



# Effect of Liquid Organic Inputs on Growth, Flowering and Yield of Chrysanthemum (*Chrysanthemum morifolium* Ramat.) and Soil Properties

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## Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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## ABSTRACT

This experiment was carried out to investigate the Effect of Liquid Organic Inputs on Growth, Flowering and Yield of Chrysanthemum (*Chrysanthemum morifolium* Ramat.) and Soil Properties. The experiment was carried out during 2022-23 and laid out in a Randomized Block Design (RBD) with fourteen treatments including different combinations of concentrations, methods, and intervals of application of Jeevamrut and Panchagavya and control (only recommended dose of FYM 15 t/ha). Among the treatments, maximum growth and vegetative attributes viz., plant height at 60, 75, 90, 105 and 120 days after transplanting (29.47 cm, 42.33 cm, 50.83 cm, 54.80 cm and 56.53 cm, respectively), number of branches at full bloom stage (8.27) and average plant spread (27.22 cm) was recorded with 500 l/ha Jeevamrut drenching and 8 % Panchagavya foliar application

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alternatively at fifteen days interval. Earliness in flowering attributes viz., first bud initiation (63.20 days), first flower opening (84.53 days) and full blooming (99.13 days) were observed in the same treatment. Alternate application of 500 l/ha Jeevamrut as soil drenching and 8% Panchagavya as foliar application at 15 days interval also resulted in a number of flowers per plant (35.52), flower yield per plant (141.39 g), flower diameter (6.32 cm) and weight of individual flower (4.11 g). While, treatment consisting of only 500 l/ha Jeevamrut soil drenching at fifteen days interval resulted in maximum available nitrogen (196.52 kg/ha) and viable bacterial count ( $94.78 \times 10^5$  cfu/g of soil) in the soil.

**Keywords:** *Chrysanthemum*; *jeevamrut*; *panchagavya*; soil chemical properties; bacterial count.

## 1. INTRODUCTION

Chrysanthemum, botanically known as *Chrysanthemum morifolium* Ramat., is one of the most popular flowering plants belonging to Asteraceae family. It is commonly known as 'Queen of the East' and 'Autumn Queen'. It is popular by different names in various languages in India. It is called '*Chandramallika*' in Bengali, '*Sevanti*' in Marathi and Gujarati, and '*Guldaudi*' in Hindi and Punjabi. Chrysanthemum is heavy nutrient feeder crop. Inorganic fertilizer application can only supply one or two nutrient elements and due to increased use of chemical fertilizers over time, the soil properties have been declining. This eventually, led to high demand for organic farming to protect soil and plant health. Organic agriculture in recent years is gaining impetus due to its inherent advantages in sustaining crop production and also in maintaining dynamic soil nutrient status, saving environment and increasing microbial biomass. Liquid organic substances that are used in organic horticulture like Jeevamrut and Panchagavya are fermented products, which are used as plant growth enhancing substances prepared by using material available from farmers. The organic amendments Jeevamrut and Panchagavya are made from cow products namely, dung, urine, milk, curd and ghee. It also contains growth regulatory substances such as IAA, GA, cytokinins and essential plant nutrients [1,2]. Panchagavya, an organic product is a potential source to play great role for promoting growth and providing immunity in plant system. Bio-chemical properties of panchagavya revealed that it possesses almost all the major nutrients like N, P, K and micro nutrients essential for plant and growth hormones like IAA and GA required for crop growth [2]. Jeevamrut is highly nutritious organic manure made from cow products. It accelerates the proliferation of soil microflora which is beneficial to soil enrichment. Soil microorganisms play an active role in replenishing soil fertility as they are

involved in the recycling of nutrients like carbon and nitrogen, which are required for plant growth and they are also responsible for the decomposition of the organic matter in the soil and, therefore, in the recycling of nutrients in soil [3,4]. Since ancient times, Panchagavya has been recommended by our traditional knowledge system and treasure of information to protect plants and soil microbes. It can act as bio-enhancer, growth promoter and immunity booster. Maintenance of soil health and productivity is a prerequisite for long term sustainable farming [5]. Earlier, very scanty work has been carried out on effect of liquid organic substances like Jeevamrut and Panchagavya on loose flower production of chrysanthemum. Keeping this in consideration, present study was conducted to evaluate the effect of different combinations of Jeevamrut and Panchagavya concentration, methods and interval of applications on growth, flowering and yield of chrysanthemum as well as soil properties.

## 2. MATERIALS AND METHODS

The present investigation was conducted during 2022-23 at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Mehsana, Gujarat. The soil of experimental field was loamy sand in texture, low in organic carbon and available nitrogen, medium in available phosphorus and potassium and moderately alkaline in reaction. One month old rooted cuttings of chrysanthemum cv. 'Ratlam Selection' having uniform size and vigour was used for the experiment. The land was brought to a fine tilth by tractor drawn cultivator and well rotten FYM (15 t/ha) was uniformly mixed in the soil. The rooted cuttings were planted at a spacing of 30 cm x 30 cm on raised beds of 1.5 m x 1.5 m in size. Transplanting of rooted cuttings was done in the last week of August, 2022. There was total fourteen treatments viz.; T<sub>1</sub>: Control (Only recommended dose of FYM 15 t/ha); T<sub>2</sub>: Jeevamrut drenching

(500 l/ha); T<sub>3</sub>: 4 % Jeevamrut foliar application; T<sub>4</sub>: 6 % Jeevamrut foliar application; T<sub>5</sub>: 8 % Jeevamrut foliar application; T<sub>6</sub>: 4 % Panchagavya foliar application; T<sub>7</sub>: 6 % Panchagavya foliar application; T<sub>8</sub>: 8 % Panchagavya foliar application; T<sub>9</sub>: Jeevamrut drenching + 4 % Jeevamrut foliar application; T<sub>10</sub>: Jeevamrut drenching + 6 % Jeevamrut foliar application; T<sub>11</sub>: Jeevamrut drenching + 8 % Jeevamrut foliar application; T<sub>12</sub>: Jeevamrut drenching + 4 % Panchagavya foliar application; T<sub>13</sub>: Jeevamrut drenching + 6 % Panchagavya foliar application and T<sub>14</sub>: Jeevamrut drenching + 8 % Panchagavya foliar application. The experiment was laid out in Randomized Block Design (RBD) in open field conditions with three replications. Treatment T<sub>2</sub> to T<sub>8</sub> was applied at 15 days interval, whereas T<sub>9</sub> to T<sub>14</sub> was applied alternatively at 15 days interval (*i.e.*, drench and foliar application alternatively). In the present investigation, different organic liquid substances were prepared freshly as per the procedure of NCOF, Ghaziabad [6]. Spread plate method [7] was used for counting population of bacteria from soil sample by using standard procedure. Observations on different growth, flowering, yield and quality parameters of chrysanthemum as well as chemical properties and viable bacterial count of soil were recorded and analyzed statistically.

### 2.1 Preparation of Jeevamrut

Cow dung 10 kg, cow urine 10 litre, jaggery 2 kg, gram flour 2 kg and soil under live tree 1 kg were taken in 200 litres capacity drum and the volume was made up to 200 litres with the addition of water. The drum was kept in the shade and covered and well stirred clock wise thrice in a day. After one week, jeevamrut was ready and then it was used for application.

### 2.2 Preparation of Panchagavya

Fresh cow dung 5 kg, cow urine 3 litre, cow milk 2 litre, curd 2 litre, cow deshi ghee 1 kg, sugarcane juice 3 litre, tender coconut water 3 litre, banana paste of 12 fruits and grape juice 2 litre were taken for making panchagavya. Fresh cow dung and ghee were mixed in a container and fermented for three days with thorough stirring. Rest of the ingredients were added on the fourth day and fermented for 15 days with stirring twice daily. The formulation was ready in 18 days. Three litres of panchagavya was diluted in 100 litre water and sprayed over the plants as per treatments.

## 3. RESULTS AND DISCUSSION

### 3.1 Growth and Vegetative Parameters

A perusal of data indicates that application of Jeevamrut and Panchagavya had significant effect on growth and vegetative characters (Table 1). At all the stages of plant growth *i.e.*, 60, 75, 90, 105 and 120 days after transplanting, maximum plant height (29.47 cm, 42.33 cm, 50.83 cm, 54.80 cm and 56.53 cm, respectively) was observed in treatment T<sub>14</sub> *i.e.* Jeevamrut drenching (500l/ha) and 8% Panchagavya foliar application alternatively at fifteen days interval which was at par with T<sub>13</sub>, T<sub>2</sub> and T<sub>12</sub>. The increase in plant height might be due to the reason that drenching of Jeevamrut acted as a tonic for soil health and promoted growth as it contains macronutrients in the form of N (0.16%), P (0.02%) and K (0.123%) [8]. The auxin content in Panchagavya upon its application might have activated cell division and cell elongation in the auxiliary buds and promoted plant growth [9]. The outcome of these parameters is in close conformity with the previous findings of Sharma [10] in a pot experiment of petunia after drench application of Jeevamrut. Similar results have been reported in Boston fern after drenching and foliar application at Jeevamrut alternatively at fifteen days intervals by Vanlalhruii [11]. These results also corroborate the findings of Bunkar [12] in French marigold after application of Panchagavya.

Among the treatments, maximum number of branches per plant (8.27) was recorded in the T<sub>14</sub> treatments which was at par with treatment T<sub>13</sub>, T<sub>2</sub> and T<sub>12</sub>. Maximum plant spread (27.87 cm, 26.57 cm and 27.22 cm in N-S direction, E-W direction and average plant spread, respectively) was also recorded in the same treatment which was at par with treatment T<sub>13</sub>, T<sub>2</sub>, T<sub>12</sub>, T<sub>11</sub>, T<sub>10</sub> and T<sub>9</sub>. The possible reason for increase in a number of branches might be that drenching of Jeevamrut has significantly increased nutrient uptake, photosynthesis and source sink relationship, besides excellent biochemical activities [13]. Further, presence of cytokinin in Panchagavya might have increased cell division and cell elongation which further induced more branches in plants. These liquid organic substances (Jeevamrut and Panchagavya) consist of NPK. Nitrogen is a major constituent of proteins and also helps in increasing growth of plant. Increased number of branches might have contributed to increase in plant spread. Further, foliar application of Panchagavya might have

helped in better absorption of nitrogen leading to increased photosynthesis process resulting in better plant growth and spread. These results are similar the findings of Choudhary et al. [14] and Barad et al. [15].

### 3.2 Flowering and Quality Parameter

The application of Jeevamrut and Panchagavya has significantly influenced various flowering and quality attributes viz., days to first bud initiation, days to first flower opening, days taken to full blooming, flower diameter (cm), weight of individual flower (g) and shelf life (days) of chrysanthemum cv. 'Ratlam Selection' (Table 2). The earliest first bud initiation (63.20 days), first flower opening (84.53 days) and full blooming (99.13 days) was recorded in treatment T<sub>14</sub> alternatively at fifteen days intervals and the results were at par with treatment T<sub>13</sub>, T<sub>2</sub>, T<sub>12</sub>, T<sub>11</sub>, T<sub>10</sub>, T<sub>9</sub> and T<sub>8</sub>. The possible reason for earliness in flowers opening might be attributed to the faster vegetative growth and storing sufficient reserved food materials for differentiation of buds into flowers which ultimately resulted in earliest blooming. These results are in conformity with the findings of Bharti et al. [16] who recorded early flowering in tuberose after foliar spray of Panchagavya. The outcome of these parameters is in accordance

with the previous findings of Barad et al. [15] and Bunkar [12]. It is well known that Jeevamrut consist of beneficial microorganisms, which act as a tonic for improving soil health. Jeevamrut increases microbial activities in soil and convert the non-available form of nutrients into an available form which fastens the vegetative growth and results in early completion of juvenile phase further leading to the early reproductive phase, hence early blooming. The results are in accordance with the findings in marigold after drenching with Jeevamrut at fifteen days intervals as compare to its foliar application [14].

Significantly largest flower diameter (6.32 cm) and maximum individual flower weight (4.11 g) was obtained with the T<sub>14</sub> alternatively at fifteen days intervals which was at par with treatment T<sub>13</sub>, T<sub>2</sub> and T<sub>12</sub> for both the characters. Increment in flower diameter might be due to enhanced cell division and cell enlargement and promotion of protein synthesis. Greater flower diameter is caused by drawing photosynthates to the flower as a consequence of intensification of sink. The increase in length of petals and pedicel accompanied by increased number of petals resulted bigger size of flower further resulting in the increase of individual flower weight.

**Table 1. Effect of Jeevamrut and Panchagavya on growth and vegetative characters of chrysanthemum**

| Treatments        | Plant height (cm) |        |        |         |         | Number of branches per plant | Plant spread (cm) |       |         |
|-------------------|-------------------|--------|--------|---------|---------|------------------------------|-------------------|-------|---------|
|                   | 60 DAT            | 75 DAT | 90 DAT | 105 DAT | 120 DAT |                              | N-S               | E-W   | Average |
| T <sub>1</sub>    | 22.13             | 34.93  | 44.70  | 50.20   | 52.17   | 5.60                         | 23.80             | 21.93 | 22.87   |
| T <sub>2</sub>    | 27.17             | 39.93  | 48.77  | 53.40   | 55.33   | 7.80                         | 27.07             | 25.53 | 26.30   |
| T <sub>3</sub>    | 22.67             | 35.80  | 45.57  | 50.87   | 52.43   | 6.27                         | 23.97             | 22.57 | 23.27   |
| T <sub>4</sub>    | 23.27             | 36.07  | 45.93  | 50.90   | 52.87   | 6.33                         | 24.30             | 23.00 | 23.65   |
| T <sub>5</sub>    | 23.53             | 36.33  | 46.10  | 51.13   | 53.00   | 6.60                         | 24.43             | 23.13 | 23.78   |
| T <sub>6</sub>    | 24.13             | 36.67  | 46.47  | 51.27   | 53.33   | 6.67                         | 24.90             | 23.50 | 24.20   |
| T <sub>7</sub>    | 24.27             | 36.73  | 46.57  | 51.63   | 53.40   | 6.80                         | 24.93             | 23.70 | 24.32   |
| T <sub>8</sub>    | 24.40             | 37.80  | 46.93  | 51.67   | 53.53   | 7.07                         | 25.40             | 24.10 | 24.75   |
| T <sub>9</sub>    | 25.00             | 38.40  | 47.20  | 51.87   | 53.73   | 7.33                         | 26.00             | 24.93 | 25.47   |
| T <sub>10</sub>   | 25.53             | 39.00  | 47.27  | 52.03   | 53.87   | 7.40                         | 26.03             | 25.10 | 25.57   |
| T <sub>11</sub>   | 26.27             | 39.47  | 47.87  | 52.13   | 53.97   | 7.53                         | 26.37             | 25.17 | 25.77   |
| T <sub>12</sub>   | 27.13             | 39.87  | 48.67  | 53.53   | 55.30   | 7.73                         | 26.40             | 25.37 | 25.88   |
| T <sub>13</sub>   | 27.53             | 40.27  | 49.57  | 54.00   | 55.60   | 7.93                         | 27.60             | 26.07 | 26.83   |
| T <sub>14</sub>   | 29.47             | 42.33  | 50.83  | 54.80   | 56.53   | 8.27                         | 27.87             | 26.57 | 27.22   |
| <b>S.Em. ±</b>    | 0.84              | 0.87   | 1.01   | 0.91    | 0.88    | 0.25                         | 0.84              | 0.79  | 0.60    |
| <b>C.D. at 5%</b> | 2.43              | 2.52   | 2.94   | 2.65    | 2.55    | 0.73                         | 2.45              | 2.30  | 1.75    |
| <b>C.V. (%)</b>   | 5.75              | 3.94   | 3.70   | 3.03    | 2.82    | 6.11                         | 5.69              | 5.63  | 4.17    |

\*Treatment T<sub>2</sub> to T<sub>8</sub> were applied at fifteen days interval and T<sub>9</sub> to T<sub>14</sub> were applied at fifteen days interval, alternatively till flowering

**Table 2. Effect of Jeevamrut and Panchagavya application on flowering and quality characters of chrysanthemum**

| Treatments        | Days to first bud initiation | Days to first flower opening | Days taken to full blooming | Flower diameter (cm) | Weight of individual flower (g) | Shelf life (days) |
|-------------------|------------------------------|------------------------------|-----------------------------|----------------------|---------------------------------|-------------------|
| T <sub>1</sub>    | 66.60                        | 88.13                        | 102.00                      | 5.60                 | 3.37                            | 6.67              |
| T <sub>2</sub>    | 63.67                        | 85.07                        | 99.60                       | 6.15                 | 3.82                            | 7.27              |
| T <sub>3</sub>    | 66.33                        | 87.13                        | 101.80                      | 5.80                 | 3.39                            | 6.73              |
| T <sub>4</sub>    | 66.07                        | 87.00                        | 101.60                      | 5.93                 | 3.41                            | 6.73              |
| T <sub>5</sub>    | 66.00                        | 86.60                        | 101.47                      | 6.00                 | 3.46                            | 6.80              |
| T <sub>6</sub>    | 65.80                        | 86.53                        | 101.40                      | 5.90                 | 3.50                            | 6.87              |
| T <sub>7</sub>    | 65.33                        | 86.33                        | 101.20                      | 5.96                 | 3.55                            | 6.93              |
| T <sub>8</sub>    | 65.27                        | 86.27                        | 100.80                      | 5.99                 | 3.58                            | 7.00              |
| T <sub>9</sub>    | 65.13                        | 86.00                        | 100.67                      | 6.00                 | 3.54                            | 7.07              |
| T <sub>10</sub>   | 64.80                        | 85.87                        | 100.53                      | 6.05                 | 3.63                            | 7.13              |
| T <sub>11</sub>   | 64.60                        | 85.80                        | 99.87                       | 6.10                 | 3.71                            | 7.20              |
| T <sub>12</sub>   | 64.53                        | 85.73                        | 99.80                       | 6.13                 | 3.81                            | 7.20              |
| T <sub>13</sub>   | 63.40                        | 84.67                        | 99.47                       | 6.20                 | 4.02                            | 7.27              |
| T <sub>14</sub>   | 63.20                        | 84.53                        | 99.13                       | 6.32                 | 4.11                            | 7.33              |
| <b>S.Em. ±</b>    | 0.72                         | 0.62                         | 0.59                        | 0.07                 | 0.11                            | 0.16              |
| <b>C.D. at 5%</b> | 2.10                         | 1.79                         | 1.71                        | 0.21                 | 0.31                            | NS                |
| <b>C.V. (%)</b>   | 1.92                         | 1.24                         | 1.01                        | 2.09                 | 5.06                            | 3.88              |

\*Treatment T<sub>2</sub> to T<sub>8</sub> were applied at fifteen days interval and T<sub>9</sub> to T<sub>14</sub> were applied at fifteen days interval, alternatively till flowering

**Table 3. Effect of Jeevamrut and Panchagavya on yield characters of chrysanthemum**

| Treatments        | Number of flowers per plant | Flower yield per plant (g) | Flower yield per plot (kg) | Flower yield per hectare (q) |
|-------------------|-----------------------------|----------------------------|----------------------------|------------------------------|
| T <sub>1</sub>    | 23.40                       | 76.84                      | 0.67                       | 82.55                        |
| T <sub>2</sub>    | 33.00                       | 124.33                     | 1.08                       | 133.54                       |
| T <sub>3</sub>    | 23.93                       | 79.05                      | 0.70                       | 86.62                        |
| T <sub>4</sub>    | 24.20                       | 81.36                      | 0.75                       | 92.61                        |
| T <sub>5</sub>    | 25.40                       | 83.92                      | 0.78                       | 96.73                        |
| T <sub>6</sub>    | 25.60                       | 86.18                      | 0.80                       | 98.36                        |
| T <sub>7</sub>    | 26.07                       | 88.25                      | 0.84                       | 103.10                       |
| T <sub>8</sub>    | 26.87                       | 91.90                      | 0.86                       | 105.77                       |
| T <sub>9</sub>    | 27.20                       | 92.68                      | 0.86                       | 106.72                       |
| T <sub>10</sub>   | 28.27                       | 96.14                      | 0.88                       | 109.00                       |
| T <sub>11</sub>   | 29.20                       | 98.83                      | 0.92                       | 113.03                       |
| T <sub>12</sub>   | 32.87                       | 118.69                     | 1.03                       | 126.83                       |
| T <sub>13</sub>   | 33.40                       | 133.67                     | 1.18                       | 145.51                       |
| T <sub>14</sub>   | 35.52                       | 141.39                     | 1.23                       | 151.57                       |
| <b>S.Em. ±</b>    | 0.83                        | 3.20                       | 0.04                       | 4.72                         |
| <b>C.D. at 5%</b> | 2.42                        | 9.29                       | 0.11                       | 13.73                        |
| <b>C.V. (%)</b>   | 5.12                        | 5.56                       | 7.38                       | 7.38                         |

\*Treatment T<sub>2</sub> to T<sub>8</sub> were applied at fifteen days interval and T<sub>9</sub> to T<sub>14</sub> were applied at fifteen days interval, alternatively till flowering

The effect of Jeevamrut and Panchagavya applications on shelf life of flowers was found non-significant.

### 3.3 Yield Parameters

The yield characters viz., number of flowers per plant, flower yield per plant (g), flower yield per

plot (kg) and flower yield per hectare (q) have been significantly influenced by Jeevamrut and Panchagavya application (Table 3). It is clear from the data that various concentrations of liquid organic substances show significant influence on a number of flowers per plant. It is evident from the data that maximum number of flowers per plant (35.52),

flower yield per plant (141.39 g), flower yield per plot (1.23 kg) and flower yield per hectare (151.57 q) was recorded in treatment T<sub>14</sub> i.e. Jeevamrut drenching (500 l/ha) and 8 % Panchagavya foliar application alternatively at fifteen days interval and all these characters at par with treatment T<sub>13</sub>. The reason might be that the nutrients in Jeevamrut and Panchagavya are readily soluble as they are in liquid forms and can be taken up by the plants at once. As, plant receives regular supply of N and P it leads to more vegetative growth, further leading to an increase in photosynthetic area which in turn results in more synthesis and accumulation of photosynthates. The quick mobilization of these photosynthates from leaves (source) to flower (sink) might have increased number of flowers per plant. Further, GA induces cell elongation and cell division which is reflected in larger flower size and longer petals as well as subsequently in higher flower yield per plant. Higher photosynthetic activities and more carbohydrate accumulation resulted in better plant growth and consequently improved flower yield per plot and hectare. These outcomes are in accordance with the previous

findings of Choudhary et al. [14] and Sabhya [17].

### 3.4 Soil Chemical Properties and Viable Bacterial Count

A perusal of data (Table 4) indicates that application of Jeevamrut and Panchagavya had non-significant effect on organic carbon (%) in soil. Data pertaining to available nitrogen (kg/ha) after the completion of experiment showed significant differences among the treatments. Significantly maximum available nitrogen (196.52 kg/ha) was observed with treatment T<sub>2</sub> i.e. Jeevamrut drenching (500 l/ha) at fifteen days interval and which was at par with treatment T<sub>14</sub>, T<sub>13</sub>, T<sub>12</sub> and T<sub>11</sub>. The increase in available nitrogen might be due to build up of soil micro flora. The fertility of soil is not only depends on its chemical composition, but also on the qualitative and quantitative nature of microorganisms. The buildup of soil available nitrogen could be attributed to greater multiplication of microbes with Jeevamrut which helped in mineralization of soil nitrogen. These results can be supported by the findings of Siddappa [18].

**Table 4. Effect of Jeevamrut and Panchagavya on soil chemical properties and viable bacterial count**

| Treatments      | Organic carbon (%) | Available nitrogen (kg/ha) | Viable bacterial count (No. × 10 <sup>5</sup> cfu/g of soil) |
|-----------------|--------------------|----------------------------|--|
| Before          | 0.28               | 191.20                     | 78.26  |
| <b>After</b>    |                    |                            |  |
| T <sub>1</sub>  | 0.26               | 121.26                     | 71.33  |
| T <sub>2</sub>  | 0.31               | 196.52                     | 94.78  |
| T <sub>3</sub>  | 0.27               | 128.23                     | 73.11  |
| T <sub>4</sub>  | 0.28               | 133.67                     | 74.28  |
| T <sub>5</sub>  | 0.27               | 137.98                     | 75.33  |
| T <sub>6</sub>  | 0.28               | 142.17                     | 76.56  |
| T <sub>7</sub>  | 0.28               | 146.35                     | 77.67  |
| T <sub>8</sub>  | 0.29               | 158.89                     | 78.89  |
| T <sub>9</sub>  | 0.27               | 167.25                     | 83.89  |
| T <sub>10</sub> | 0.28               | 171.43                     | 85.56  |
| T <sub>11</sub> | 0.29               | 179.80                     | 85.78  |
| T <sub>12</sub> | 0.29               | 183.98                     | 87.22  |
| T <sub>13</sub> | 0.30               | 188.16                     | 88.44  |
| T <sub>14</sub> | 0.30               | 192.34                     | 89.11  |
| S.Em. ±         | 0.01               | 7.76                       | 0.88   |
| C.D. at 5%      | NS                 | 22.57                      | 2.55   |
| C.V. (%)        | 5.46               | 8.38                       | 1.86   |

\*Treatment T<sub>2</sub> to T<sub>8</sub> were applied at fifteen days interval and T<sub>9</sub> to T<sub>14</sub> were applied at fifteen days interval, alternatively till flowering

In the present investigation, viable bacterial count differed significantly after the application of Jeevamrut and Panchagavya treatments and it can be inferred from the data that maximum viable bacterial count ( $94.78 \times 10^5$  cfu/g of soil) was recorded in treatment T<sub>2</sub> i.e. Jeevamrut drenching (500 l/ha) at fifteen days interval. The most dominant group of microorganisms in soil are bacteria probably, one half of the microbial biomass. Increase in microbial population might be due to organic inputs which provide food and micro environment to the microbes by releasing CO<sub>2</sub> during the process of decomposition in the soil which helps in multiplication and growth of microbes. These results are in accordance with the findings of Patel et al. [19] and Thakur [20] who recorded increase in viable bacteria in soil after application of Jeevamrut and Panchagavya.

#### 4. CONCLUSION

Based on the results of the present investigation it is concluded that 500 l/ha of soil drenching with Jeevamrut and 8 % foliar application of Panchagavya, alternatively at fifteen days intervals upto flower initiation stage is beneficial for obtaining better growth, higher yield with and good quality flowers in 'Ratlam Selection' variety of chrysanthemum. However, Jeevamrut drenching (500 l/ha) at fifteen days intervals is beneficial for enhancing available nitrogen and viable bacterial count in the soil.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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