



Impact of Spacing and Foliar Spray of Liquid Organic Manures on Growth and Yield of *Zaid* Groundnut (*Arachis hypogea*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted on groundnut during *Zaid* 2022 at crop research farm of SHIATS, Allahabad to find out the effect of foliar spray of liquid organic manures and spacing on growth and yield of *Zaid* groundnut. The spacing of 60 x 10 cm along with the application of Panchagavya 3% had significant and positive effect on growth and yield of groundnut with increased plant height, number of branches, plant dry weight, number of pods/ plants, 100 pod weight, seed index and pod yield. Therefore, treatment combination of 60 x 10 cm spacing along with the application of Panchagavya 3% was most productive and cost effective.

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1. INTRODUCTION

“Groundnut (*Arachis hypogea* L.) the king of oilseed crops plays a vital role in the economy of national edible oil. It belongs to family Fabaceae (Leguminosae) and genus *Arachis* and species *hypogea*. The word *Arachis hypogea* has been derived from Greek word, *Arachis* meaning legume, *hypogea* meaning below ground. Groundnut is well recognized by different names peanut, earthnut, monkey nut, manila nut etc. It is also called as wonder nut and poor men’s cashew nut as its kernels contain about 25% protein which is about 1.3 times higher than meat, 2.5 times higher than eggs and 8 times higher than fruits. The oil content of kernels ranges from 40-50 % and is extensively used for cooking purpose. India is the second largest producer of groundnut after China. Groundnut ranks first among the oilseed crops in India contributing 33% of the world’s production and 40% of area. Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra are the major groundnut producing states in India, contributing more than 80% of total groundnut production. Among all the oilseed crops, groundnut accounts for more than 40% acreage and 60% production in the country and ranks first place among the oilseed crops in India” [1].

“Plant density (Plant spacing) is an efficient management tool for maximizing grain yield by increasing the capture of solar radiation within the canopy thereby increasing land use efficiency. The plant population is often determined by the various attributes which are largely under grower control and one of the major aspects of crop ecology, production and management which often limit crop production is improper crop density in field” [2].

The continuous and imbalanced use of chemical fertilizers alone has resulted in deterioration of soil health and lower productivity of groundnut. There is need for enriching the soil with organic matter in the rooting zone in vertisols to enhance aeration and pod development in groundnut. Over the last few years, the importance and use of panchagavya and other liquid of Organic formulations in promoting good vegetative growth, providing immunity to the plant and increasing yield have been recognized and acknowledged among many organic farmers. These liquid organic formulations are prepared with on-farm materials available with farmers

which are known to be rich sources of naturally occurring microflora mainly lactic acid bacteria, yeast, photosynthetic bacteria, actinomycetes, nitrogen-fixing bacteria, phosphorus solubiliser and fungi [3]

In this connection the present study was taken up to study the impact of various combinations of spacings and different liquid organic manure spray application on growth and yield of *zaid* groundnut.

2. MATERIALS AND METHODS

The field experiment was conducted at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The farm is situated at 25° 57'12" N latitudes, 87° 50'12" E longitude and an altitude of 98 meters above mean sea level. This area is situated on the right side of the river Yamuna and the opposite side of Allahabad city. The research experimental plot was laid out in randomized block design consisting of ten treatment combinations each replicated thrice. The treatments combinations consist of different spacings and foliar application of various organic manures i.e., (T₁) 50 x 10 cm + Panchagavya (3%), (T₂) 50 x 10 cm + Vermiwash (3%), (T₃) 50 x 10 cm + Cow urine (10%), (T₄) 60 x 10 cm + Panchagavya (3%), (T₅) 60 x 10 cm + Vermiwash (3%), (T₆) 60 x 10 cm + Cow urine (10%), (T₇) 70 x 10 cm + Panchagavya (3%), (T₈) 70 x 10 cm + Vermiwash (3%), (T₉) 70 x 10 cm + Cow urine (10%), (T₁₀) Control; 30 x 10 cm + RDF (20- 40-40). “Five random plants were selected from each plot to record observations on plant growth attributes. Similarly, five random plant samples were collected from each plot at the time of harvest for recording observations on plant yield attributes. Experimental data collected was subjected to statistical analysis by adopting Fisher’s method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez [4]. Critical Difference value were calculated whenever the ‘F’ test was found significant at 5% level” [5].

3. RESULTS AND DISCUSSION

Plant height of groundnut increased towards maturity with proper spacing and foliar application of organic manures. In 20 there was no significant difference among the treatments.

However, maximum plant height was recorded in T₄ (60 x 10 cm + Panchagavya 3%) of about 12.10 cm and significantly minimum plant height was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 8.41 cm. In 40 DAS, the significantly higher plant height was recorded in T₄ (60 x 10 cm + Panchagavya 3%) of about 25.70 cm and was statistically on par with (60 x 10 cm + Cow urine 10%) which recorded 24.75 cm. The significantly lower plant height was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 17.87 cm. In 60 DAS, maximum plant height was recorded in T₄ (60 x 10 cm + Panchagavya 3%) of about 43.50 cm and was on par with T₆ (60 x 10 cm + Cow urine 10%) which recorded 24.75 cm. Significantly minimum plant height was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 30.25 cm. At harvest, significantly maximum plant height was recorded in T₄ (60 x 10 cm + Panchagavya 3%) of about 69.91 cm and was followed by T₆ (60 x 10 cm + Cow urine 10%) which recorded 24.75 cm. Minimum plant height was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 48.61 cm.

“Spacing practices had significant effects on plant height may be due to an optimum spacing resulted in lesser competition for sunlight, water, nutrients and space between the plants which resulted in higher plant height. This is due to the enhanced growth rate of plant since it contains the favourable macro and micro nutrients, growth hormones and biofertilizers in liquid formation more over the presence of growth enzymes in it favours rapid cell division and elongation. Thus, it is essential for the general growth and vigor of the plants” [5,6].

The maximum plant dry weight was recorded at 20, 40, 60 DAS and at harvest stage in T₄ (60 x 10 cm + Panchagavya 3%) of about 4.6 g, 10.6 g, 19.4 g and 25.3 g plant⁻¹ respectively followed by T₆ (60 x 10 cm + Cow urine 10%) which recorded 4.4 g, 18.7g, 19.4 g and 24, g plant⁻¹ respectively. Lesser plant dry weight was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 3.2 g, 7.4 g, 13.5 g and 17.6 g plant⁻¹ respectively.

“Application of panchagavya will boost up the plant growth attributes will lead to accumulation of growth regulators which leads enhancement in the photosynthesis” [7]. “Highest dry matter production was observed in 60x10 cm spacing due to better photosynthetic activity, due to

greater exposure of sunlight, and increased availability of nutrients. Dry matter production increased steadily with advancing growth stages and reached the maximum at harvest. The DMP (kg/ha) was found to be more with spacing of 60 x 10 cm, which could be attributed to higher population and accumulation of nutrients/unit area compared to other spacing” Sathyamoorthi et al. [8].

3.1 Yield Attributes and Yield

No. of pods plant⁻¹ was recorded after harvest of the crop. It was found to be maximum with T₄ (60 x 10 cm + Panchagavya 3%) of about 59.5 no. of pods plant⁻¹. However, it was statistically on par with T₆ (60 x 10 cm + Cow urine 10%) which recorded 57.3 no. of pods plant⁻¹. Minimum was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 50.3 no. of pods plant⁻¹. No. of seeds pod⁻¹ was recorded after harvest of the crop. It was found to be maximum with T₄ (60 x 10 cm + Panchagavya 3%) of about 1.87 no. of seeds pod⁻¹. However, it was statistically on par with T₆ (60 x 10 cm + Cow urine 10%) which recorded 1.80 no. of seeds pod⁻¹. Minimum was recorded in T₁₀ (Control 30 x 10 cm with RDF) of about 1.30 no. of seeds pod⁻¹.

“The beneficial effects of panchagavya addition were also related to improvement in soil physical properties. The beneficial response of panchagavya to yield attributes and yield of pods might also be attributed to the availability of sufficient amounts of readily usable form of plant nutrients throughout the growth period and specially at critical growth periods of crop resulting in better uptake, plant vigour and superior yield attributes” [9]. “Crop yield attributes in the complex function of physiological processes and biochemical activities, modify plant anatomy and morphology of the growing plant. No. of pods/plant and No. of seeds/pods was significantly influenced by different treatments of panchagavya application. This might be attributed to the favourable effect on vegetative growth; plant height and reproductive growth. Row spacing was significantly impacted on yield attributes and were vary due to change in row spacing”. Verma et al. [10]. “Higher number of pods/plants might have been possible due to more vigour and strength attained by the plants as a result of better photosynthetic activities with sufficient availability of light, and supply of nutrients in balanced quantity of the plants at growing stages” [11].

Table 1. Effect of row spacing and liquid organic manures on plant height (cm) and dry matter weight (g plant⁻¹)

| Treatments | | Plant height (cm) | | | | Dry matter weight (g plant ⁻¹) | | | |
|----------------------------|---|-------------------|--------|--------|---------|--|--------|--------|---------|
| | | 20DAS | 40 DAS | 60 DAS | Harvest | 20DAS | 40 DAS | 60 DAS | Harvest |
| T ₁ | 50 x 10 cm + Panchagavya (3%) | 10.99 | 23.35 | 39.52 | 63.52 | 4.2 | 9.7 | 17.6 | 23.0 |
| T ₂ | 50 x 10 cm + Vermiwash (3%) | 9.92 | 21.07 | 35.66 | 57.32 | 3.8 | 8.7 | 15.9 | 20.8 |
| T ₃ | 50 x 10 cm + Cow urine (10%) | 10.35 | 21.98 | 37.20 | 59.79 | 3.9 | 9.1 | 16.6 | 21.6 |
| T ₄ | 60 x 10 cm + Panchagavya (3%) | 12.10 | 25.70 | 43.50 | 69.91 | 4.6 | 10.6 | 19.4 | 25.3 |
| T ₅ | 60 x 10 cm + Vermiwash (3%) | 10.17 | 21.61 | 36.58 | 58.78 | 3.9 | 8.9 | 16.3 | 21.3 |
| T ₆ | 60 x 10 cm + Cow urine (10%) | 11.65 | 24.75 | 41.89 | 67.32 | 4.4 | 10.2 | 18.7 | 24.4 |
| T ₇ | 70 x 10 cm + Panchagavya (3%) | 10.87 | 23.08 | 39.07 | 62.79 | 4.1 | 9.6 | 17.4 | 22.7 |
| T ₈ | 70 x 10 cm + Vermiwash (3%) | 9.55 | 20.29 | 34.34 | 55.19 | 3.6 | 8.4 | 15.3 | 20.0 |
| T ₉ | 70 x 10 cm + Cow urine (10%) | 10.24 | 21.75 | 36.82 | 59.17 | 3.9 | 9.0 | 16.4 | 21.4 |
| T ₁₀ | Control 30 x 10 cm (RDF 20- 40-40 NPK kg ha ⁻¹) | 8.41 | 17.87 | 30.25 | 48.61 | 3.2 | 7.4 | 13.5 | 17.6 |
| SEm (±) CD (P=0.05) | | NS | 0.37 | 0.61 | 0.56 | 0.052 | 0.115 | 0.300 | 0.347 |
| | | NS | 1.10 | 1.83 | 1.69 | 0.156 | 0.342 | 0.881 | 1.032 |

Table 2. Effect of row spacing and liquid organic manures on number of pods plant⁻¹, number of seeds pod⁻¹, pod yield (kg ha⁻¹), haulm yield (kg ha⁻¹)

| Treatments | | No. of pods plant ⁻¹ | No. of seeds pod ⁻¹ | Pod yield (kg ha ⁻¹) | Haulm yield (kg ha ⁻¹) |
|----------------------------|---|---------------------------------|--------------------------------|----------------------------------|------------------------------------|
| T ₁ | 50 x 10 cm + Panchagavya (3%) | 54.0 | 1.70 | 2774 | 5013 |
| T ₂ | 50 x 10 cm + Vermiwash (3%) | 48.8 | 1.53 | 2503 | 4914 |
| T ₃ | 50 x 10 cm + Cow urine (10%) | 50.9 | 1.60 | 2611 | 4982 |
| T ₄ | 60 x 10 cm + Panchagavya (3%) | 59.5 | 1.87 | 3053 | 5142 |
| T ₅ | 60 x 10 cm + Vermiwash (3%) | 50.0 | 1.57 | 2567 | 4921 |
| T ₆ | 60 x 10 cm + Cow urine (10%) | 57.3 | 1.80 | 2940 | 5050 |
| T ₇ | 70 x 10 cm + Panchagavya (3%) | 53.4 | 1.68 | 2742 | 4993 |
| T ₈ | 70 x 10 cm + Vermiwash (3%) | 46.9 | 1.48 | 2410 | 4886 |
| T ₉ | 70 x 10 cm + Cow urine (10%) | 50.3 | 1.58 | 2584 | 4955 |
| T ₁₀ | Control 30 x 10 cm (RDF 20-40- 40 NPK kg ha ⁻¹) | 41.4 | 1.30 | 2123 | 4566 |
| SEm (±) CD (P=0.05) | | 0.76 | 0.27 | 48.43 | 82.0 |
| | | 2.27 | 0.07 | 143.91 | 243.32 |

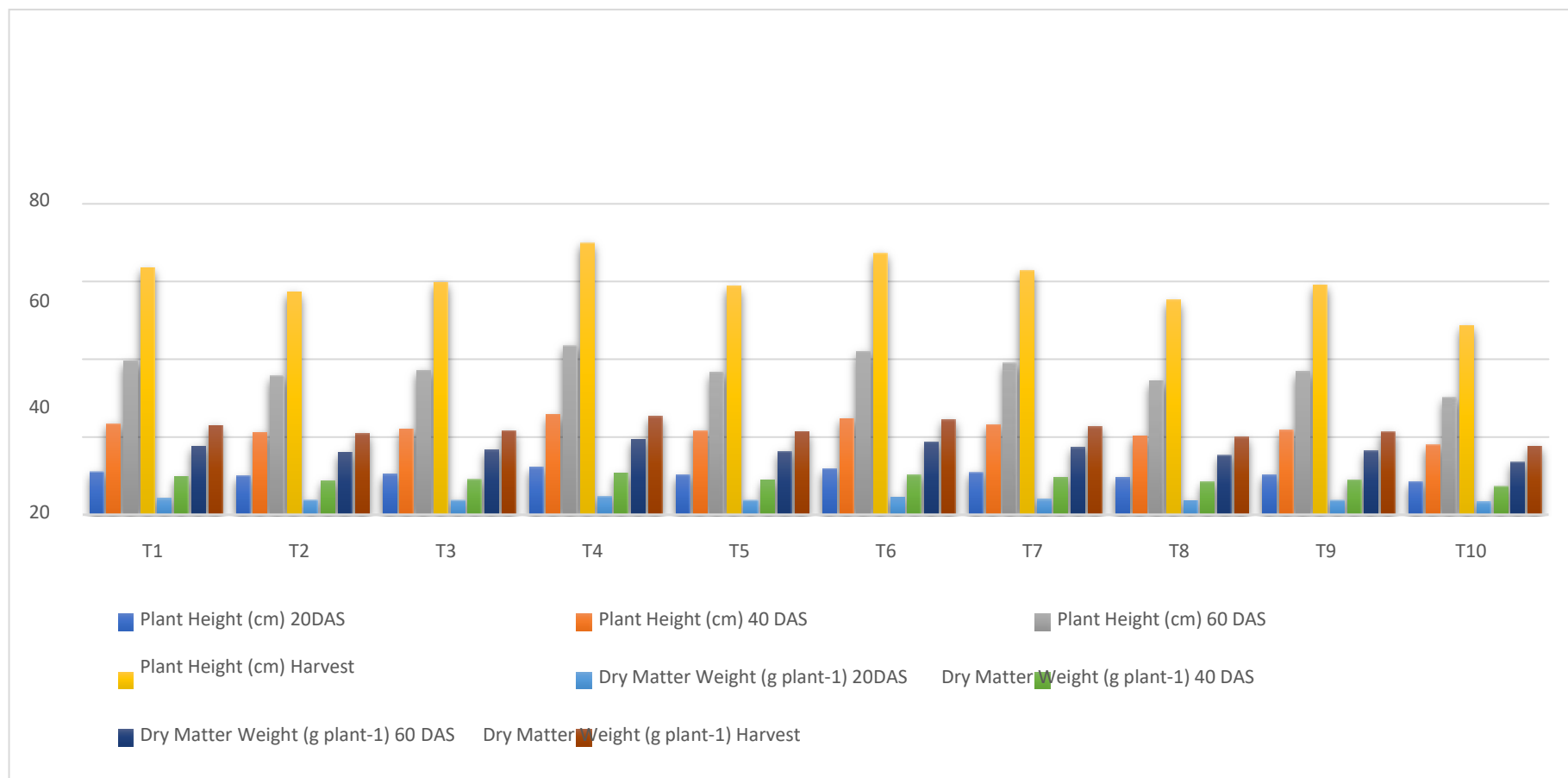


Fig. 1. Effect of treatments on plant height and dry matter production

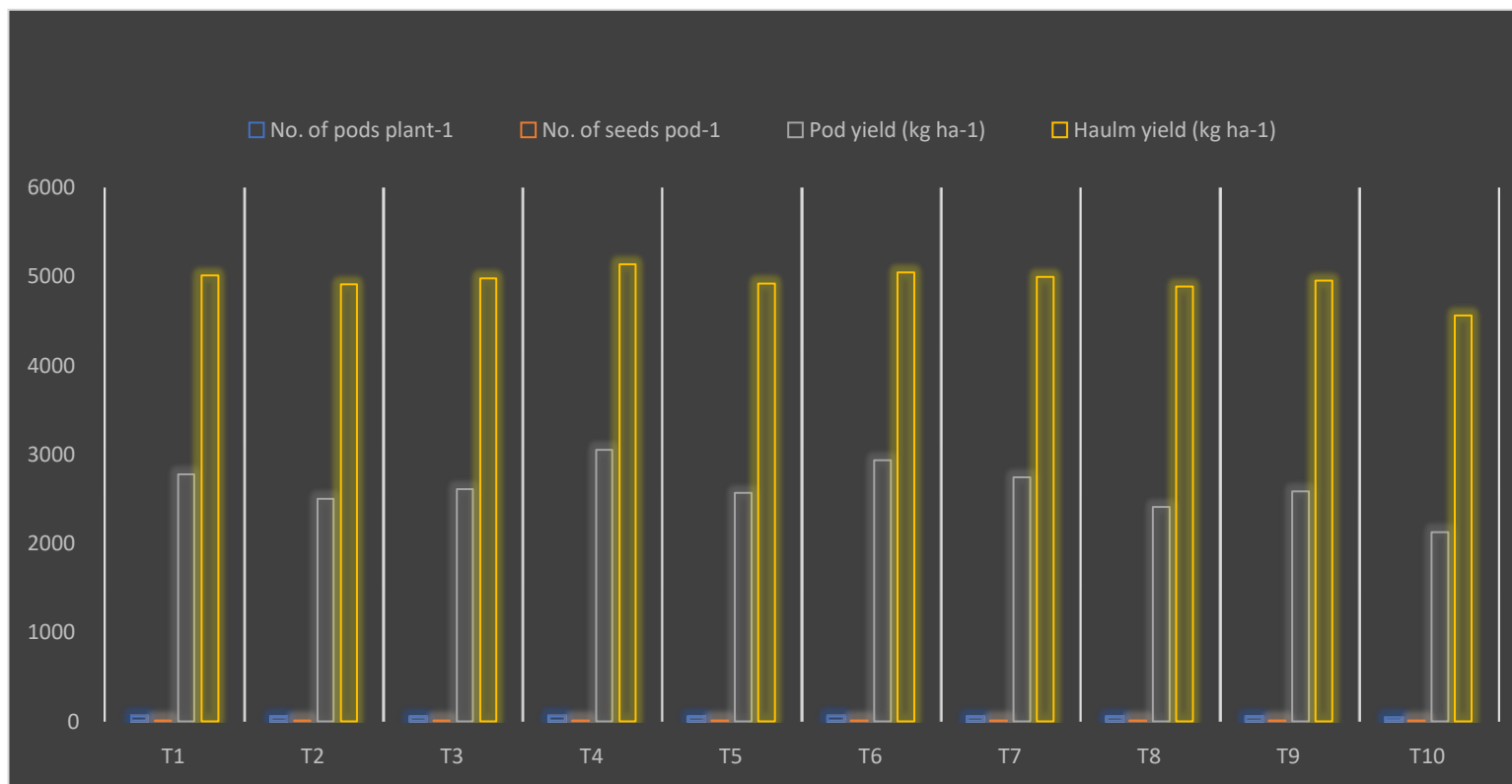


Fig. 2. Effect of treatments on yield attributes and yield

Pod yield was found to be maximum with T₄ (60 x 10 cm + Panchagavya 3%) of about 3053 kg ha⁻¹ and was found to be statistically on par with T₆ (60 x 10 cm + Cow urine 10%) which recorded 2940 kg ha⁻¹. Pod yield was minimum with T₁₀ (Control 30 x 10 cm with RDF) of about 2123 kg ha⁻¹. Haulm yield was found to be maximum with T₄ (60 x 10 cm + Panchagavya 3%) of about 5142 kg ha⁻¹ and was found to be statistically on par with T₆ (60 x 10 cm + Cow urine 10%) which recorded 5050 kg ha⁻¹ and T₁ (50 x 10 + Panchagavya 3%) of about 5013 kg ha⁻¹. Haulm yield was minimum with T₁₀ (Control 30 x 10 cm with RDF) of about 4566 kg ha⁻¹.

“The significant increase in Seed yield, and haulm yield was recorded with treatment with application of spacing 60 cm x 10 cm + panchagavya (3%) due to increase in yield attributes like number of pods plant⁻¹, number of seeds pod⁻¹ which leads to increase in photosynthesis” [5].

“Crop yield in the complex function of physiological processes and biochemical activities, modify plant anatomy and morphology of the growing plant. Pod and haulm yield were significantly influenced by different treatments of panchagavya application. This might be attributed to the favourable effect on vegetative growth; plant height and reproductive growth. These finding corroborates with the results of several other workers” [12]. “The optimum spacing 60x10 cm helped plant to receive sufficient amount of heat, water and nutrients from soil which increased number of pods plant⁻¹, seeds pod⁻¹ and test weight which directly helped in increase of pod yield in groundnut” [5].

4. CONCLUSION

It is concluded that the application of 3% Panchagavya at 60 x 10 cm spacing recorded higher plant height, dry weight at 20 DAS, 40 DAS, 60 DAS & at harvest and a greater number of pods per plant and haulm yield (3053 and 5142 kg ha⁻¹).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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