

## **Influence of Organic and Inorganic inputs on Vegetative, Flowering and Yield attributes of Marigold cv. Pusa NarangiGaiinda**

### **ABSTRACT**

The present investigation was carried out on “Influence of organic and inorganic inputs on vegetative, flowering and yield attributes of marigold cv. Pusa NarangiGaiinda” at instructional farm, Department of Floriculture and Landscape Architecture, College of Horticulture and Forestry, Pasighat, Arunachal Pradesh during the year 2021-22. A field experiment was laid out in Randomized Block Design (RBD) with 13 treatments in three replications. Significant responses of organic and inorganic inputs were noticed on vegetative, flowering and yield characters of the marigold. The maximum plant height (130.70 cm), number of primary branches (11.20), number of secondary branches (14.40), leaf area (56.57 cm<sup>2</sup>), East-Westplant spread (49.25 cm), North-South plant spread (46.50 cm) were associated with the treatment combinations of T<sub>12</sub>-FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha. The treatment combination of T<sub>12</sub>. FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha showed earlier bud initiation (44.10 days) and the maximum number of flowers per plant (20.23), flower yield/ha (159.73 q). However, the maximum flower diameter (62.19 mm) was recorded in the treatment combination of T<sub>10</sub> - FYM @ 25t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha. The study shows that combination of organic inputs significantly enhanced the vegetative, flowering and yield attributes in marigold.

**Keywords:** Marigold, mustard oilcakes, FYM, Vermicompost, NPK

---

### **INTRODUCTION**

Floriculture has become a productive and vibrant industry, paving way for exploring the potential market globally. In India, area under marigold cultivation was around 73.99 thousand hectares with the production of 760.96 thousand tonnes of loose flowers and 19.15 thousand tonnes of cut flower during the year 2020-21 (Anonymous, 2021). Marigold

**Comment [Mk1]:** Do no repeat the same words

**Comment [Mk2]:** What is the unit?

**Comment [Mk3]:** Same above

**Comment [Mk4]:** Explain?

belongs to the family Asteraceae. *Tagetes* consists of 33 species, among these the most commonly cultivated species are African marigold (*Tagetes erecta*) and French marigold (*Tagetes patula*) Marigold has introduced by Portuguese in India (Singh, 2006). It was cultivated in Tamil Nadu, Karnataka, Gujarat, Haryana and Madhya Pradesh. Indiscriminate use of inorganic fertilizers has negative impact on the soil microbial population, organic carbon content and availability of essential nutrients. In contrast, organic manures enhance organic matter in the soil and it promotes the growth of plants by providing all the essential macro and micro nutrients. Incorporation of FYM enhanced the proliferation of micro-flora, predominantly *Azotobacter* (Gupta *et al.*, 1999). *Azotobacter* is a nitrogen-fixing bacterium which may be used in various non-leguminous crops (Kumari *et al.*, 2017). Vermicompost is a rich source of micronutrients and also it act as chelating agents, regulating the availability of metabolic micronutrients in the plants. It enhances the plant growth and productivity by supplying nutrients in the most accessible forms (Panwar *et al.*, 2019). Mustard oil cake is widely used as organic manure for cultivation of flower crops due to its rich nutrient content, especially, nitrogen. Loose flowers are extensively used for making garland, flower baskets, floral decorations and religious gifts. In landscaping, marigold used in flower beds, shrubbery border and potted plants. Marigold petals have the highest concentration of xanthophylls and lutein (80-90%). Lutein, the primary constituent of xanthophyll, is used to colour food and marigold flower extract is used to treat eye disease and ulcers. Marigold essential oil contains anti-inflammatory and insect-repellent properties (Singh, 2006). Marigold carotenoid pigment is used in chicken feed as supplement to improve the yellow colour of egg yolks and broiler skin (Kumar and Sharma, 2013).

## **MATERIALS AND METHODS**

The experiment was carried out at the instructional farm, Department of Floriculture and Landscape Architecture, College of Horticulture and Forestry, Pasighat, Arunachal Pradesh (28.07°N Latitude and 95.32°E Longitude) during the year 2021-22. The experiment soil was sandy loam in texture with the initial pH 5.2, available NPK (313.6 kg/ha N, 313.6 kg/ha P and 202.2 kg/ha K). Marigold seedlings cv. Pusa Narangi Gaiinda of 10-15 cm in height was transplanted on the raised beds of uniform size 3×3 m at a spacing of 30×30 cm. The standard inter cultural practices were undertaken as per need during the entire investigation. The field experiment was laid out in Randomized Block Design (RBD) with 13 treatments combinations such as T<sub>0</sub> - Control, T<sub>1</sub> - RDF @ 120:80:60 NPK kg/ha, T<sub>2</sub> - RDF @ 120:80:60 NPK kg/ha + Dolomite @ 222 kg/ha, T<sub>3</sub> - FYM @ 25t/ha, T<sub>4</sub> - Vermicompost @ 5t/ha, T<sub>5</sub> - Mustard oil cake @ 5t/ha, T<sub>6</sub> - FYM @ 25t/ha + Dolomite @ 222 kg/ha, T<sub>7</sub> - Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha, T<sub>8</sub> - Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha, T<sub>9</sub> - FYM @ 25t/ha + Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha, T<sub>10</sub> - FYM @ 25t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha, T<sub>11</sub> - Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha, T<sub>12</sub> - FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha in three replications. Observation on vegetative parameters viz., Plant height (cm), number of primary branches, number of secondary branches, leaf area (cm<sup>2</sup>), East-West plant spread (cm), North-South plant spread (cm); flowering characteristics such as days taken to bud initiation, number of flowers per plant, flower diameter (mm) and flower yield (q/ha) were recorded. Data was analysed statistically as suggested by Gomez and Gomez (1984).

## **RESULTS AND DISCUSSION**

### **Effect of organic and inorganic inputs on vegetative parameters of Marigold**

The organic and inorganic inputs significantly affected the vegetative parameters in marigold as presented in Table 1.

### **Plant height (cm)**

The maximum plant height (130.70 cm) was associated with application of T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) which was followed by T<sub>7</sub> (Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha) [113.50 cm]. However, the minimum plant height (86.22 cm) was recorded in T<sub>0</sub> (Control). This could be attributed to the absorption of micronutrients and macronutrients that were made available at optimal levels by the use of various organic inputs such as FYM, vermicompost and mustard oil cake. Vermicompost comprises 9.15 to 17.98% organic carbon on average, macro as well as micronutrients like Nitrogen, Phosphorus, Potassium, zinc, sulphur, sodium, calcium, magnesium and iron (Adhikary, 2012). The addition of FYM to the soil improves the physical, chemical, and biological properties of the soil, resulting in increased root growth and development and hence absorption of nutrients and water from a larger soil volume, leading to improved plant growth. This is in corroboration with the findings of Kumar and Sharma (2013) in marigold, Premkumar *et al.* (2016) in chrysanthemum, Kumar *et al.* (2020) in chrysanthemum and Kumar *et al.* (2022) in rose.

### **Number of primary branches**

The more number of primary branches (11.20) was observed in T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) which was followed by T<sub>9</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha) (9.70). Moreover, the minimum number of branches (5.20) was observed in T<sub>0</sub> (Control).

Accelerated cell division and elongation in cells and enhanced metabolic activity in plants might be due to the application of FYM, which provides a higher level of nutrients to crops. Furthermore, it may lead to the breakdown of apical dominance and hence the emergence of axillary buds, leading to an increased number of primary branches per plant. Similar findings have also been reported by Premkumar *et al.* (2016) in chrysanthemum, Swathi *et al.* (2017) in marigold, Kumar *et al.* (2020) in chrysanthemum.

### **Number of secondary branches**

The highest number of secondary branches (14.40) was noticed in T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) in comparison to other treatments including control (4.83) and it was followed by T<sub>10</sub> (FYM @ 25t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) produced 12.40 number of secondary branches. The application of vermicompost led to an increased number of secondary branches which is considered as homogeneous in nature and has desirable properties, a relatively low level of contaminants, plant growth promoting hormones, increased levels of soil enzymes, a greater microbial population, and retains more nutrients for quite a longer period of time without negatively impacting the environment. The foregoing findings are in consistent with that of Premkumar *et al.* (2016) in chrysanthemum, Khan *et al.* (2020) and Kumar *et al.* (2020) in chrysanthemum.

### **Leaf area (cm<sup>2</sup>)**

Increased leaf area was noticed in the treatment combinations T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) [56.57 cm<sup>2</sup>] and it was statistically on par with T<sub>9</sub> and T<sub>11</sub>. However, Control (T<sub>0</sub>) showed the minimum leaf area (32.09 cm<sup>2</sup>). The probable reason might be due to the enhanced soil fertility and

moisture retention capacity through the added vermicompost or FYM, which ultimately increased the leaf area. These findings are close agreements with the Sharma *et al.* (2016) in marigold, Chawla *et al.* (2018) and Madhuri *et al.* (2018) in tuberose.

### **Plant spread (cm)**

Among the different treatments, the highest east-west plant spread (49.25 cm) was recorded in the T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) and observed to be superior over control (26.50 cm), which was followed by the treatment T<sub>2</sub> (RDF @ 120:80:60 NPK kg/ha + Dolomite @ 222 kg/ha) exhibited the east-west plant spread of 41.21 cm. In addition to that, the maximum north-south plant spread (46.50 cm) was noticed in the T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) which was followed by the treatment T<sub>1</sub> (RDF @ 120:80:60 NPK kg/ha) recorded the north-south plant spread of 40.60 cm. However, the lowest east-west plant spread (28.50 cm) was observed in T<sub>0</sub> (Control). This is possibly attributed to the fact that the efficient decomposition and mineralization of organic inputs such as FYM, vermicompost, and mustard oil cake, leads to the release of the micro and macro nutrients which are readily accessible to plants, aiding the growth of plants. Besides the above, the fixed forms of nutrients also might have been solubilized through the organic acids secreted during the decomposition of added organic inputs. The increased plant spread could also be ascribed to the development of an increased number of leaves, which ultimately increased the photosynthesis activity and photosynthetic translocation to various parts of the plants, and in turn increased plant spread. These findings are in consistent with those of Kumar and Sharma (2013) in marigold, Swathi *et al.* (2017) in marigold, Premkumar *et al.* (2016), Kumar *et al.* (2020) in chrysanthemum and Chander *et al.* (2015) in marigold.

**Comment [Mk5]:** Format is change plz verify

### **Effect of organic and inorganic inputs on flowering and yield attributes of marigold**

The organic and inorganic inputs significantly affected the flowering and yield attributes in marigold as shown in Table 2.

### **Number of days taken to bud initiation (days)**

Earlier bud initiation (44.10 days) was noticed in the treatment combinations T<sub>12</sub> (FYM @ 25 t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha). However, the number of days taken to bud initiation was found to a maximum in T<sub>0</sub> (Control) [63.20 days]. The probable reason might be that the gibberellins present in vermicompost and FYM, helped in regulating the flowering that leads to cause an early flowering in marigold. These results are consistent with those of Kumar and Sharma (2013) in marigold, Swathi *et al.* (2017) in marigold, Kumar *et al.* (2020) in chrysanthemum and Koley and Khan (2012) in marigold.

#### **Number of flowers/plant**

The number of flowers/plant was significantly varied with the application of different treatment. Among the various treatments, the treatment T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) produced the highest number of flowers (20.23) and it was statistically at par with the treatments T<sub>10</sub> and T<sub>11</sub>. However, least number of flowers (10.47) was recorded in T<sub>0</sub> (Control). The maximum of flowers/plant might due to the fact that the vermicompost containing essential macro and micro nutrients, growth accelerating hormones, enzymes, exerted a positive and significant impact on micro flora, which resulted in increased number of flowers. These findings are consistent with those of Sunitha *et al.* (2007) in marigold, Chaitra and Patil (2007) in China aster, Kumar *et al.* (2020) in chrysanthemum, Swathi *et al.* (2017), Idan *et al.* (2014) Chauhan *et al.* (2005) and Priyadarshini *et al.* (2018) in Marigold.

#### **Flower diameter (mm)**

The diameter of flower was significantly influenced by various organic and inorganic. Among the different treatment combinations, T<sub>10</sub> (FYM @ 25t/ha) + Mustard oil cake @

5t/ha + Dolomite @ 222 kg/ha) showed maximum diameter (62.19 mm) which was followed by T<sub>8</sub> (Mustard oil cake @ 5t/ha+ Dolomite @ 222 kg/ha) [53.40 mm]. However, T<sub>0</sub> (Control) produced the flowers with minimum diameter (37.30 mm) in comparison to other treatments. The increased marigold flower size might be attributed to the enhanced vegetative growth, facilitated by the improved nutritional condition of the soil through the added organic inputs. These findings of Kumar and Sharma (2013), Dash *et al.* (2021), Swathi *et al.* (2017) in marigold are in line with the present findings.

#### **Flower yield (q/ha)**

The treatments had a significant and positive influence on flower yield. The treatment T<sub>12</sub> (FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha) recorded maximum flower yield (159.73 q/ha) which was followed by T<sub>10</sub> (FYM @ 25t/ha + Mustard oil cake @ 5t/ha+ Dolomite @ 222 kg/ha) [137.30 q/ha] in comparison to control T<sub>0</sub> (39.83 q/ha). The increase in flower production might be attributed to the use of organic inputs, which improved the soil productivity and fertility through increased supply of both macro and micro nutrients and enhanced physical and biological conditions. These findings are in consistent with that of Kumar and Sharma (2013) and Swathi *et al.* (2017) in marigold. However, the flower yield recorded in the present investigation was comparatively less than the recorded in findings of others. This might be due to the extreme weather conditions (rainfall) prevailed during the reproductive stage in the experimental location. According to Devi *et al.*, 2017, the prolonged precipitation delayed the opening of flower buds. Heavy rainfall combined with limited sun shine hours may have accelerated vegetative growth over flowering, resulting in fewer flower buds and a lower flower yield/plant (Prakash *et al.*, 2016).

The present experiment revealed that the incorporation of organic manures such as FYM, vermicompost and mustard oil cake significantly impacted the vegetative, flowering and yield attributes in marigold. Thus it is apparent from entire experiment that the treatment combinations T<sub>12</sub> - FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha, T<sub>10</sub> - FYM @ 25t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha and T<sub>9</sub> - FYM @ 25t/ha + Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha was significantly associated with the enhanced vegetative growth, flowering and quality attributes in marigold and recommended for enhancing productivity of marigold as well as promoting the soil health.

**Table 1: Effect of organic and inorganic inputs on vegetative parameters of Marigold**

Treatments	Plant height (cm)	Number of primary branches	Number of secondary branches	Leaf area (cm <sup>2</sup> )	East-West Plant spread (cm)	North- South Plant spread (cm)
T <sub>0</sub> Control	86.22	5.20	4.83	32.09	26.50	28.50
T <sub>1</sub> RDF @120:80:60 NPK kg/ha	120.34	8.30	9.80	45.30	40.40	40.60
T <sub>2</sub> RDF @ 120:80:60 NPK kg/ha + Dolomite @ 222 kg/ha	122.43	8.70	10.77	46.10	41.21	43.20
T <sub>3</sub> FYM @ 25t/ha	111.10	7.30	8.70	44.27	36.31	32.90
T <sub>4</sub> Vermicompost @ 5t/ha	117.90	7.60	8.40	48.02	34.63	37.40
T <sub>5</sub> Mustard oil cake @ 5t/ha	119.73	7.90	8.20	47.19	39.27	40.40
T <sub>6</sub> FYM @ 25t/ha + Dolomite @ 222 kg/ha	118.70	9.02	9.40	43.27	40.85	38.50
T <sub>7</sub> Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha	113.50	8.40	9.20	45.24	39.72	36.40
T <sub>8</sub> Mustard oil cake @ 5t/ha + Dolomite @222 kg/ha	120.30	8.70	10.10	49.30	39.81	41.75
T <sub>9</sub> FYM @ 25t/ha + Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha	123.45	9.70	13.39	51.91	43.47	43.11
T <sub>10</sub> FYM @ 25t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	128.45	9.34	12.40	48.11	46.20	44.70
T <sub>11</sub> Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	127.83	8.20	11.60	52.23	45.31	42.87
T <sub>12</sub> FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	130.70	11.20	14.40	56.57	49.25	46.50
<b>SE(d)</b>	<b>7.25</b>	<b>0.64</b>	<b>0.75</b>	<b>3.15</b>	<b>3.15</b>	<b>2.47</b>
<b>C.D at 5%</b>	<b>14.98</b>	<b>1.32</b>	<b>1.56</b>	<b>6.50</b>	<b>6.51</b>	<b>5.10</b>
<b>C.V (%)</b>	<b>7.50</b>	<b>9.29</b>	<b>9.14</b>	<b>8.22</b>	<b>9.60</b>	<b>7.62</b>

**Table 2: Effect of organic and inorganic inputs on flowering and yield attributes of marigold**

Treatments	Number of days taken to bud initiation (days)	Number of flowers/plant	Flower diameter (mm)	Flower yield (q/ha)
T <sub>0</sub> Control	63.20	10.47	37.30	39.83
T <sub>1</sub> RDF @ 120:80:60 NPK kg/ha	51.66	16.13	47.79	95.01
T <sub>2</sub> RDF @ 120:80:60 NPK kg/ha + Dolomite @ 222 kg/ha	50.37	17.17	49.45	102.28
T <sub>3</sub> FYM @ 25t/ha	53.70	14.07	44.67	79.65
T <sub>4</sub> Vermicompost @ 5t/ha	52.03	13.63	46.73	75.75
T <sub>5</sub> Mustard oil cake @ 5t/ha	51.83	15.14	48.60	81.34
T <sub>6</sub> FYM @ 25t/ha + Dolomite @ 222 kg/ha	50.50	16.25	49.40	94.05
T <sub>7</sub> Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha	49.87	15.60	51.33	90.79
T <sub>8</sub> Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	50.85	16.20	53.40	91.34
T <sub>9</sub> FYM @ 25t/ha + Vermicompost @ 5t/ha + Dolomite @ 222 kg/ha	47.40	17.07	56.68	125.58
T <sub>10</sub> FYM @ 25t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	48.50	19.33	62.19	137.30
T <sub>11</sub> Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	49.40	18.14	58.38	123.91
T <sub>12</sub> FYM @ 25t/ha + Vermicompost @ 5t/ha + Mustard oil cake @ 5t/ha + Dolomite @ 222 kg/ha	44.10	20.23	59.16	159.73
<b>SE(d)</b>	<b>2.95</b>	<b>1.30</b>	<b>3.17</b>	<b>6.63</b>
<b>C.D at 5%</b>	<b>6.09</b>	<b>2.69</b>	<b>6.54</b>	<b>13.69</b>
<b>C.V (%)</b>	<b>7.09</b>	<b>9.89</b>	<b>7.58</b>	<b>8.14</b>

## References

- Adhikary, S. (2012). Vermicompost, the story of organic gold: a review. *Agricultural Sciences*. **3**: 905-917.
- Anonymous, (2021). Area and production for Horticultural crops. Department of Agriculture and Farmers Welfare. <https://agricoop.nic.in/en/StatHortEst#gsc.tab=0>.
- Chaitra, R. and Patil, V. S. (2007). Integrated nutrient management studies in china aster (*Callistephus chinensis* (L.) Nees) cv.Kamini. *Karnataka Journal of Agricultural Sciences*. **20**(3): 689-690.
- Chander, S., Beniwal, B. S., Dalal, R. P. S. and Sheron, S. (2015). Effect of organic manures on growth, floral, characters and yield attributes of French marigold (*Tagetes patula* L). *Annals of Biology*. **31**(2): 264-269.
- Chauhan, S., Singh, C. N. and Singh, A. K. (2005). Effect of vermicompost and pinching on growth and flowering in marigold cv. Pusa NarangiGainda. *Progressive Horticulture*. **37**(2): 419-22.
- Chawla, S.L., Patel, M.A., Patil, S., Bhatt, D. and Patel, R.B. (2018). Effect of land configuration and integrated nutrient management on growth, quality and yield of tuberose (*Polianthes tuberosa*) var. Prajwal. *Indian Journal of Agricultural Sciences*. **88**(12): 1854-8.
- Dash, R. M., Patra, S. K., Jena, S. and Mund, S. R. (2021). Effect of FYM, Vermicompost and Cocopeat on Growth and Yield of African Marigold (*Tagetes erecta* L.) cv. Siracole. *International Journal of Current Microbiology and Applied Science*. **10**(03): 1402-1408.

- Devi, M. P., Hemanta, L., Chakraborty, A. and Chakrabarty, S. (2017). Agrometeorological indices: effect on growth and flowering behaviour in marigold. *Journal of Crop and weed*. **13**(3):82-85.
- Gomez, K. A. and Gomez, A .A. (1984). Statistical Procedures for Agricultural Research. 2nd edn. Wiley, New York. pp. 680.
- Gupta, N. S., Sadavarte, K. T., Mahorkar, V. K., Jadhao, B. J. and Dorak, D. V. (1999). Effect of graded levels of nitrogen and bio inoculants on growth and yield of marigold. *Journal of Soils and Crops*. **9**: 80-3.
- Idan, R.O., Prasad, V.M. and Saravanan, S. (2014). Effect of organic manures on flower yield of African marigold (*Tagetes erecta*) cv. Pusa NarangiGainda. *International Journal Agriculture Science and Research*. **4**(1): 39-50.
- Khan, S., Venkatesha, M., Venkateshamurthy, P. and Raghupathi, D. (2020). Effect of Vermicompost in Combination with Microbial Consortium on Growth of Chrysanthemum (*Dendranthema grandiflora* L.) cv. Marigold. *International Journal of Current Microbiology and Applied Science*.**9**(09): 3436-3442.
- Koley, S. and Khan, S. (2012). Effect of mustard oil cake and urea as nitrogen sources on vegetative and reproductive attributes of African marigold (*Tagetes erecta* L.) cv. Siracole. *Journal of Interacademia*. **16**(4): 826-829.
- Kumar, M., Vishnupriya, J. and Subramaniyan, P. (2020). Influence of organic manure and bio-fertilizers for growth and yield in Chrysanthemum cv. Poornima white. *International Journal of Current Research*. **12**(11):14929-14933.
- Kumar, P., Sheoran, S. and Beniwal, B.S. (2022). Growth and yield parameters of rose as influenced by different organic manures and their levels. *The pharma innovation Journal*. **11**(6): 394-398.

- Kumar, S. and Sharma, S. (2013). Effect of organic manure, drying methods on flower yield and carotenoid contents in marigold (*Tagetes erecta* L.). *Asian Journal of Horticulture*. **8**(2):385-390.
- Kumari, S., Ramteke, P., Rajwade, V., Lawrence, R. and Masih, H. (2017). Isolation and Characterization of Phosphorus and Potassium Solubilising Microbes from Rhizosphere of Orchard Field and Its Effect on Seedling Growth of Broccoli (*Brassica Oleracea* var. *Italica*L.). *Chemical Review and Letters*. **6** (23):432-1442.
- Madhuri, G., Palai, S.K and Pattanaik, G. (2018). Growth and flowering parameters of tuberose (*Polianthes tuberosa* L.) cv. phulerajani influenced by organic manures. *The pharma innovation Journal*. **7**(5): 97-99
- Panwar, A., Bhuj, B. D., Srivastava, R., Chand, S., Ahuja, D. and Chaudhary, M. (2019). To study the effects of organic and inorganic fertilizers on vegetative and floral parameters of Gladiolus var. Nova flux. *International Journal of Chemical Studies*. **7**(5): 3118-3121.
- Prakash, S., Anitha, P., Giridharan, M. P., Rajagopalan, A. and Sudarsana Rao, G. V. (2016). Impact of seasons and pinching on growth and flowering in African marigold (*Tagetes erecta* L.). *Journal of Tropical Agriculture*. **54**(1):50-54.
- Premkumar, A., Parul, P., Mamta, B., Sandeep, U. and Nautiyal, B. P. (2016). Response of Chrysanthemum Cultivar Dolly White to Different Sources and Combinations of Organic Manures under the Mid Hill Regions of Uttarakhand. *International Journal Agricultural Sciences*. **8**(59):3294-3297.
- Priyadarshini, A., Palai, S. K. and Nath, M. R. (2018). Effect of source of nitrogen on growth and yield of African marigold (*Tagetes erecta* L.). *The pharma innovation Journal*. **7**(7): 917-921.

- Sharma, G., Sahu, N. P. and Shukla, N. (2016). Effect of bio-organic and inorganic nutrient sources on growth and flower production of African marigold. *Horticulturae*.**3**(1):11  
doi: 10.3390/horticulturae3010011.
- Singh, A.K. (2006). Flower crops cultivation and management. New Delhi, New India publishing agency, pp. 463.
- Sunitha, H. M., Hunje, R., Vyakaranahal, B. S. and Bablad, H. B. (2007). Effect of plant spacing and integrated nutrient management on yield and quality of seed and vegetative growth parameters in African marigold (*Tagetes erecta* Linn.). *Journal of Ornamental Horticulture*.**10**(4):245-249.
- Swathi, K., Sarkar, I., Maitra, S. and Sharma, S. (2017). Organic Manures and Bio-inoculants Mediated Influence on growth and Flowering of African Marigold (*Tagetes erecta* L.) cv.Pusa NarangiGainda. *International Journal of Bio-resource and Stress Management*.**8**(3):429-432.