



ORGANIC APPROACH FOR SUSTAINED PRODUCTIVITY OF *RABI* GROUNDNUT (*Arachis hypogaea* L.)

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ABSTRACT

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A field experiment was conducted at the dry land farm of S.V. Agricultural College, Tirupati during *rabi*, 2016 to study the effect of organic manures *viz.*, FYM and neem cake and organic sources *viz.*, Panchagavya, Jeevamrutha and Ghanajeevamrutha along with 100 per cent recommended dose of fertilizers on growth, yield attributes and yield of groundnut. Application of 100 per cent recommended dose of fertilizers (30-40-50 kg N, P₂O₅ and K₂O ha⁻¹) resulted in improved growth parameters, yield attributes and yield of groundnut. Among the organic sources tested, application of 100 per cent N through FYM (60 %) + Neem cake (40 %) + Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 % at every 10 days interval up to 15 days before harvest recorded significantly higher growth parameters, yield attributes and yield of groundnut compared to application of 100 per cent N through FYM (60 %) + Neem cake (40 %).

KEYWORDS: Groundnut, Organic manures, Panchagavya, Jeevamrutha, Ghanajeevamrutha, Yield attributes and Yield.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is considered to be one of the most important food legume and oilseed crops in India, which is cultivated over an area of 4.7 m ha, with a production of 7.4 m t and average productivity of 1552 kg ha⁻¹. Groundnut is an exhaustive crop and removes large quantities of nutrients from the soil (Kachot *et al.*, 2001). The factors responsible for low yields in groundnut are inadequate and imbalanced use of nutrients (Rao and Shaktawat, 2005). Adequate fertilization in the form of application of organic manures not only improve yield but also maintains soil health and sustains the soil productivity (Lourduraj, 1999). The ever-increasing cost of chemical fertilizer has made it to be realized once again that organic material will have to be utilized judiciously to maintain and improve the soil fertility and productivity. Hence, an attempt was made to investigate the effect of organic sources on the productivity of *rabi* groundnut.

MATERIAL AND METHODS

A field experiment was carried out during *rabi*, 2016 at the dry land farm of S.V. Agricultural College, Tirupati. The experimental soil was sandy loam in texture, neutral in reaction (pH 6.8), low in organic carbon (0.42 per cent) and available nitrogen (142 kg ha⁻¹), medium in available

phosphorus (34 kg ha⁻¹) and available potassium (174 kg ha⁻¹). The experiment was laid out in a randomized block design with three replications. The experiment consisted of nine treatments *viz.*, Control (T₁), 100 per cent RDF (30-40-50 kg N, P₂O₅ & K₂O ha⁻¹) (T₂), 100 per cent N through FYM (60%) + Neem cake (40%) (T₃), Seed treatment with ghanajeevamrutha + Soil application of jeevamrutha @ 500 l ha⁻¹ before sowing, at every 10 days interval upto 15 days before harvest (T₄), Seed treatment with ghanajeevamrutha + Soil application of ghanajeevamrutha @ 500 kg ha⁻¹ at the time of sowing + Foliar spray of jeevamrutha @ 500 l ha⁻¹ at every 10 days interval up to 15 days before harvest (T₅), Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 % at every 10 days interval up to 15 days before harvest (T₆), 100 per cent N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Soil application of jeevamrutha @ 500 l ha⁻¹ before sowing, at every 10 days interval up to 15 days before harvest (T₇), 100 per cent N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Soil application of ghanajeevamrutha @ 500 kg ha⁻¹ at the time of sowing + Foliar spray of jeevamrutha @ 500 l ha⁻¹ at every 10 days interval up to 15 days before harvest (T₈), 100 per cent N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Foliar

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spray of panchagavya @ 3 % at every 10 days interval up to 15 days before harvest (T_9). FYM and neem cake were applied based on per cent of nitrogen content. FYM contains 0.5% N and neem cake contains 1.9% N and these organic manures were applied to the field 15 days before sowing for decomposition. The test variety used in the present experiment was Dharani by adopting spacing of 22.5 cm x 10 cm.

Panchagavya stock solution was prepared by using the following ingredients. Cow dung 7 kg and 1 kg cow ghee were mixed well and kept for 2 days and 2 l of cow urine and 10 l of water were added to the mixture and left for 15 days. Then 2 l of cow milk + 2 l of curd + 2 l of tender coconut water + 250 g black jaggery + 12 no. of ripened bananas were added to accelerate the fermentation. All the materials were added to a wide mouthed pot and kept under shade. The mixture was left for 14 days and stirred twice a day for about 20 minutes both in the morning and evening and then filtered. Before spraying in the field, three per cent spray solution was prepared by mixing 30 ml of panchagavya in 1000 ml of water and it was applied as foliar spray @ 500 l ha⁻¹ at 10 days interval starting from 10 DAS to 15 days before crop harvest.

Jeevamrutha was prepared by using the following ingredients. A plastic drum of 200 l capacity was filled with 90 l of water. Cow dung 5 kg was mixed with 10 l of water in a bucket and this mixture was added to drum followed by stirring with long stick. Then 5 l of cow urine was poured slowly with continuous stirring. Black jaggery 1 kg was pounded to powder and added to drum with continuous stirring. Horse gram flour (1kg) was added slowly to the mixture with stirring to avoid formation of clumps. One handful of fertile soil was added to the above mixture as source of beneficial micro-organisms. Jeevamrutha was stirred well until the mixture became homogenous. The drum was covered with plastic lid and was incubated for 5-6 days. Jeevamrutha was stirred twice a day both morning and evening during the incubation period. After 6-8 days, jeevamrutha was applied to soil or as foliar spray depending on the treatment @ 500 l ha⁻¹ at 10 days interval starting from 10 DAS to 15 days before crop harvest.

Ghanajeevamrutha was prepared by using following ingredients. Initially 50 kg cow dung was spread on the polythene sheet. Black jaggery 1 kg was pounded to powder and added to cow dung and mixed well.

Horsegram flour (1 kg) was added slowly to the mixture with hand mixing to avoid formation of lumps. One and half handful of fertile soil was added to the above mixture and mixed thoroughly until it became homogenous. Then measured quantity of cow urine (2.5 l) was added to the above mixture and this mixture was allowed to dry under the shade for 6-7 days. After a week, ghanajeevamrutha was applied to soil @ 500 kg ha⁻¹ at the time of sowing as per the treatments.

RESULTS AND DISCUSSION

Growth parameters and yield attributes

Application of 100 per cent recommended dose of fertilizers (30-40-50 kg N, P₂O₅ and K₂O ha⁻¹) significantly improved all the growth parameters of groundnut viz., plant height, LAI and dry matter production at all the stages of crop growth due to adequate supply of NPK and the major plant nutrients (Table 1) (Zalate and Padmani, 2009). Among the organic sources tested, 100 per cent N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 % at every 10 days interval up to 15 days before harvest recorded improved growth parameters of groundnut viz., plant height, LAI and dry matter production at all the stages of crop growth due to presence of organic manures in slow conversion of organic forms of plant nutrients (all essential nutrients) into available forms and improvement in soil physical and physico - chemical conditions and biological soil properties which might have contributed for improvement in crop growth and development (Kumar *et al.*, 2012), and Panchagavya spray was known to produce bioactive substances secreted by beneficial microorganisms like *Pseudomonas*, *Azotobacter* and phosphobacteria. These growth promoting secretions might have contributed to improved growth parameters of groundnut (Xu *et al.*, 2000).

Application of 100 per cent RDF improved the yield attributes *i.e.* number of pods plant⁻¹, hundred pod weight, hundred kernel weight and shelling per cent due to favourable effect of readily available nutrients with 100 per cent RDF (T_2) is evident with higher dry matter accumulation and effective translocation of photosynthates to the sink (Lourduraj and Rajagopal, 1996). Among the organic sources tested, 100 per cent N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Foliar spray of

Table 1. Effect of different organic sources on growth parameters of groundnut

Treatments	Plant height (cm)	Leaf area (cm ²)	Drymatter production (kg ha ⁻¹)
T ₁ : Control	16.2	0.89	3862
T ₂ : 100 per cent RDF (30-40-50 kg N, P ₂ O ₅ & K ₂ O ha ⁻¹)	24.1	2.19	6782
T ₃ : 100 per cent organic N through FYM (60%) + Neem cake (40%)	20.4	1.54	6259
T ₄ : Seed treatment with ghanajeevamrutha + Soil application of jeevamrutha @ 500 l ha ⁻¹	19.2	1.12	5755
T ₅ : Seed treatment with ghanajeevamrutha + Soil application of ghanajeevamrutha @ 500 kg ha ⁻¹ + Foliar spray of jeevamrutha @ 500 l ha ⁻¹	19.5	1.22	5867
T ₆ : Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 %	21.2	1.78	6532
T ₇ : T ₃ + T ₄ = (100 per cent organic N through FYM (60%) + Neem cake (40%)) + (Seed treatment with ghanajeevamrutha + Soil application of jeevamrutha @ 500 l ha ⁻¹)	19.8	1.33	5982
T ₈ : T ₃ + T ₅ = (100 per cent organic N through FYM (60%) + Neem cake (40%)) + (Seed treatment with ghanajeevamrutha + Soil application of ghanajeevamrutha @ 500 kg ha ⁻¹ + Foliar spray of jeevamrutha @ 500 l ha ⁻¹)	20.1	1.43	6198
T ₉ : T ₃ + T ₆ = (100 per cent organic N through FYM (60%) + Neem cake (40%)) + (Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 %)	22.2	2.05	6659
S.Em ±	0.19	0.03	38.5
CD (P = 0.05)	0.57	0.11	116

Table 2. Effect of different organic sources on yield attributes and yield of groundnut

Treatments	Number of pods plant ⁻¹	Hundred pod weight (g)	Hundred kernel weight (g)	Shelling percentage (%)	Pod yield (kg ha ⁻¹)	Kernel yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)
T ₁ : Control	15.2	87.5	28.7	63.5	1140	724	1631
T ₂ : 100 per cent RDF (30-40-50 kg N, P ₂ O ₅ & K ₂ O ha ⁻¹)	34.7	113.8	42.2	73.0	2533	1850	3472
T ₃ : 100 per cent organic N through FYM (60%) + Neem cake (40%)	24.3	103.5	33.5	70.5	1852	1306	2317
T ₄ : Seed treatment with ghanajeevamrutha + Soil application of jeevamrutha @ 500 l ha ⁻¹	20.4	99.5	31.2	66.8	1438	961	1948
T ₅ : Seed treatment with ghanajeevamrutha + Soil application of ghanajeevamrutha @ 500 kg ha ⁻¹ + Foliar spray of jeevamrutha @ 500 l ha ⁻¹	21.4	100.6	31.8	67.4	1547	1043	2009
T ₆ : Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 %	27.7	106.4	36.4	71.3	2054	1465	2645
T ₇ : T ₃ + T ₄ = (100 per cent organic N through FYM (60%) + Neem cake (40%)) + (Seed treatment with ghanajeevamrutha + Soil application of jeevamrutha @ 500 l ha ⁻¹)	22.4	101.5	32.5	68.6	1655	1136	2110
T ₈ : T ₃ + T ₅ = (100 per cent organic N through FYM (60%) + Neem cake (40%)) + (Seed treatment with ghanajeevamrutha + Soil application of ghanajeevamrutha @ 500 kg ha ⁻¹ + Foliar spray of jeevamrutha @ 500 l ha ⁻¹)	23.3	102.6	32.9	69.0	1756	1211	2207
T ₉ : T ₃ + T ₆ = (100 per cent organic N through FYM (60%) + Neem cake (40%)) + (Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 %)	31.5	110.2	39.7	71.7	2333	1672	3010
S.E.m ±	0.34	0.42	0.61	0.84	65.9	52.0	59.2
CD (P = 0.05)	1.0	1.3	1.8	2.5	198	157	179

panchagavya @ 3 % at every 10 days interval up to 15 days before harvest recorded improved yield attributes *i.e.* number of pods plant⁻¹, hundred pod weight, hundred kernel weight and shelling per cent due to application of organic manures which besides supplying N, P, K, secondary and micro nutrients, also improved the soil condition, which enhanced the root proliferation and source to sink relationship (Choudhary *et al.*, 2014). Panchagavya included coconut water which contain kinetin and hence increased the cytokinin content in leaf, which in turn increased the chlorophyll content and photosynthetic activity and reflected through the inflated stature of all the yield attributes (Mavarkar *et al.*, 2016).

Yield

Pod and kernel yield significantly improved with the application of 100% recommended dose of fertilizers (30-40-50 kg N, P₂O₅ and K₂O ha⁻¹) over the control due to the reason that fertilizers can supply the required quantity of nutrients instantly in a balanced proportion coinciding with the crop requirement (Thomas and Thenua *et al.*, 2010) (Table 2). Among the organic sources tested, 100 per cent N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 % at every 10 days interval up to 15 days before harvest recorded higher pod yield due combined application of organic manures which might have improved the soil environment which encouraged better root spread resulting in better absorption of nutrients from lower layers which led to the higher pod yield. The seed treatment with ghanajeevamrutha might have increased the activity of microbes there by solubalisation and uptake of nutrients were enhanced (Manjunatha *et al.*, 2009). The easy transfer of nutrients to plant through foliar spray of panchagavya, which contains several nutrients *viz.* macronutrients like nitrogen, phosphorus, potassium and micronutrients required for the growth and development of plants, various aminoacids, vitamins and growth regulators like auxins, gibberellins might have influenced the necessary growth and development in plants which lead to higher pod yield (Somasundaram *et al.*, 2007).

CONCLUSION

In conclusion, application of 100 per cent recommended dose of fertilizers (30-40-50 kg N, P₂O₅ and K₂O ha⁻¹) (T₂) appears necessary for *rabi* groundnut for realizing higher crop growth and productivity Among

the organic sources tested, 100 per cent organic N through FYM (60%) + Neem cake (40%) + Seed treatment with ghanajeevamrutha + Foliar spray of panchagavya @ 3 % (T₉) resulted in optimum crop growth, yield attributes and pod yield compared to other treatments.

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