG strain [4,28]. Allelopathy is the ability of an organism to produce chemicals that are toxic to other organisms. *Tegetes* species roots release the chemical alpha-terthienyl, one of the most toxic naturally occurring compounds found to date**.** This compound is nematicidal, insecticidal, antiviral and cytotoxic. The presence of alpha-terthienyl inhibits growth because of itself and also because *Tegetes* species are non-host plants even when they do not contain allelopathic compounds [5,31]. The roots of *Tegetes* species roots release a chemical named alpha-terthienyl, it is one of the most toxic naturally occurring chemical found. This compound is nematicidal, insecticidal, antiviral, and cytotoxic in nature. The presence of this compound inhibits the nematode eggs to hatch yet it is unclear that the compound produced by *Tegetes* species exhibits allelopathic effect it may also be possible because marigold are a non host for the nematodes.

The use of chemical fertilizer is increasing day by day for the sake of increasing production. By the excess use of chemical fertilizer, the fertility of soil and health also deteriorate. Therefore, the use of organic media is one of the alternative ways for enhancing production and improves soil health. They increase the organic matter in the soil, increase microbial activity, enables a soil to hold more water, also help to improve the drainage in clay soil, improve nutritional security and reduce many problems related to crop production, Organic matter increases plant nutrients in the soil. Organic Growing medias help in sustainable and economic food production as well as sustainable agriculture. There are specific cultivars for different period of year and no particular cultivar of a group is suitable for growing successfully throughout the year. Therefore, it is very important to select the suitable cultivar for growing in a particular season with the use of different Organic Growing medias. Keeping these aims in view, the present experiment "Assessing different growing media on growth, flowering, yield and economics of Marigold (*Tegetes erecta* L.) under Low Hills of Uttarakhand" was conducted at Horticulture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Pathri Bagh, Dehradun, Uttarakhand, India.

Materials and method

The field experiment was conducted at Horticulture Research Block, Department of Horticulture, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand during the summer season of 2022-23. The experiment was laid out in Randomized Block Design (RBD) and replicated thrice. Total ten treatments were tried namely T1 (control@100% soil), T2 (Vermicompost+soil@3:1), T3 (FYM+soil @3:1), T4(Coco peat+soil@3:1), T5 (Leaf compost+soil@3:1) T6 (Cow urine+soil@20%:1), T7 (Vermicompost+FYM+Coco peat+soil @1:1:1:1), T8 (Vermicompost+FYM+Cow Urine+soil @1:1:20%:1), T9 (Vermicompost+FYM+Leaf compos+soil@1:1:1:1) and T10 (Vermicompost+FYM+Leaf compost+Cow Urine+Coco peat+ soil@1:1:1:20%:1:1). The soil of the research field was sandy loam in texture having pH of 7.12 with available nitrogen (220.04%), available phosphorus (9.1 kg ha- 1) and available potassium (18.1 kg ha). The Marigold cultivar "Pusa Basanti" was choosen for research purpose. Organic growing media were prepared by mixing different concentration of vermicompost, FYM, coco peat, cow urine and leaf compost with soil and filling them in 1.5kg polybags according to their treatment respectively. The nursery was prepared on 31 March 2022 and the seedlings were transplanted on 21 April 2022 in their respective polybags. All the cultural practices were done at regular intervals as per the requirement of crop during the course of research work. During the experimentation, 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 30, 60, 90 days after transplanting and at final harvest. The obtained data were statistically analyzed with using standard statistical method as suggested by [6].

Table:1 Treatment details

Treatment	Combinations	Concentration
T_1	Control	Soil 100%
T_2	Vermicompost + Soil	3 : 1
T_3	FYM + Soil	3 : 1
T_4	Cocopeat + Soil	3 : 1
T_5	Leaf compost + Soil	3 : 1
T_6	Cow urine + Soil	20 %: 1
T_7	Vermicompost + FYM + cocopeat + Soil	1 : 1 : 1 : 1
T_8	Vermicompost + FYM + cow urine + Soil	1 : 1 : 20 %: 1
T_9	Vermicompost + FYM + leaf compost + Soil	1 : 1 : 1 : 1
T_{10}	Vermicompost + FYM + Cocopeat + cow urine + leaf compost + Soil	1 : 1 : 1 : 20% : 1 : 1

Result and discussion

The various growth, flowering and yield attributes viz. plant height (cm), number of primary branches, plant spread (cm), stem diameter (cm), number of leaves per plant, internodal length(cm) flower yield per hectare (Kg/ha), flower yield per plant (Kg) were significantly influenced by different doses of organic growing media as compared to control during the course of investigation. The data presented in Table-2, 3, 4, 5 and 6 were showed that the significant improvement was noticed when applied different combinations of organic growing media as compared to control. The findings of the present investigation were recorded and are thoroughly discussed below:

Growth attributes

Plant height (cm)

The observation of plant height, recorded at 30, 60, 90 DAT and at Final harvest was presented in Table 2 and Fig.1 revealed significant differences among the treatments. At 30 days after transplanting the maximum plant height was recorded in treatment T_2 (45.52cm). However, significant differences were observed with treatments T_3 (40.78cm) and T_1 (38.84cm). The following treatments were at par viz. T_5 (36.17cm), T_{10} (35.07cm), T_8 (33.32cm), T_7 (32.71cm), T_6 (32.62cm) and T_9 (31.96 cm). The minimum plant height (31.11 cm) was recorded under the treatment T_4. In case of 60 days after transplanting the maximum plants height was obtained in treatments T_2 (54.90cm), which was at par with treatment T_1 (50.28cm) and T_3 (49.86cm). The significant difference was recorded with treatment T_{10} (46.83cm), T_5 (46.19cm), T_8 (45.45cm), T_7 (43.25 cm), T_6 (42.92 cm) and T_9 (41.61 cm). The minimum plant height (41.19cm) was recorded under treatment T_4**.** At 90 days of transplanting the maximum height was obtained in the treatments T_{10} (73.89 cm), which was at par with the treatment T_8 (71.55 cm) and T_2 (71.09 cm). The significant differences were recorded with the treatments T_9 (70.64 cm), T_3 (69.63 cm), T_7 (69.06 cm), T_5 (69.07 cm), T_1 (68.57 cm) and T_6 (67.12 cm). The minimum plant height (65.07 cm) was recorded under treatment T_4. At final harvest, the plant height was maximum in T_{10} (103.04cm) which was comparable with T_8 (98.42 cm) and T_9 (96.84cm). However, significant difference was observed with treatment T_7 (95.64cm), T_5 (93.92cm), T_6 (93.02cm), T_3 (92.55cm), T_2 (92.24) and T_1 (90.31cm) while, minimum plant height was obtained in the treatment T_4 (88.68cm).

Internodal length (cm)

The observation of internodal length was recorded at 30, 60, 90 DAT and at final harvest and the results were significantly differs among the treatments. At 30 days after transplanting, the highest internodal length of African marigold was recorded in treatment T_3 (2.46cm) and it was at par with T_2 (1.86cm) and T_4 (1.74cm). However, significant differences were observed with treatment T_5 (1.71cm), T_8 (1.55cm), T_9 (1.54cm), T_{10} (1.45cm) and T_1 (1.37cm). The minimum number of leaves (1.36cm) was recorded under the treatment T_6. In case of 60 days after transplanting the maximum internodal length was obtained in treatment (6.26 cm) and it was at power with T_4 (5.27cm) and T_5 (5.09cm) however significant differences were observed with treatments T_2 (4.99cm) T_7 (4.09cm), T_8 (4.07cm) T_1 (4.03cm) T_6 (3.99cm) and T_{10} (3.96cm). The minimum internodal length was observed in T_9 (3.95cm). In case of 90 days after transplanting the maximum internodal length was observed in T_3 (9.72cm) which was at par T_4 (8.47cm), T_5 (7.89cm), T_2 (7.75cm). The significance differences were observed with treatment T_1 (6.28cm) T_6 (6.17cm) T_7 (6.16cm) T_8 (6.04cm) and T_9 (5.85cm). The minimum internodal length (5.77cm) was recorded under the treatment T_{10}. At the final harvest day after transplanting the maximum internodal length was observed in T_3 (12.6cm), which was at par T_4 (11.17cm). The significance difference was observed with treatments T_5 (10.85cm), T_2 (10.36cm), T_9 (10.23cm), T_{10} (9.95 cm), T_7 (9.57cm), T_6 (9.55cm), T_8 (9.44cm). The minimum internodal length was observed in T_1 (8.42cm) which is presented on Table 2 and shown in Fig. 2.

Plant spread (cm)

The observation of internodal length was recorded at 30, 60, 90 DAT and at final harvest and the results were significantly differs among the treatments. At 30 days after transplanting, the highest plant spread was recorded in treatment T_{10} (30.78cm) and it was at par with T_4 (24.64cm) and T_3 (24.39cm). However, significant differences were observed with treatment T_5 (23.62cm), T_6 (21.20cm), T_8 (21.01cm), T_9 (18.06cm), T_2 (16.06cm) and T_1 (15.70cm). The minimum plant spread (13.53cm) was recorded under the treatment T_7. In case of 60 days after transplanting the maximum plant spread was obtained in treatment T_{10}(41.23cm) and it was at par with T_3 (33.95

cm) and T_4 (33.63cm) however significant differences were observed with treatments T_5 (32.36cm) T_6 (30.27 cm), T_8 (29.58cm) T_9 (26.76cm) T_2 (25.39cm) and T_1 (24.72cm). The minimum plant spread was observed in T_7 (22.46cm). In case of 90 days after transplanting the maximum plant spread was observed in T_{10} (57.38cm) which was at par T_4 (46.29cm), T_3 (44.91cm), T_5 (44.83cm). The significance differences were observed with treatment T_8 (44.76 cm), T_6 (41.74cm), T_9 (39.14cm), T_2 (38.87cm) and T_1 (35.04cm). The minimum plant spread (34.07cm) was recorded under the treatment T_7. At the final harvest day after transplanting the maximum plant spread was observed in T_{10} (70.31cm), which was at par T_4 (61.57cm). The significance difference was observed with treatments T_5 (59.63cm), T_{10} (59.54cm), T_3 (59.40 cm), T_6 (55.52cm), T_9 (52.38cm), T_2 (51.37cm), T_1 (46.60cm). The minimum internodal length was observed in T_7 (45.31cm) which is presented on Table 2 and shown in Fig. 3.

Number of Primary branches

The observation of primary branches was recorded at 30, 60, 90 DAT and at final harvest and the results were significantly differs among the treatments. At 30 days after transplanting, the highest number of primary branches was recorded in treatment T_2 (15.80) and it was at par with T_3 (14.16) and T_1 (13.15). However, significant differences were observed with treatment T_5 (12.56), T_{10} (12.17), T_8 (11.57), T_9 (11.42), T_7 (11.36) and T_6 (11.32). The minimum number of primary branches (10.80) was recorded under the treatment T_4. In case of 60 days after transplanting the maximum number of primary branches was obtained in treatment T_2 (19.06) and it was at par with T_1 (17.46) and T_3 (17.31). However significant differences were observed with treatments T_{19} (16.26), T_5 (15.99), T_8 (15.79), T_7 (15.02), T_2 (25.390) and T_6 (14.30). The minimum number of primary branches was observed in T_9 (14.44). In case of 90 days after transplanting the maximum number of primary branches was observed in T_{10} (25.66) which was at par T_8 (24.84), T_2 (24.68) and T_9 (24.56). The significance difference were observed with treatment T_3 (24.18), T_5 (23.96), T_7 (23.98), T_1 (23.80) and T_6 (23.30). The minimum number of primary branches was (22.59) was recorded under the treatment T_4. At the final harvest day after transplanting the maximum number of primary branches was observed in T_{10} (35.77) which was at par T_8 (34.17). The significance difference was observed with treatments T_9 (33.63), T_7 (33.21), T_5 (32.61), T_6 (32.29), T_3 (32.14), T_2 (32.03), T_1 (31.01). The minimum number of primary branches was observed in T_4 (30.79) which is presented on Table 3 and shown in Fig. 4.

Number of Leaves

The observation of number of leaves per plant was recorded at 30, 60, 90 DAT and at final harvest and the results shows significant differences between the treatments. At 30 days after transplanting the highest value of number of leaves was recorded in treatment T_2 (126.19) and the lowest value (98.85) in the treatment T_9. At 60 days after transplanting, the maximum number of leaves was obtained in treatments T_2 (159.48) which were at par with the treatments T_3 (154.23) and T_{10} (151.42). The significant difference was observed with treatment T_8 (147.03), T_5 (142.87), T_7 (139.83), T_6 (138.76), T_9 (134.52) and T_1 (133.18). The minimum number of leaves per plant (130.73) was recorded under the treatment T_4. In case of 90 days after transplanting, the maximum number of leaves was obtained in treatments T_9 (200.08) which were at par with the treatments T_{10} (199.08) and T_8 (189.30). The significant difference was observed with treatment T_6 (180.28), T_7 (178.95), T_2 (161.78), T_3 (158.44), T_5 (157.06) and T_1 (153.34). The minimum number of leaves (147.937) was recorded under the treatment T_4. At final harvest days after transplanting, the number of leaves was maximum in T_{10} (297.71) which was comparable with T_9 (247.54) and T_8 (239.96). However, significant difference was observed with treatment T_6 (231.36), T_7 (226.83), T_5 (213.36), T_3 (210.13) and T_2 (209.91). While, minimum number of leaves was obtained in the treatment T_1 (202.19) which is presented on

Table 3 and shown in Fig. 5. Perhaps, the food formation was fast and more during initial stages, which might have resulted in better growth. The results of present findings are also corroborated by earlier workers [7,8,27].

Stem diameter (cm)

The observation of stem diameter was recorded at 30, 60, 90 DAT and at final harvest and the results shows significant differences between the treatments. At 30 days after transplanting the highest value of stem diameter was recorded in treatment T_9 (0.61cm) and the lowest value (0.45cm) in T_4. In case of 60 days after transplanting, the maximum stem diameter was obtained in treatments T_{10} (1.22cm) which were at par with the treatments T_8 (1.21cm) and T_9 (1.18). The significant differences were observed with treatments T_2 (1.15cm), T_7 (1.14cm), T_1 (1.07cm), T_3 (1.04cm), T_5 (0.97cm) and T_4 (0.913 cm). The minimum stem diameter (0.87cm) was recorded under the treatment T_5. In case of 90 days after transplanting, the maximum stem diameter was obtained in treatments T_{10} (2.0 cm), which were at par with the treatments T_2 (1.92cm) and T_7 (1.92cm). The significant differences were observed with treatments T_9 (1.92cm), T_8 (1.89cm), T_3 (1.87cm), T_5 (1.86cm), T_1 (1.84cm) and T_6 (1.80cm). The minimum stem diameter (1.73cm) was recorded under the treatment T_4. At final harvest days after transplanting, the stem diameter was maximum in T_{10} (2.21cm) which was comparable with T_9 (22.11cm) and T_2 (2.10cm) however, significant difference was observed with treatment T_5 (2.09cm), T_6 (2.07cm), T_8 (2.07 cm), T_3 (2.06cm) and T_4 (2.01 cm). While, minimum stem diameter was obtained in the treatment T_1 (1.94 cm) which is presented on Table 3 and shown in Fig. 6. The better performance of growth attributes might be due to the sufficient amount of water in the growing media which might have increased various physiological processes, better plant nutrient uptake, higher rates of photosynthesis, which might reflect on increase in plant height, intermodal length, plant spread, number of primary branches, number of leaves and stem diameter. Similar findings were also reported by [9, 10,26].

Flowering attributes

Flower stalk length (cm)

Different organic growing media treatments were found significant to achieve the flower stalk length. The treatment T_{10} was significantly superior over the rest other treatments in respect to flower stalk length with length of (10.84 cm) which was at par with T_9 (10.12 cm) and minimum stalk length was recorded in T_6 (9.76 cm).

Flower stalk girth (mm)

The results in table 3 shows that the treatment T_{10} was significantly superior over others in respect to flower stalk girth (9.93 mm) which was at par with T_9 (9.46 mm) and minimum in T_8 (8.70 mm).

Number of days taken for first flower

The number of days taken for first flower varied between 64.11 to 91.25. The highest number of days taken for first flowering was recorded in T_4 (91.25) and the minimum by T_6 (64.11).The significance difference were reported in T_1 (88.68), T_5 (85.01), T_2 (83.42), T_8 (82.41), T_3 (75.67), T_9 (74.80), T_{10} (67.01) and T_7 (66.54). The combined influence of growing media improve drainage, aeration, lower compactness along with Leaf mould and Vermicompost bring down the pH to optimum level for availability of macro and micro nutrient uptake by plant root system which help to improve water holding capacity and higher photosynthetic activity result in better C:N ratio. When C:N ratio improve, simultaneously florigen plant hormone level also improves, which is responsible for earliest flower bud initiation, flower bud show colour. It might be due to

the vigorous growth of the plant growing in the media and the rapid uptake of nutrient and water has a pronouns effect on production [11,12,13] .

Duration of flowering

The duration of flowering varied between 71.22 to 51.45 days. The highest flowering duration was recorded in T_{10} (71.22) and the minimum in T_2 (51.46). The significance difference were recorded in T_8 (67.44), T_9 (66.29), T_6 (64.45), T_7 (55.83), T_5 (55.77), T_3 (54.96), T_4 (54.76) and T_1 (52.18).

Number of flowers per plant

Data depicted in table 4 clearly reveals that the number of flowers per plant of all the treatments under study differs significantly and ranged from 36.21 to 107.35. The maximum number of flowers were noted in the treatment T_{10} (107.35), which was found statistically at par with rest of the treatments. Further, minimum number of leaves was recorded in the treatment T_1 (36.21). Increased number of flower is attributed to the production of large number of flower buds along with the fact that termination of vertical growth by pinching lead to more laterals or secondary branches at early stage of growth, which then had sufficient time to accumulate carbohydrates for proper flower bud differentiation producing a greater number of flowers per plant [10-11]. Similar results were also reported by [14,15, 24] in marigold.

Number of florets

It is clear from the table 4 and Fig 5 that the number of florets of different treatments differed significantly and range from 139.53 to 58.56. The maximum number of florets was noted in the treatment T_{10} (139.53). However significant differences were observed with rest of the treatments. The minimum number of florets (58.56) was recorded in treatment T_1.

Average fresh weight (g)

The fresh weight of flowers varied significantly from 2.40g (T_2) to 7.68g (T_{10}). The maximum average fresh weight was noted in the treatment T_{10}. Reason of maximum fresh weight of flower might be due to more availability of nutrients, media and genetic makeup. Similar findings have been reported by [16,17, 25].

Average Dry weight (g)

The dry weight of flowers varied significantly from 0.830g (T_2) to 3.69g (T_8). The maximum average dry weight was noted in the treatment T_8.

Shelf life (Days)

The longevity of flowers varied significantly from 3.57 (T_1) to 11.83(T_{10}). The maximum longevity was noted in the treatment T_{10}. That performance was influenced by the forms of different organic growing media. The increase in flower longevity might be due to the fact that organic substrate contains optimum levels of essential nutrients that produces quality flowers giving superior longevity of flowers on plant. Similar findings recorded by [18,19,20].

Yield attributes

Flower yield (g/plant)

The data regarding the yield of harvested flowers differed significantly due to various treatments and are presented in table 5. The yield of flowers varied significantly from 140.37g (T_1) to 558.81g (T_{10}). The maximum yield of flowers was noted in the treatment T_{10}. Similar results were also recorded by [21,22,].

Flower yield (q/ha)

The yield of flowers varied significantly from 43.44q/ha (T_1) to 145.56 q/ha (T_{10}). The maximum yield of flowers was noted in the treatment T_{10} and minimum in control. Similar results were also recorded by [23].

Economics

The economics of all the treatments were given in table 6. The net profit per hectare ranges from Rs.25,197 to 89,384. The maximum net profit per hectare was recorded under the treatment T_9 (Rs 89,384). While minimum net profit per hectare was obtained in the treatment T_2 (Rs.25,197). The benefit cost ratio ranged from 1:1.68 to 1:6.69 depending on different treatments. It was found to be highest (1:6.69) under the treatments T_6 (Cow Urine + soil) and lowest (1:1.68) under the treatment T_{10} (Vermi compost + FYM + Leaf compost + Cow urine + Coco peat + Soil) [24,32].

Conclusion

On the basis of present experimental research on "Assessing different growing media on growth, flowering and yield of African Marigold under Low Hills of Uttarakhand" in cultivar Pusa Basanti, it can be concluded that among different organic growing media treatments, the combination of (Vermicompost + FYM + Leaf compost + Cow urine + Coco peat + Soil) i.e. T_{10} was found to be most effective for increasing height of plant, number of leaves per plant, diameter of main stem, number of primary branches, plant spread, internodal length, flower stalk length, flower stalk girth, number of days taken to appearance of first flower, duration of flowering, number of flowers per plant, average fresh and dry weight of flowers, diameter of flower, longevity, yield per plant and yield (q/ha). Whereas economics of African marigold was recorded highest in T_6.

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Table 2: Effect of various organic growing media on plant height, internodal length and plant spread at different harvest intervals

	PLANT HEIGHT (cm)					INTERNODAL LENGTH (cm)					PLANT SPREAD (cm)				
Treatment	30 DAT	60 DAT	90 DAT	AT FINAL HARVEST	MEAN	30 DAT	60 DAT	90 DAT	AT FINAL HARVEST	MEAN	30 DAT	60 DAT	90 DAT	AT FINAL HARVEST	MEAN
T1	38.84	50.28	68.56	90.31	62.00	1.36	4.03	6.27	8.42	5.03	15.70	24.72	35.03	46.60	30.51
T2	45.51	54.90	71.09	92.24	65.94	1.86	4.99	7.75	10.36	6.24	16.05	25.39	38.87	51.37	32.92
T3	40.78	49.86	69.62	92.55	63.21	2.46	6.26	9.72	12.62	7.77	24.39	33.94	44.91	59.40	40.66
T4	31.11	41.18	65.06	88.68	56.51	1.74	5.27	8.47	11.16	6.66	24.63	33.63	46.29	61.57	41.53
T5	36.16	46.19	69.01	93.92	61.32	1.70	5.08	7.89	10.85	6.38	23.62	32.35	44.83	59.62	40.11
T6	32.62	42.91	67.12	93.02	58.92	1.36	3.98	6.17	9.55	5.27	21.20	30.26	41.74	55.52	37.18
T7	32.71	43.25	69.06	95.63	60.16	1.53	4.09	6.15	9.57	5.34	13.53	22.46	34.07	45.31	28.84
T8	33.32	45.47	71.54	98.41	62.19	1.55	4.06	6.04	9.43	5.27	21.00	29.58	44.76	59.54	38.72
T9	31.95	41.60	70.63	96.84	60.26	1.54	3.95	5.85	10.23	5.39	18.06	26.76	39.14	52.38	34.09
T10	35.06	46.83	73.89	103.03	64.71	1.45	3.96	5.77	9.95	5.29	30.78	41.23	57.38	70.31	49.93
CD $_{(5\%)}$	4.88					0.76					2.05				
SE (m)	1.67					0.26					0.70				
SE (d)	2.36					0.37					0.99				
C.V. (%)	5.43					8.95					3.75				

Table 3: Effect of various organic growing media on primary branches, number of leaves and stem diameter at different harvest intervals

	PRIMARY BRANCHES					NUMBER OF LEAVES					STEM DIAMETER (cm)				
Treatment	30 DAT	60 DAT	90 DAT	AT FINAL HARVEST	MEAN	30 DAT	60 DAT	90 DAT	AT FINAL HARVEST	MEAN	30 DAT	60 DAT	90 DAT	AT FINAL HARVEST	MEAN
T1	13.15	17.46	23.80	31.01	21.36	105.26	133.18	153.34	202.19	148.49	0.54	1.07	1.84	1.94	1.35
T2	15.80	19.06	24.68	32.03	22.89	126.19	159.48	161.78	209.91	164.34	0.58	1.15	1.92	2.10	1.44
T3	14.16	17.31	24.17	32.14	21.95	125.28	154.23	158.44	210.13	162.02	0.57	1.04	1.87	2.06	1.39
T4	10.80	14.30	22.59	30.79	19.62	99.13	130.73	147.93	200.80	144.65	0.45	0.91	1.73	2.00	1.28
T5	12.56	15.99	23.96	32.61	21.28	111.35	142.87	157.06	213.73	156.25	0.49	0.97	1.86	2.09	1.36
T6	11.32	14.83	23.30	32.29	20.44	100.92	138.75	180.28	231.36	162.83	0.44	0.87	1.80	2.07	1.30
T7	11.35	15.02	23.98	33.21	20.89	101.17	139.83	178.94	226.83	161.70	0.58	1.13	1.92	2.05	1.42
T8	11.57	15.79	24.84	34.17	21.59	103.07	147.03	189.30	239.96	169.84	0.57	1.20	1.89	2.07	1.44
T9	11.41	14.44	24.56	33.62	21.01	98.84	134.51	200.07	247.54	170.24	0.61	1.18	1.92	2.11	1.46
T10	12.17	16.26	25.65	35.77	22.47	108.47	151.41	199.08	297.71	189.17	0.61	1.22	2.01	2.21	1.51
CD $_{(5\%)}$	1.70					3.92					0.07				
SE (m)	0.58					1.20					0.03				
SE (d)	0.82					1.59					0.04				
C.V. (%)	2.45					3.07					3.66				

Table 4: Effect of various organic growing media on flower stalk length, flower stalk girth, number of days for first flower, Duration of flowering, Number of Flowers per plant, Number of florets, Average fresh weight (g), Average dry weight (g) and shelf life of flowers per hectare at final harvest interval

Treatment	Flower stalk length (cm)	Flower stalk girth (mm)	Number of days for first flower	Duration of flowering (Days)	Number of Flowers per plant	Number of florets	Average fresh weight (g)	Average dry weight (g)	Shelf life (days)
T_1	7.31	5.73	88.68	52.18	36.21	58.56	2.77	0.95	3.57
T_2	8.44	6.07	83.42	51.46	45.38	64.68	2.40	0.83	4.66
T_3	8.67	5.93	75.67	54.96	47.61	80.05	3.54	1.57	4.02
T_4	9.45	6.00	91.25	54.76	49.47	92.31	4.40	1.99	5.17
T_5	8.70	6.87	85.01	55.77	52.59	72.19	4.09	1.72	7.07
T_6	9.76	7.10	64.11	64.45	65.19	93.97	4.93	2.21	9.44
T_7	8.38	7.30	66.54	55.83	86.60	80.87	6.63	3.29	9.52
T_8	9.69	8.70	82.41	67.44	89.15	95.56	7.62	3.69	10.78
T_9	10.12	9.47	74.80	66.29	95.40	107.16	7.12	3.57	10.82
T_{10}	10.84	9.93	67.01	71.22	107.35	139.53	7.68	3.18	11.83
C.D. 5%	1.40	0.67	4.75	5.04	5.67	10.68	1.03	0.59	1.11
SE(m)	0.47	0.22	1.59	1.68	1.89	3.57	0.34	0.20	0.37
SE(D)	0.66	0.32	2.24	2.38	2.68	5.05	0.49	0.28	0.53
C.V	8.86	5.33	3.53	4.90	4.86	6.98	11.68	15.04	8.39

Table 5: Effect of various organic growing media on yield of flowers per plant and yield of flowers per hectare

Treatment	Yield of flowers per plant (g)	Yield of flowers per hectare (q)
T_1	140.37	43.44
T_2	169.14	53.18
T_3	206.22	57.16
T_4	219.77	67.08
T_5	257.63	76.49
T_6	332.33	83.97
T_7	397.28	90.95
T_8	361.34	101.40
T_9	439.27	106.01
T_{10}	558.81	145.56
C.D. 5%	36.53	10.79
SE(m)	12.20	3.60
SE(D)	17.25	5.09
C.V	6.85	7.56

Table 6: Economic of African marigold cultivation under the influence of different organic growing media

Treatment	Net return (Rs ha^{-1})	B:C ratio
T_1	43283.52	1 : 2.44
T_2	25,197	1 : 0.91
T_3	51,327	1 : 10.12
T_4	38264	1 : 0.88
T_5	61,028	1 : 5.02
T_6	71,174	1 : 6.69
T_7	39,441	1 : 1.77
T_8	85,761	1 : 6.60
T_9	89,384	1 : 6.52
T_{10}	84,631	1 : 1.68

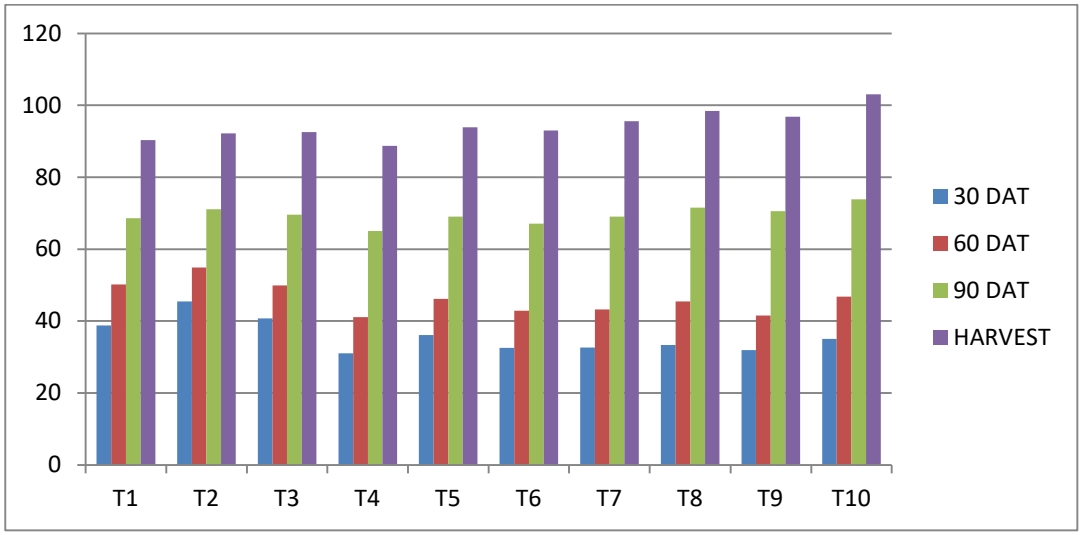

Fig 1: The effect of various organic growing media on plant height (cm) at different harvest interval on African marigold

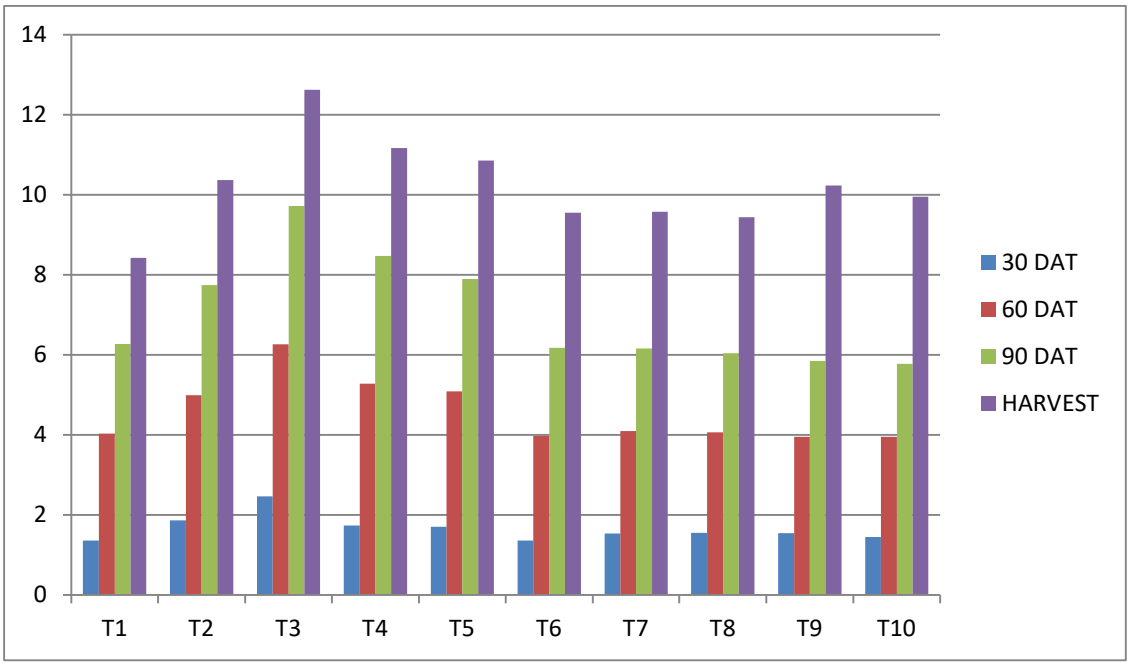

Fig 2: The effect of various organic growing media on internodal length (cm) at different harvest interval on African marigold

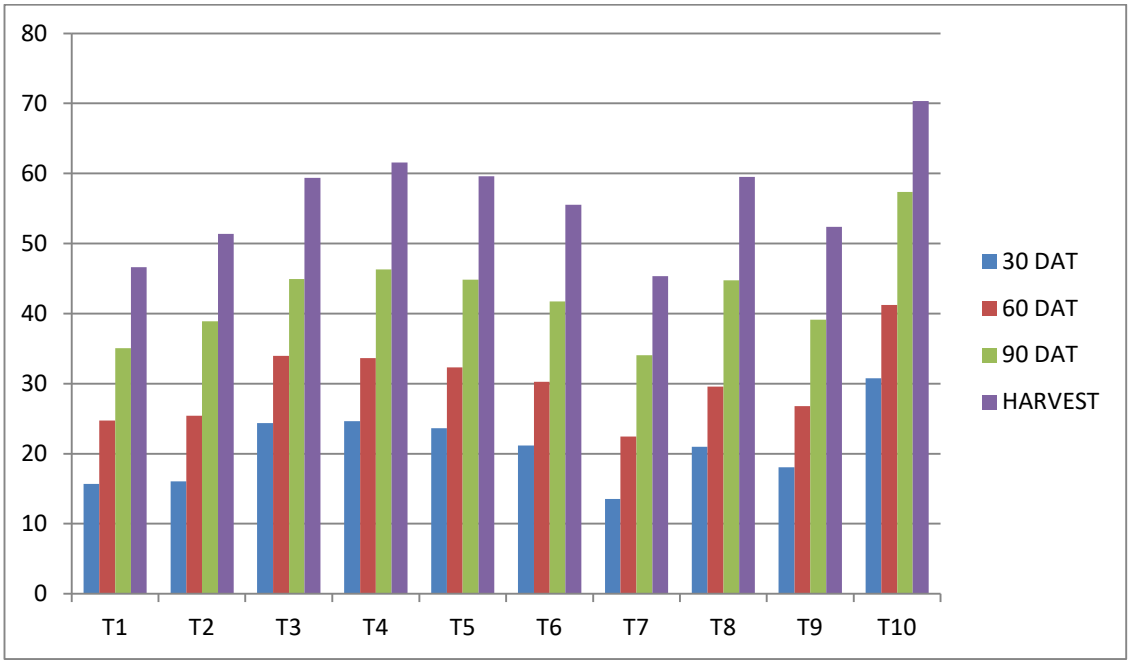

Fig 3: The effect of various organic growing media on plant spread (cm) at different harvest interval on African marigold

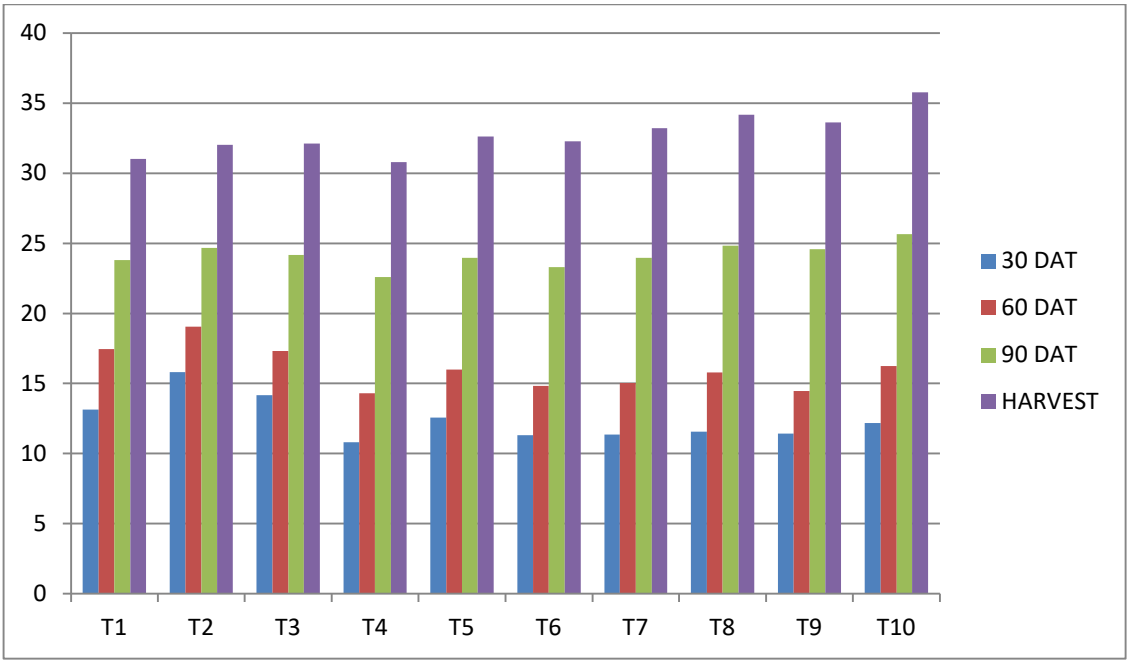

Fig 4: The effect of various organic growing media on primary branches at different harvest interval on African marigold

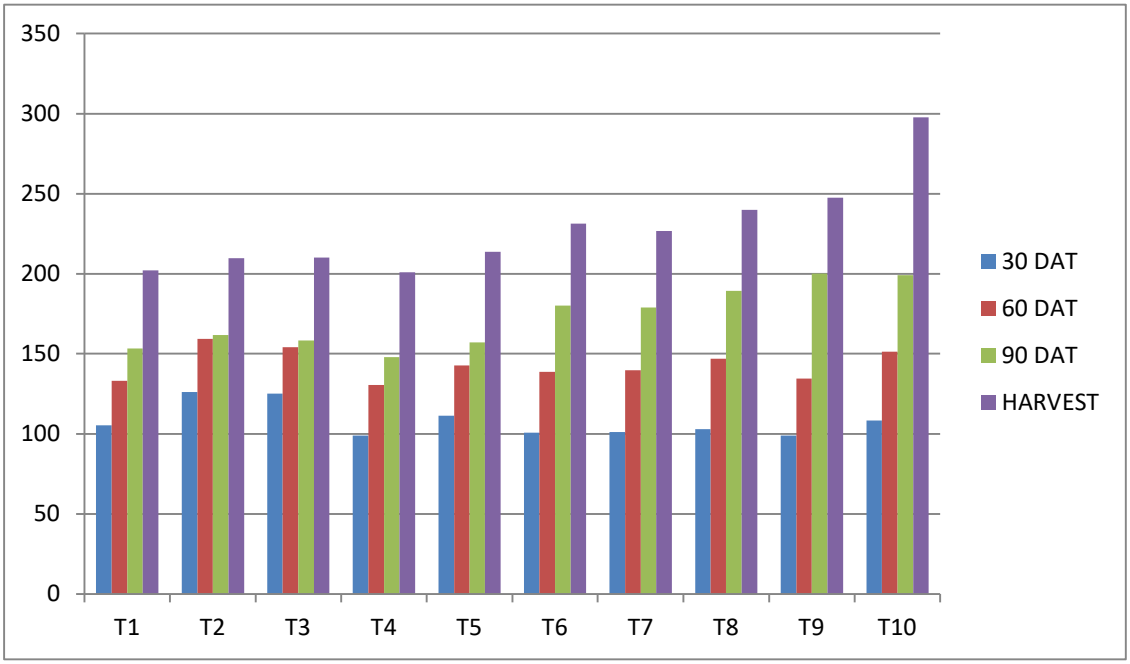

Fig 5: The effect of various organic growing media on number of leaves at different harvest interval on African marigold

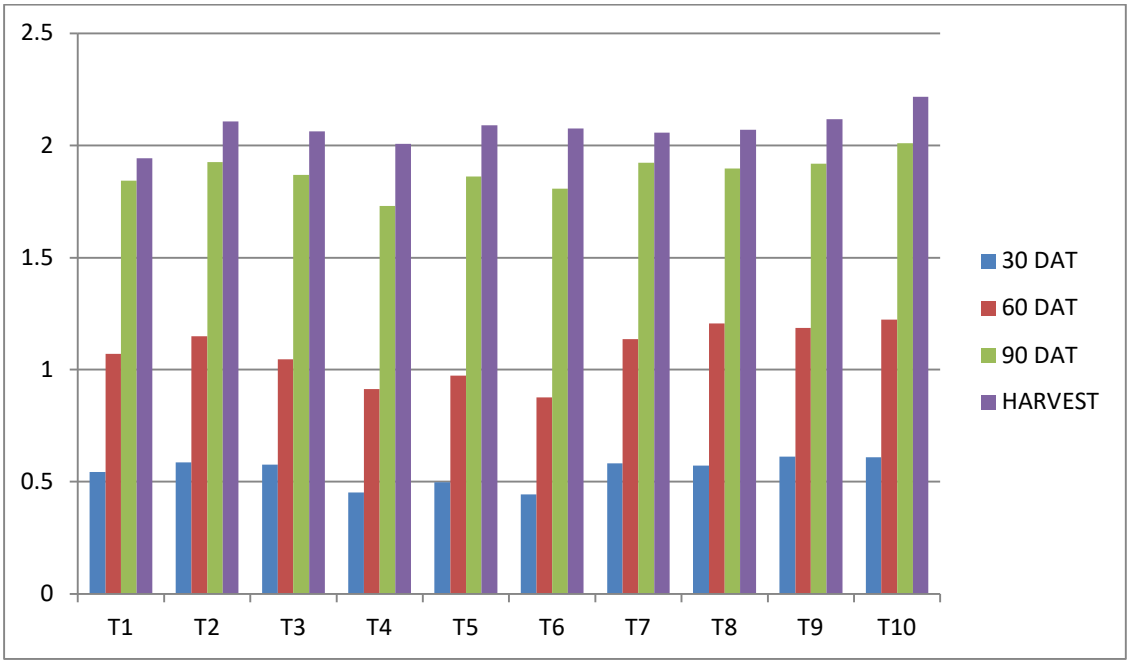

Fig 6: The effect of various organic growing media on stem diameter at different harvest interval on African marigold