*Original Research Article*

# Influence of organics on productivity and economics of summer greengram [*Vigna radiata* (L.) Wilczek]


## ABSTRACT

A field experiment was executed to investigate the impact of organic fertilizers and organic sprays on the yield and economic aspects of summer greengram cultivation. The experiment followed a split plot design with three replications. The main plots encompassed four organic fertilizer treatments: Control (M1), Farm yard manure (M2), Vermicompost (M3), and Poultry manure (M4). The sub-plots included three organic spray treatments: Control (S1), Panchagavya (S2), and Jeevamrutha (S3).

The outcomes indicated that the utilization of poultry manure in conjunction with panchagavya spray resulted in the highest seed yield (779 kg $ha^{-1}$) and haulm yield (1909 kg $ha^{-1}$) for summer greengram. Additionally, this particular combination exhibited elevated gross returns (₹ 48,648 ha-1), net returns (₹ 30,125 $ha^{-1}$), and a favorable benefit-cost ratio (2.60).



**Key words**: Greengram, Organic sprays, *Panchagavya*, *Jeevamrutha*, Seed yield, Economics.


## INTRODUCTION

In India, the cultivation of pulses spans across approximately 23.55 million hectares, resulting in an annual production of 17.15 million tonnes, with an average yield of 728 kg per hectare. Specifically, in Andhra Pradesh, pulses are grown across 1.04 million hectares, yielding around 0.95 million tonnes and exhibiting a productivity of 911 kg per hectare (Indiastat, 2014-15).

Within the rainfed and irrigated conditions of the Southern Agro-climatic zone of Andhra Pradesh, crops are sown during the kharif season to make use of rainfall and during rabi season to capitalize on residual moisture, allowing for fields to remain fallow in summer, from February to April. Recognizing this vacant period, the introduction of summer greengram into the cropping system is proposed to address the demand for pulses.

Summer greengram is a suitable addition due to its brief maturity period of only 60 to 65 days, allowing it to fit neatly within the available time frame. It thrives solely on residual moisture and requires minimal farming inputs. The rapid growth habit of summer greengram requires limited agronomic attention, while its ability to cover the ground swiftly handles weed issues, often within 2 to 3 weeks of sowing.

The extensive use of agricultural chemicals has weakened the ecological foundation and led to soil and water resource degradation, along with a decline in food quality. This has prompted a surge of interest in adopting "Organic Farming" as a solution to the challenges posed by modern chemical-based agriculture. Organic farming not only sustains crop production but also nurtures the environment.

Organic amendments like farmyard manure (FYM), vermicompost, and poultry manure improve soil organic carbon levels, enhance soil water retention, promote soil structure, and make micro and macro nutrients more accessible, ultimately boosting soil quality and crop output. These organic practices also stimulate soil microorganisms, which in turn enhance nutrient solubility and availability to plants. Organic products such as panchagavya and jeevamrutha play a significant role in promoting plant growth and immunity. They offer essential nutrients, growth-promoting hormones, and beneficial microorganisms like lactic acid bacteria, yeast, actinomycetes, and photosynthetic bacteria. These microorganisms, along with well-established fertilizers like azotobacter, azospirillum, and phosphobacterium, contribute to improving soil health, crop growth, and yield.

In light of these considerations, the integration of summer greengram and the adoption of organic farming practices present promising avenues for enhancing sustainable crop production and preserving the ecosystem



## MATERIAL AND METHODS

In the summer season of 2017, a field experiment was executed at S.V. Agricultural College Farm in Tirupati. The soil used for the experiment had a sandy loam texture, neutral pH (6.8), low organic carbon content (0.38 percent), and a limited availability of nitrogen (150 kg $ha^{-1}$). It featured a medium availability of phosphorus (12 kg $ha^{-1}$) and a high availability of potassium (161 kg $ha^{-1}$).

The experimental setup followed a split plot design with three replications. The primary plot encompassed four distinct organic manure treatments: Control (M1), Farm yard manure (M2) at a rate of 10 t $ha^{-1}$, Vermicompost (M3) at 2 t $ha^{-1}$, and Poultry manure (M4) at 2 t $ha^{-1}$. The sub-plots included three organic spray treatments: Control (S1), Panchagavya (S2) at a spray concentration of 3 percent, and Jeevamrutha (S3) as a direct spray without dilution at a rate of 200 l $ha^{-1}$.

The designated organic manures were thoroughly integrated into the soil 15 days before sowing the crop. Panchagavya was prepared a month ahead of its application, while jeevamrutha was prepared 2-5 days before being applied to the greengram crop. The application of panchagavya was initiated 10 days after sowing and continued until 10 days before the harvest period.

## RESULTS AND DISCUSSION

### Yield attributes

Yield attributes, including the number of pods per plant, pod length, number of seeds per pod, and test weight of greengram, were influenced by various organic manures and organic sprays. The exception was the number of pods per plant, which was impacted not only by different organic manures and organic sprays individually but also by their combined interaction. Conversely, the number of seeds per pod remained unaffected by any of the organic treatments (refer to Table 1).

Among the treatments, plots enriched with poultry manure displayed the highest yield attributes, outperforming all other treatments. The subsequent favorable treatment was the incorporation of vermicompost, followed by farm yard manure. Conversely, plots without any organic manure recorded a lower number of pods per plant. This phenomenon can be attributed to the more robust and vigorous vegetative growth, which consequently facilitated a more efficient allocation of nutrients from source to sink. Similar observations were made by Yadav *et al.* (2007) and Rao *et al.* (2013).

Furthermore, higher yield attributes were evident in plots where panchagavya was utilized as a spray, closely followed by the effects of jeevamrutha spray. On the contrary, untreated plots showed inferior yield attributes. This outcome can be attributed to an enhanced supply of essential nutrients to the plants, which promoted robust vegetative growth, heightened photosynthetic activity, and efficient translocation and accumulation of photosynthates in economically valuable parts of the plant. This conclusion aligned with the findings of Patil *et al.* (2012), Chaudhari *et al.* (2013), and Jadhav and Kulkarni (2016).

**Table 1. Yield attributes of greengram as influenced by different organic manures and organic sprays**

| Treatments | Number of pods plant$^{-1}$ * | Length of the pod (cm) | Number of seeds pod$^{-1}$ | Test weight (g) |
|---|---|---|---|---|
| **Organic manures** | | | | |
| $M_1$ – Control | 18.9 | 8.6 | 11.8 | 22.70 |
| $M_2$ - FYM @ 10 t ha$^{-1}$ | 26.0 | 8.8 | 12.3 | 23.03 |
| $M_3$ - Vermicompost @ 2 t ha$^{-1}$ | 29.6 | 9.3 | 12.1 | 23.74 |
| $M_4$ - Poultry manure @ 2 t ha$^{-1}$ | 31.7 | 9.4 | 12.6 | 25.50 |
| **SEm±** | 0.39 | 0.10 | 0.17 | 0.51 |
| **CD (P=0.05)** | 1.3 | 0.3 | N.S. | 1.8 |
| **Organic sprays** | | | | |
| $S_1$ - Control | 23.2 | 8.8 | 11.8 | 21.87 |
| $S_2$ - *Panchagavya* as 3 % spray | 29.9 | 9.4 | 12.5 | 25.29 |
| $S_3$ - *Jeevamrutha* without dilution @ 200 l ha$^{-1}$ | 26.6 | 8.9 | 12.3 | 24.07 |
| **SEm±** | 0.48 | 0.14 | 0.28 | 0.388 |
| **CD (P=0.05)** | 1.4 | 0.4 | N.S. | 1.16 |
| **Interaction** | | | | |

| S at M | | | | |
|---|---|---|---|---|
| **SEm±** | 0.68 | 0.17 | 0.30 | 0.879 |
| **CD (P=0.05)** | 2.9 | N.S. | N.S. | N.S. |
| **M at S** | | | | |
| **SEm±** | 0.87 | 0.25 | 0.48 | 0.812 |
| **CD (P=0.05)** | 2.7 | N.S. | N.S. | N.S. |

* Interaction table furnished separately

**Table 2. Number of pods plant$^{-1}$ of greengram as influenced by interaction of organic manures and organic sprays**

| **Treatments** | **Organic manures** | | | | |
|---|---|---|---|---|---|
| **Organic sprays** | **$M_1$** | **$M_2$** | **$M_3$** | **$M_4$** | **Mean** |
| **$S_1$** | 17.0 | 23.7 | 29.6 | 31.7 | 23.2 |
| **$S_2$** | 20.7 | 31.0 | 32.7 | 35.0 | 29.9 |
| **$S_3$** | 19.0 | 23.3 | 31.3 | 32.7 | 26.6 |
| **Mean** | 18.9 | 26.0 | 29.6 | 31.7 | |

The interaction between organic manures and organic sprays yielded noteworthy results, notably in the case of the number of pods per plant. The combination of poultry manure and panchagavya spray exhibited the highest number of pods per plant (as indicated in Table 2), a significant improvement over other combinations and notably higher than the count achieved with no manure and no organic spray. These significant interactions between organic manures and sprays in relation to yield attributes corroborated the findings of Rao *et al.* (2013).

**Table 3. Seed yield and haulm yield (kg ha$^{-1}$) of greengram as influenced by different organic manures and organic sprays**

| **Treatments** | **Seed yield** | **Haulm yield** |
|---|---|---|
| **Organic manures** | | |

| | | |
|---|---|---|
| $M_1$ – Control | 444 | 1023 |
| $M_2$ - FYM @ 10 t $ha^{-1}$ | 642 | 1635 |
| $M_3$ - Vermicompost @ 2 t $ha^{-1}$ | 670 | 1816 |
| $M_4$ - Poultry manure @ 2 t $ha^{-1}$ | 726 | 1852 |
| **SEm$\pm$** | 8.9 | 27.5 |
| **CD (P=0.05)** | 31 | 95 |
| **Organic sprays** | | |
| $S_1$ - Control | 529 | 1482 |
| $S_2$ - *Panchagavya* as 3 % spray | 672 | 1642 |
| $S_3$ - *Jeevamrutha* without dilution @ 200 l $ha^{-1}$ | 660 | 1620 |
| **SEm$\pm$** | 5.6 | 17.4 |
| **CD (P=0.05)** | 17 | 52 |
| **Interaction** | | |
| **S at M** | | |
| **SEm$\pm$** | 15.5 | 47.6 |
| **CD (P=0.05)** | N.S. | N.S. |
| **M at S** | | |
| **SEm$\pm$** | 12.9 | 39.6 |
| **CD (P=0.05)** | N.S. | N.S. |

**Seed yield and Haulm yield**

Poultry manure incorporation resulted in the highest seed yield among the treatments, significantly surpassing the other options (refer to Table 3). Following this, vermicompost exhibited the next best performance, although it was on par with farm yard manure. Both of these were notably superior to the control treatment. Regarding haulm yield, poultry manure treatment led to the highest production, comparable with vermicompost and farm yard manure, and notably surpassing the control treatment. Conversely, the lowest haulm yield was observed in the control group.

The increased seed and haulm yield can be attributed to the heightened provision of essential plant nutrients facilitated by the translocation of photosynthates accumulated through the influence of organic nutrient sources. This translocation and subsequent accumulation in the economically valuable parts of the plant contributed to enhanced yield attributes, elevated chlorophyll content, and increased nitrate reductase activity, resulting in improved grain yield. This aligns with the findings of Anil Kumar *et al.* (2007), Rao *et al.* (2013), and Singh *et al.* (2015).

Regarding the organic sprays, panchagavya application led to higher seed and haulm yield, on par with the results obtained from jeevamrutha application, with no significant difference between the two. Conversely, the control group yielded lower seed and haulm yield. The increased seed and haulm yield in response to panchagavya could be attributed to the presence of IAA and GA in the spray, stimulating plant responses and leading to increased production of growth regulators within the cellular system. The ensuing action of these growth regulators within the plant system encouraged essential growth and development processes, along with improved translocation and accumulation of photosynthates from source to sink, ultimately enhancing grain yield. These findings correlate with the outcomes of studies conducted by Somasundaram *et al.* (2007), Swaminathan et al. (2007), Chaudhari *et al*. (2013), and Yadav and Tripathi (2013).

When considering the combined effect of organic manures and organic sprays, the application of poultry manure in conjunction with panchagavya spray resulted in the highest seed yield (779 kg ha$^{-1}$) and haulm yield (1909 kg ha$^{-1}$) for summer greengram, outperforming the individual application of organic manures and organic sprays.

**Table 4. Gross return (ha$^{-1}$), net return (ha$^{-1}$) and B C ratio of greengram as influenced by different organic manures and organic sprays**

| Treatments | Gross return | Net return | B C ratio |
|---|---|---|---|
| **Organic manures** | | | |
| $M_1$ - Control | 27,683 | 12,440 | 1.79 |
| $M_2$ - FYM @ 10 t ha$^{-1}$ | 40,343 | 19,989 | 1.99 |
| $M_3$ - Vermicompost @ 2 t ha$^{-1}$ | 42,016 | 10,824 | 1.30 |
| $M_4$ - Poultry manure @ 2 t ha$^{-1}$ | 45,429 | 27,936 | 2.56 |
| **SEm±** | 577.7 | 411.4 | 0.044 |
| **CD (P=0.05)** | 1,994 | 1420 | 0.15 |
| **Organic sprays** | | | |
| $S_1$ – Control | 33,235 | 14,173 | 1.80 |
| $S_2$ - *Panchagavya* as 3 % spray | 41,962 | 19,831 | 1.99 |
| $S_3$ - *Jeevamrutha* without dilution @ 200 l ha$^{-1}$ | 41,406 | 19,389 | 1.94 |
| **SEm±** | 353.7 | 302.7 | 0.031 |
| **CD (P=0.05)** | 1,060 | 907 | 0.09 |
| **Interaction** | | | |
| **S at M** | | | |
| **SEm±** | 1000.7 | 712.7 | 0.077 |
| **CD (P=0.05)** | 2,281 | 1,927 | 0.20 |
| **M at S** | | | |
| **SEm±** | 817.0 | 643.2 | 0.068 |
| **CD (P=0.05)** | 2,634 | 2,047 | 0.21 |

## Economics

Poultry manure application yielded the highest gross return among the experimented treatments, clearly outperforming all others (refer to Table 4). Following this, vermicompost emerged as the next favourable option, closely aligned with farm yard manure. In contrast, the control treatment resulted in a lower gross return. Notably, poultry manure treatment led to the highest net return and benefit-cost (B C) ratio, significantly surpassing all other treatments. Farm yard manure treatment followed, and the subsequent best results were observed in the control group. Vermicompost treatment yielded a lower net return and B C ratio. The increased gross return can be attributed to improved crop nutrition, resulting in enhanced grain and haulm yield. Similar outcomes were reported by Yadav and Tripathi (2013) and Rao *et al.* (2013).

Regarding organic sprays, panchagavya application led to higher gross return, net return, and B C ratio, on par with the performance of jeevamrutha. Conversely, the control group exhibited a lower gross return. The elevated gross return can be attributed to improved crop nutrition due to consistent application of organic sprays, resulting in heightened grain and haulm yield.

## Conclusion

the experiment established that achieving high greengram production is attainable through the pre-sowing incorporation of poultry manure at a rate of 2 t ha$^{-1}$, coupled with the application of 3% panchagavya spray at 10 days intervals.

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