**Evaluation of different Organic manures on Growth and Yield of Chia (*Salvia hispanica* L.)**


## ABSTRACT

A field trial was conducted during *Rabi* 2020 and 2021 at Research Institute on Organic framing (RIOF), University of Agricultural sciences, GKVK, Bengaluru to find out the effect of organic manures on growth and yield of chia. A three factorial randomized block design was employed with first factor as nutrient sources *viz.*, $S_1$ = FYM (100%) on N equivalent basis, $S_2$= FYM+ vermicompost (50:50) ratio on N equivalent basis, $S_3$= FYM+ vermicompost (75:25) ratio on N equivalent basis, second factor *viz.*, jeevamrutha levels $J_0$ = Without jeevamrutha, $J_1$= With Jeevamrutha 1000 liters $ha^{-1}$ and panchagavya levels $P_0$= Without panchagavya, $P_1$= With Panchagavya 5% foliar spray being third factor. Pooled data of two years revealed that higher seed and haulm yield of chia (920,1480 kg $ha^{-1}$ respectively) was obtained with application of ($S_2$). Soil application of jeevamrutha ($J_1$) resulted in higher seed and haulm yield (984, 1598 kg $ha^{-1}$ respectively) and among panchagavya levels foliar application of panchagavya ($P_1$) resulted in seed and haulm yield (952,1468 kg $ha^{-1}$ respectively), besides all the growth and yield attributes were in same trend of yield.



**Key words**: Chia, Nutrient uptake, FYM, Vermicompost, Jeevamrutha, Panchagavya


## 1. INTRODUCTION

The success of industrial agriculture and the green revolution in recent decades has often masked significant externalities affecting natural resources and human health as well as agriculture itself [17]. Globally 795 million people are undernourished with a share of 12.9 percent of developing countries[9]. Currently only 150 plant species are commercialized on global level of which 12 species provide approximately 80% of calorie demand, while these grains are devoid of essential micronutrient [11]. To address this problem there is a need to broaden the field of research by exploiting neglected crop species, which have potential to gain high market value, which have traditionally played the key role in many cultures as staple food, but presently neglected as they percolated in small niches of global food system. Potential crops or underutilized crops or orphan crops or neglected crops are considered as crops of 21$^{st}$ century as they possess high nutritional profile, besides they acts as life support species in extreme environmental conditions.

Chia (*Salvia hispanica* L.) is nutri rich crop belongs to *Lamiaceae* family which played an important role in the diet of prehispanic Mexicans and had undeniable importance as rich source of nutrients. It is a pseudo cereal and its center of origin is between Mexico and Guatemala, it is becoming popular as "super food" as it is considered to be one of the greatest vegetarian source of omega (ω) 3 fatty acid (50 to 57 % ) and omega (ω) 6 fatty acid (17 to 26%), oil (24.36 % to 35%), fiber (34% to 40%), protein(16.54% to 25%), carbohydrates(26.5% to 42.12%), moisture(5.8%), vitamin A and C, niacin, antioxidants along with higher content of minerals [1]. Chia crop is a new introduction to India by Central Food Technological Research Institute (CFTRI), Mysore to the rainfed farmers of Mysore and Chamrajnagar districts of Karnataka. With increase of public health awareness, the demand for organic food products in the market is increasing. So for the profitable cultivation of chia under organic production system there is need to standardize the organic nutrients required, for higher productivity with this background a field experiment was conducted to evaluate the effect of different organic manures on growth, yield and nutrient uptake of chia.

## 2. MATERIALS AND METHODS

The study was conducted during two consecutive years of *Rabi* 2020 and *Rabi* 2021 at research and demonstration block on Research Institute of Organic farming (RIOF), University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India. Local variety of chia was selected and direct sowing was done with spacing of 90 cm ×15 cm. The nutrient sources used were Farm yard manure (FYM), vermicompost (VC), jeevamrutha (J) and panchagavya (P). A three factorial randomized block design was employed with three nutrient sources,*viz.*,$S_1$ nutrients supplied through FYM alone ($S_1$ = FYM100%), $S_2$ 50 % nutrients supplied through FYM and 50 % nutrients supplied through vermicompost ($S_2$= FYM+ vermicompost 50:50), $S_3$ 75% nutrients supplied through FYM and 25 % nutrients applied through vermicompost ($S_3$=FYM+ vermicompost 75:25), two levels of jeevamrutha $J_0$ = without jeevamrutha, $J_1$= with jeevamrutha 1000 liters (L) $ha^{-1}$ soil application and two levels of panchagavya $P_0$= without panchagavya, $P_1$= With panchagavya 5% foliar spray. The treatments were replicated thrice. The basal dose of FYM 10 t $ha^{-1}$ was applied 20 days before sowing. Treatment wise FYM was applied 15 days before sowing, whereas VC was top dressed at 30Days after sowing (DAS). Soil application of jeevamrutha @1000 L $ha^{-1}$ and foliar spray of panchagavya (5%) was done at 20, 40 and 60 DAS according to treatment. Irrigation was supplied to each and every plot at every 15 to 20 days interval. Regular weeding was done till 35-40 DAS and earthing operation was done at 40 DAS.

Nondestructive and destructive method of sampling was done to record the observations of growth and yield attributes from five randomly selected and tagged chia plants in each net plot at different intervals throughout the investigation period during two consecutive years of research. The laboratory analysis of samples were done after digestion by following standard procedures for nitrogen [2] Micro Kjeldhal method, phosphorus [7], vanadomolybdate yellow color method, potassium[7], flame photometric method content and expressed as total uptake of nutrients. Experimental data collected was subjected to statistical analysis by adopting Fishers method of analysis of variance (ANOVA) as outlined by [5]. Critical difference values were calculated whenever the F -test was significant at 5 percent level.

**Preparation of jeevamrutha**

Jeevamrutha was prepared by mixing 10 kg cow dung, 10 liters of cow urine, 2 kg organic jaggary, 2 kg pulse flour and hand full of soil collected from the field. All these were put in 200 liters' plastic drum and mixed thoroughly and volume was made up to 200 liters by adding water. The mixture was stirred well in clock wise direction thrice a day and plastic drum was kept in shade covered with wet jute bag. Jeevamrutha fermented for 10 days was applied to the wet soil by diluting in water.

**Preparation of panchagavya**

Panchagavya was prepared by mixing 7 kg fresh cow dung and 1 kg cow ghee and incubated in a container for 2 days. On third day, 10 liters of desi cow urine and 10 liters of water were added, mixed thoroughly and incubated for fermentation for 13 days. Then, 3 liters of cow milk, 2 liters of cow curd, 3 liters of organic tender coconut water, 3 kg of organic jaggary and 12 ripened cavendish bananas were added and contents were incubated for 6 days. The mixture was stirred thoroughly thrice a day at morning, afternoon and evening. Container was kept in shade and it was covered with wet jute bag. After 21 days of fermentation mixture was filtered through a cotton cloth and used for spraying. 50 ml of panchagavya was diluted with water and sprayed by knapsack sprayer according to treatment.

## 3. RESULTS AND DISCUSSION

### A. Growth attributes of chia as influenced by different sources of organic nutrients

Growth parameters of chia viz., Plant height, Leaf area and dry matter accumulation were significantly influenced organic manure application are presented in Table 1.

**Plant height (cm) of chia at harvest**

Plant height of chia varied significantly due to application of solid and liquid organic manures. Significantly higher plant height of chia (80.51 cm) was recorded due to application of 50 per cent N equivalent through FYM and 50 per cent N equivalent through VC and was found on par with application of 75 per cent N equivalent through FYM 25 per cent N equivalent vermicompost (78.79 cm), whereas lower plant height was observed with application of N equivalent 100 percent through FYM (74.53 cm). Soil application of jeevamrutha 1000 L $ha^{-1}$ recorded higher plant height of (83.56 cm) as compared to without application of jeevamrutha (72.33 cm). Foliar spray of 5% panchagavya recorded higher plant height (81.29 cm) as compared to without application of panchagavya (74.60 cm). Plant height of chia did not vary significantly due to the interaction of nutrient sources, jeevamrutha and panchagavya at harvest. The increase in plant height of chia might be due to readily available nutrient present in the manures. Application of liquid organic manures might have accelerated the soil microbial activities leading to better availability of nitrogen, which might have enhanced rapid cell division and reflected in the increase of chia plant height [8].

**Leaf area ($cm^2$) of chia at 60 DAS**

Leaf area of chia differed significantly due to application of bulky and liquid organic. Maximum leaf area (1083.32 $cm^2$) was recorded with the application 50 per cent N equivalent through FYM and 50 per cent N equivalent through VC and was found on par with application of 75 per cent N equivalent through FYM 25 per cent N equivalent vermicompost (1037.72 $cm^2$), whereas lower leaf area (1011.63 $cm^2$) was recorded with application of N equivalent 100 percent through FYM. Application of jeevamrutha 1000 L $ha^{-1}$ recorded higher leaf area (1102.88 $cm^2$) as compared to without application of jeevamrutha (985.56 $cm^2$) and foliar spar of 5% panchagavya recorded higher leaf area (1085.72 $cm^2$) as compared to without application of panchagavya (1002.73 $cm^2$). Leaf area of chia did not differ significantly due to interaction effect of solid and liquid organic manures at 60 DAS. The increase of leaf area is due to more number of branches and number of leaves per plant. Application of FYM and vermicompost and jeevamrutha might have improved the biological efficiency of chia crop by creating the greater source and increase of photosynthetic efficiency of plants[15].

**Dry matter accumulation of chia at harvest**

Significantly higher dry matter accumulation was recorded with application of 50 per cent N equivalent through FYM and 50 per cent N equivalent through VC (130.53 g) and was found on par with application of 75 per cent N equivalent through FYM 25 per cent N equivalent vermicompost (124.48 g), whereas lower leaf area was recorded with application of N equivalent 100 percent through FYM (114.93 g). Application of jeevamrutha 1000 L $ha^{-1}$ recorded higher dry matter (141.88 g) as compared to without application of jeevamrutha (104.74 g) and foliar spar of 5% panchagavya recorded higher dry matter (131.79 g) as compared to without panchagavya (114.84g). Dry matter accumulation of chia did not differ significantly due to interaction effect of solid and liquid organic manures. Favourable environment for mineralization and continuous supply of essential macro and micro nutrients, might have reflected in increased dry matter production of chia [17].

**B. Yield attributes and yield of chia as influenced by different sources of organic nutrients**

Yield attributes and yield of chia *viz*., Seed yield per plant, Seed and haulm yield were significantly influenced organic manure application are presented in Table 2.

**Seed yield per plant (g) of chia**

Seed yield per plant of chia differed significantly due to application of organic manures. Significantly higher seed yield per plant was with 50 per cent N equivalent through FYM and 50 per cent N equivalent through VC (24.50 g) and was found on par with application of 75 per cent N equivalent through FYM 25 per cent N equivalent vermicompost (23.68 g), whereas lesser seed yield per plant of chia was recorded with application of N equivalent 100 percent through FYM (22.43g). Application of jeevamrutha 1000 L $ha^{-1}$ recorded higher seed yield per plant (27.48 g) as compared to without jeevamrutha (19.23 g) and foliar spar of 5% panchagavya recorded higher seed yield per plant (26.32 g) as compared to without panchagavya (20.76 g). Interaction of jeevamrutha and panchagavya resulted in significantly higher seed yield per plant (31.80 g). The other interactions of FYM and vermicompost with jeevamrutha and panchagavya were found to be non-significant. Increase in seed yield per plant might be associated to more efficient sink formation, greater sink size and greater carbohydrates translocation from vegetative parts to seeds [4].

**Seed yield (kg $ha^{-1}$) of chia**

Significantly higher seed yield of chia was due to application 50 per cent N equivalent through FYM and 50 per cent N equivalent through VC (920 kg $ha^{-1}$) and was found on par with application of 75 per cent

N equivalent through FYM 25 per cent N equivalent vermicompost (901kg $ha^{-1}$), whereas lesser seed yield of chia was recorded with application of N equivalent 100 percent through FYM (867 kg $ha^{-1}$). Application of jeevamrutha 1000 L $ha^{-1}$ recorded seed yield (984 kg $ha^{-1}$) as compared to without jeevamrutha (809 kg $ha^{-1}$) and foliar spar of 5% panchagavya recorded higher seed yield (952 kg $ha^{-1}$) as compared to without panchagavya (841 kg $ha^{-1}$). Seed yield of chia did not differ significantly due to interaction effect of solid and liquid organic manures. The improvement in yield is due to faster mineralization of nutrients to soil which increases the soil available nutrients and enhanced the sink potential and in turn production and translocation of photosynthates to spikes[3].

**Haulm yield (kg $ha^{-1}$) of chia**

Haulm yield of chia differed significantly due to application of organic manures. Application of 50 per cent N equivalent through FYM and 50 per cent N equivalent through VC resulted significantly higher haulm yield (1480 kg $ha^{-1}$) and was found on par with application of 75 per cent N equivalent through FYM 25 per cent N equivalent vermicompost (1405 kg $ha^{-1}$), whereas lesser haulm yield of chia was recorded with application of N equivalent 100 percent through FYM (1295 kg $ha^{-1}$). Application of jeevamrutha 1000 L $ha^{-1}$ recorded haulm yield (1598 kg $ha^{-1}$) as compared to without jeevamrutha (1190 kg $ha^{-1}$) and foliar spar of 5% panchagavya recorded higher haulm yield (1486 kg $ha^{-1}$) as compared to without panchagavya (1302 kg $ha^{-1}$). Haulm yield of chia did not differ significantly due to interaction effect of solid and liquid organic manures. Haulm yield of any crop is a function of growth attributes of a crop, higher haulm yield might be due to higher growth attributes [7].



**Conclusion**

The combined use of bulky organic manures in appropriate proportion *viz*.,50 per cent N equivalent through FYM and 50 per cent N equivalent through VC along with soil application of jeevamrutha and panchagavya enhanced the growth, yield and nutrient uptake of chia crop than individual application.

The results of this trial could enlighten the knowledge on importance of adding solid organic manures by integrating with liquid organic manure in order to enhance the growth and yield of chia crop.

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| Treatments | Plant height (cm) | | | Leaf area (cm $^2$) | | | Dry matter accumulation(g) | | |
|---|---|---|---|---|---|---|---|---|---|
| | $J_0$ | $J_1$ | Mean | $J_0$ | $J_1$ | Mean | $J_0$ | $J_1$ | Mean |
| **Nutrient sources (S)** | | | | | | | | | |
| $S_1$ | 67.45 | 81.61 | **74.53** | 957.78 | 1065.47 | **1011.63** | 100.02 | 129.85 | **114.93** |
| $S_2$ | 75.34 | 85.69 | **80.51** | 1001.45 | 1165.20 | **1083.32** | 109.51 | 151.55 | **130.53** |
| $S_3$ | 74.20 | 83.39 | **78.79** | 997.47 | 1077.97 | **1037.72** | 104.70 | 144.25 | **124.48** |
| **Mean** | **72.33** | **83.56** | | **985.56** | **1102.88** | | **104.74** | **141.88** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S** | 1.49 | 4.36 | | 16.12 | 47.29 | | 2.88 | 8.45 | |
| **J** | 1.21 | 3.56 | | 13.17 | 38.61 | | 2.35 | 6.90 | |
| **S X J** | 2.10 | NS | | 22.80 | NS | | 4.07 | NS | |
| | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean |
| $S_1$ | 70.97 | 78.09 | 74.53 | 971.75 | 1051.50 | 1011.63 | 103.08 | 126.79 | 114.93 |
| $S_2$ | 76.86 | 84.17 | 80.51 | 1025.28 | 1141.37 | 1083.32 | 123.08 | 137.98 | 130.53 |
| $S_3$ | 75.98 | 81.61 | 78.79 | 1011.16 | 1064.28 | 1037.72 | 118.36 | 130.59 | 124.48 |
| **Mean** | **74.60** | **81.29** | | **1002.73** | **1085.72** | | **114.84** | **131.79** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S** | 1.21 | 3.56 | | 13.17 | 38.61 | | 2.35 | 6.90 | |
| **S X P** | 2.10 | NS | | 22.80 | NS | | 4.07 | NS | |
| | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean |
| $J_0$ | 68.40 | 76.25 | 72.33 | 953.92 | 1017.21 | 985.56 | 97.41 | 112.08 | 104.74 |
| $J_1$ | 80.80 | 86.32 | 83.56 | 1051.54 | 1154.22 | 1102.88 | 132.28 | 151.49 | 141.88 |
| **Mean** | **74.60** | **81.29** | | **1002.73** | **1085.72** | | **114.84** | **131.79** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **J X P** | 1.72 | NS | | 18.62 | NS | | 3.33 | NS | |
| **Interaction S X J X P** | $P_0$ | $P_1$ | | $P_0$ | $P_1$ | | $P_0$ | $P_1$ | |
| $S_1$ $J_0$ | 62.32 | 72.58 | | 905.82 | 1009.73 | | 90.48 | 109.56 | |
| $J_1$ | 79.61 | 83.60 | | 1037.68 | 1093.27 | | 115.67 | 144.02 | |
| $S_2$ $J_0$ | 71.44 | 79.23 | | 978.98 | 1023.91 | | 104.71 | 114.32 | |
| $J_1$ | 82.27 | 89.11 | | 1071.58 | 1258.82 | | 141.46 | 161.65 | |
| $S_3$ $J_0$ | 71.44 | 76.95 | | 976.95 | 1017.99 | | 97.03 | 112.37 | |
| $J_1$ | 80.51 | 86.26 | | 1045.36 | 1110.58 | | 139.70 | 148.81 | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S X J X P** | 2.97 | NS | | 32.25 | NS | | 5.76 | NS | |

**Table 1. Growth attributes of chia as influenced by different organic manures application at harvest**

**Note**: CD at 5%, $J_0$ = Without Jeevamrutha, $J_1$= With Jeevamrutha 1000 liters ha$^{-1}$, $P_0$= Without Panchagavya, $P_1$= With Panchagavya5%, $S_1$= FYM (100%), $S_2$= FYM+ vermicompost (50:50), $S_3$=FYM+ vermicompost (75:25), **DAS**= Days After Sowing, **NS**= non-significant

**Table2: Yield attributes and yield of chia as influenced by different organic manures application**

| Treatments | Seed yield per plant | | | Seed yield (kg ha$^{-1}$) | | | Haulm yield (kg ha$^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|---|
| | $J_0$ | $J_1$ | Mean | $J_0$ | $J_1$ | Mean | $J_0$ | $J_1$ | Mean |
| **Nutrient sources (S)** | | | | | | | | | |
| $S_1$ | 17.55 | 27.32 | **22.43** | 778 | 957 | **867** | 1085 | 1506 | **1295** |
| $S_2$ | 20.70 | 28.30 | **24.50** | 829 | 1012 | **920** | 1281 | 1679 | **1480** |
| $S_3$ | 19.45 | 27.92 | **23.68** | 819 | 982 | **901** | 1204 | 1607 | **1405** |
| **Mean** | **19.23** | **27.84** | | **809** | **984** | | **1190** | **1598** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S** | 0.45 | 1.32 | | 12.70 | 37.23 | | 36.43 | 106.85 | |
| **J** | 0.37 | 1.08 | | 10.37 | 30.40 | | 29.75 | 87.24 | |
| **S X J** | 0.64 | **NS** | | 17.95 | **NS** | | 51.52 | NS | |
| | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean |
| $S_1$ | 19.76 | 25.11 | **22.43** | 806 | 929 | **867** | 1216 | 1375 | **1295** |
| $S_2$ | 21.44 | 27.56 | **24.50** | 867 | 974 | **920** | 1359 | 1602 | **1480** |
| $S_3$ | 21.08 | 26.29 | **23.68** | 850 | 951 | **901** | 1331 | 1480 | **1405** |
| **Mean** | **20.76** | **26.32** | | **841** | **952** | | **1302** | **1486** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S** | 0.37 | 1.08 | | 10.37 | 30.40 | | 29.75 | 87.24 | |
| **S X P** | 0.64 | **NS** | | 17.95 | **NS** | | 51.52 | **NS** | |
| | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean |
| $J_0$ | 17.63 | 20.84 | **19.23** | 760 | 857 | **809** | 1091 | 1288 | **1190** |
| $J_1$ | 23.89 | 31.80 | **27.84** | 921 | 1046 | **984** | 1513 | 1683 | **1598** |
| **Mean** | 20.76 | 26.32 | | **841** | **952** | | **1302** | **1486** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **J X P** | 0.52 | 1.53 | | 14.66 | **NS** | | 42.07 | **NS** | |
| **Interaction S X J X P** | $P_0$ | $P_1$ | | $P_0$ | $P_1$ | | $P_0$ | $P_1$ | |
| $S_1$ $J_0$ | 16.31 | 18.79 | | 713 | 843 | | 1000 | 1169 | |
| $J_1$ | 23.20 | 31.43 | | 899 | 1016 | | 1433 | 1580 | |
| $S_2$ $J_0$ | 18.41 | 22.99 | | 792 | 865 | | 1162 | 1400 | |
| $J_1$ | 24.48 | 32.13 | | 941 | 1083 | | 1555 | 1803 | |
| $S_3$ $J_0$ | 18.16 | 20.73 | | 776 | 863 | | 1111 | 1296 | |
| $J_1$ | 23.99 | 31.84 | | 924 | 1040 | | 1550 | 1665 | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S X J X P** | 0.90 | **NS** | | 25.39 | NS | | 72.86 | **NS** | |

**Note**: CD at 5%, $J_0$ = Without Jeevamrutha, $J_1$= With Jeevamrutha 1000 liters ha$^{-1}$, $P_0$= Without Panchagavya, $P_1$= With Panchagavya5%, $S_1$= FYM (100%), $S_2$= FYM+ vermicompost (50:50), $S_3$=FYM+ vermicompost (75:25), **DAS**= Days After Sowing, **NS**= non-significant

**Table 3: Nutrient uptake of chia as influenced by different organic manures application at harvest**

| Treatments | Nitrogen uptake (kg ha$^{-1}$) | | | Phosphorus uptake (kg ha$^{-1}$) | | | Potassium uptake (kg ha$^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|---|
| | $J_0$ | $J_1$ | Mean | $J_0$ | $J_1$ | Mean | $J_0$ | $J_1$ | Mean |
| **Nutrient sources (S)** | | | | | | | | | |
| $S_1$ | 22.15 | 34.59 | **28.37** | 3.96 | 6.04 | **5.00** | 30.24 | 47.15 | **38.69** |
| $S_2$ | 27.16 | 44.99 | **36.08** | 4.83 | 7.10 | **5.96** | 37.06 | 60.65 | **48.86** |
| $S_3$ | 27.00 | 41.25 | **34.13** | 4.63 | 6.64 | **5.64** | 35.66 | 55.21 | **45.44** |
| **Mean** | **25.44** | **40.28** | | **4.47** | **6.59** | | **34.32** | **54.34** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S** | 0.48 | 1.40 | | 0.11 | 0.32 | | 1.17 | 3.44 | |
| **J** | 0.39 | 1.14 | | 0.09 | 0.26 | | 0.96 | 2.81 | |
| **S X J** | 0.67 | NS | | 0.15 | **NS** | | 1.66 | **NS** | |
| | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean |
| $S_1$ | 24.51 | 32.23 | **28.37** | 4.44 | 5.56 | **5.00** | 34.33 | 43.06 | **38.69** |
| $S_2$ | 30.78 | 41.37 | **36.08** | 5.33 | 6.59 | **5.96** | 40.62 | 57.09 | **48.86** |
| $S_3$ | 30.26 | 37.99 | **34.13** | 5.15 | 6.12 | **5.64** | 40.20 | 50.67 | **45.44** |
| **Mean** | **28.52** | **37.20** | | **4.98** | **6.09** | | **38.39** | **50.27** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S** | 0.39 | 1.14 | | 4.44 | 5.56 | | 0.96 | 2.81 | |
| **S X P** | 0.67 | **NS** | | 5.33 | 6.59 | | 1.66 | **NS** | |
| | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean | $P_0$ | $P_1$ | Mean |
| $J_0$ | 22.60 | 28.28 | **25.44** | 4.00 | 4.95 | **4.47** | 30.64 | 38.00 | **34.32** |
| $J_1$ | 34.44 | 46.12 | **40.28** | 5.96 | 7.23 | **6.59** | 46.13 | 62.55 | **54.34** |
| **Mean** | **28.52** | **37.20** | | **4.98** | **6.09** | | **38.39** | **50.27** | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **J X P** | 0.55 | 1.62 | | 0.13 | **NS** | | 1.35 | 3.97 | |
| **Interaction S X J X P** | $P_0$ | $P_1$ | | $P_0$ | $P_1$ | | $P_0$ | $P_1$ | |
| $S_1$ $J_0$ | 18.93 | 25.38 | | 3.42 | 4.50 | | 26.56 | 33.92 | |
| $J_1$ | 30.10 | 39.08 | | 5.46 | 6.62 | | 42.10 | 52.19 | |
| $S_2$ $J_0$ | 24.55 | 29.78 | | 4.33 | 5.33 | | 33.01 | 41.12 | |
| $J_1$ | 37.02 | 52.96 | | 6.34 | 7.86 | | 48.24 | 73.06 | |
| $S_3$ $J_0$ | 24.32 | 29.68 | | 4.23 | 5.04 | | 32.37 | 38.95 | |
| $J_1$ | 36.19 | 46.31 | | 6.08 | 7.21 | | 48.04 | 62.39 | |
| | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | | **S.Em ±** | **C.D.** | |
| **S X J X P** | 0.95 | **NS** | | 0.22 | **NS** | | 2.35 | **NS** | |

**Note**: CD at 5%, $J_0$ = Without Jeevamrutha, $J_1$= With Jeevamrutha 1000 liters ha$^{-1}$, $P_0$= Without Panchagavya, $P_1$= With Panchagavya5%, $S_1$= FYM (100%), $S_2$= FYM+ vermicompost (50:50), $S_3$=FYM+ vermicompost (75:25), **DAS**= Days After Sowing, **NS**= non-significant