Impact of spacing and foliar spray of liquid organic manures on growth and yield of *Zaid* groundnut (*Arachis hypogea*)

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 × 10 cm spacing along with the application of Panchagavya 3% was most productive and cost effective.

Key Words: foliar spray, liquid organic manures, spacing, panchagavya

Introduction

"Groundnut (*Arachis hypogea* L.) the king of oilseed crops plays a vital role in the economyof 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 asits kernels contain about 25% protein which is about 1.3 times higher than meat, 2.5 times higherthan 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" (Jaiswal and Gourkhede 2017).

“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” (Yeswanth and Debarma 2022).

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 o

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 (Devakumar et al., 2014).

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.

Material 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 250 57'12" N latitudes, 870 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., (T_1) 50 x 10 cm + Panchagavya (3%), (T_2) 50 x 10 cm + Vermiwash (3%), (T_3) 50 x 10 cm + Cow urine (10%), (T_4) 60 x 10 cm + Panchagavya (3%), (T_5) 60 x 10 cm + Vermiwash (3%), (T_6) 60 x 10 cm + Cow urine (10%), (T_7) 70 x 10 cm + Panchagavya (3%), (T_8) 70 x 10 cm

+ Vermiwash (3%), (T_9) 70 x 10 cm + Cow urine (10%), (T_{10}) 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 (2010). Critical Difference value were calculated whenever the ‘F’ test was found significant at 5% level”. [6]

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 T_4 (60 x 10 cm + Panchagavya 3%) of about 12.10 cm and significantly minimum plant height was recorded in T_{10} (Control 30 x 10 cm with RDF) of about 8.41 cm. In 40 DAS, the significantly higher plant height was recorded in T_4 (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 T_{10} (Control 30 x 10 cm with RDF) of about 17.87 cm. In 60 DAS, maximum plant height was recorded in T_4 (60 x 10 cm + Panchagavya 3%) of about 43.50 cm and was on par with T_6 (60 x 10 cm + Cow urine 10%) which recorded 24.75 cm. Significantly minimum plant height was recorded in T_{10} (Control 30 x 10 cm with RDF) of about 30.25 cm. At harvest, significantly maximum plant height was recorded in T_4 (60 x 10 cm + Panchagavya 3%) of about 69.91 cm and was followed by T_6 (60 x 10 cm + Cow urine 10%) which recorded 24.75 cm. Minimum plant height was recorded in T_{10} (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 spacingresulted 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”. (Khan *et al*., 2021) and (Kumar *et al*.,2021).

The maximum plant dry weight was recorded at 20, 40, 60 DAS and at harvest stage in T_4 (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 T_6 (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 T_{10} (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". (Kumawat et al. 2009). "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 bemore with spacing of 60 × 10 cm, which could be attributed to higher population and accumulationof nutrients/unit area compared to other spacing". Sathyamoorthi *etal.* (2008).

Yield attributes and Yield

No. of pods plant^{-1} was recorded after harvest of the crop. It was found to be maximum with T_4 (60 x 10 cm + Panchagavya 3%) of about 59.5 no. of pods plant^{-1}. However, it was statistically on par with T_6 (60 x 10 cm + Cow urine 10%) which recorded 57.3 no. of pods plant^{-1}. Minimum was recorded in T_{10} (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 T_4 (60 x 10 cm + Panchagavya 3%) of about 1.87 no. of seeds pod^{-1}. However, it was statistically on par with T_6 (60 x 10 cm + Cow urine 10%) which recorded 1.80 no. of seeds pod^{-1}. Minimum was recorded in T_{10} (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". (Somasundaram et al., 2003). " 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". Vermaet al. (2008). "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" (Hamakareem *et al*. 2016).

Pod yield was found to be maximum with T_4 (60 x 10 cm + Panchagavya 3%) of about 3053 kg ha^{-1} and was found to be statistically on par with T_6 (60 x 10 cm + Cow urine 10%) which recorded 2940 kg ha^{-1}. Pod yield was minimum with T_{10} (Control 30 x 10 cm with RDF) of about 2123 kg ha^{-1}. Haulm yield was found to be maximum with T_4 (60 x 10 cm + Panchagavya 3%) of about 5142 kg ha^{-1} and was found to be statistically on par with T_6 (60 x 10 cm + Cow urine 10%) which recorded 5050 kg ha^{-1} and T_1 (50 x 10 + Panchagavya 3%) of about 5013 kg ha^{-1}. Haulm yield was minimum with T_{10} (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". [6]

"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" (Yadav et al., 2017). "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". [6]

Conclusion

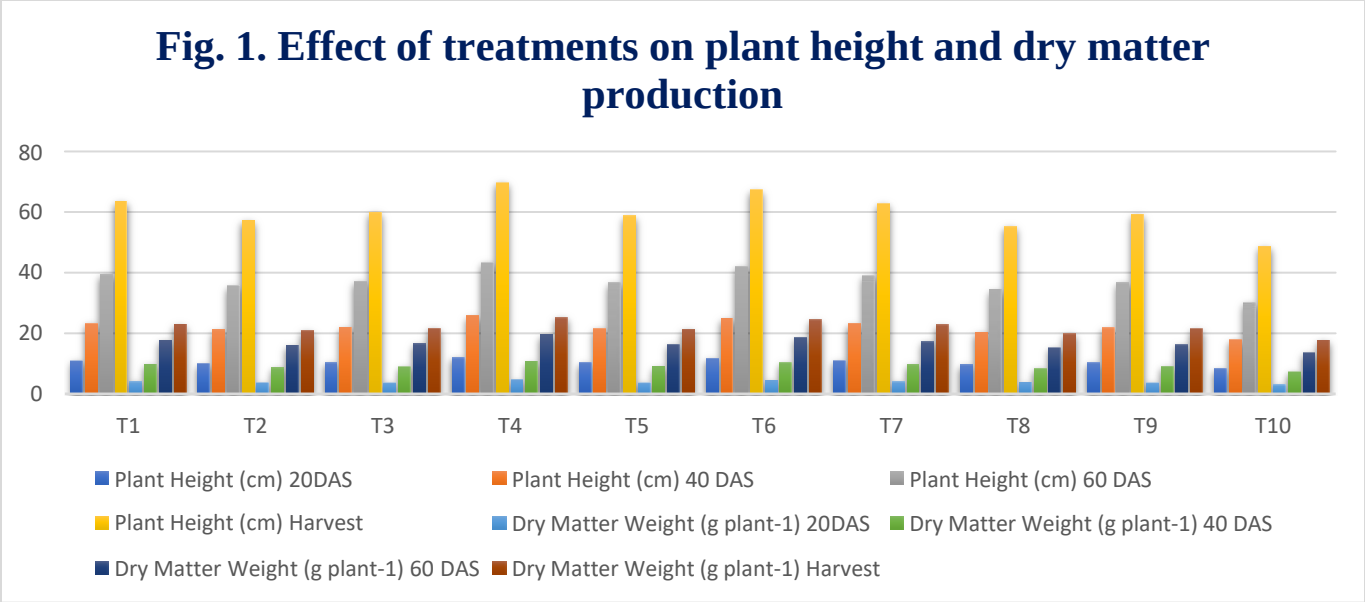
It is concluded that the application of 3% Panchagavya at 60 × 10 cm spacing recorded higher plant height, dry weight at 20 DAS, 40 DAS, 60 DAS & at harvest and a greater number of pods per plant and haulm yield (3053 and 5142 kg ha^{-1}).

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 (±)		NS	0.37	0.61	0.56	0.052	0.115	0.300	0.347
CD (P=0.05)		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 (±)		0.76	0.27	48.43	82.0
CD (P=0.05)		2.27	0.07	143.91	243.32



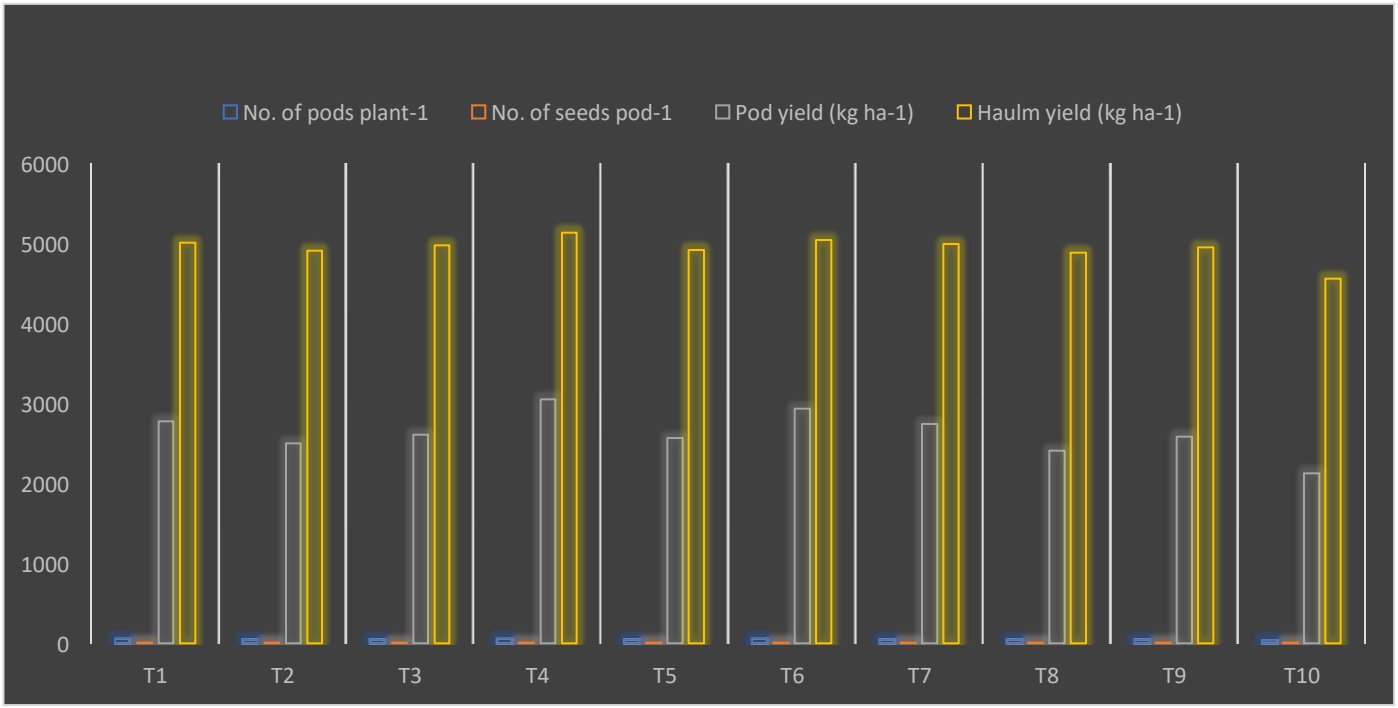


Fig 2. Effect of treatments on yield attributes and yield

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