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Efficacy of Rhizobium on the Productivity of Rice Fallow Groundnut

E. Aruna* and G. Karuna Sagar

Agricultural Research Station, ANGRAU, Utukur, Kadapa, A.P., India

**Corresponding author*

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A B S T R A C T

A field experiment was conducted at Agricultural Research Station, Utukur, Kadapa, Andhra Pradesh, India, during *rabi* seasons of 2016 and 2017 to test the efficacy of rhizobium inoculation along with fertilizers in popular varieties of groundnut dharani and K-6. The results indicated that, the two test varieties were equally performed regarding number of branches, pods per plant and pod yield in both the years. Different fertilizer levels of 100 and 125% RDF with or without rhizobium did not significantly influence the plant height, number of pods per plant and pod yield. Lower dose of 75% RDF without rhizobium recorded significantly lower yield parameters of number of pods per plant and pod yield.

Introduction

Groundnut (*Arachis hypogaea* L.) is the most important oilseed crop of tropical and subtropical regions of the world. It belongs to the family Leguminaceae and sub-family Papilionaceae. It consists of 44 to 50% of edible oil and 25% high quality protein. It is grown in all the seasons i.e. *kharif, rabi and summer*. Poor nutrient management is one of the main causes for low yields in groundnut. Groundnut seeds inoculated with Bradyrhizobium *sp* respond favorably by forming nodules on the roots and by fixation of atmospheric nitrogen. Hence, there is a great possibility to increase production of legume plants by exploiting better colonization of their root and rhizosphere through *rhizobial* inoculation, which can fix atmospheric nitrogen and protect nature from pollution. There is a great need to supplement or substitute chemical fertilizers with organic manures or to explore biological means to improve the soil health. These bacteria, although present in most of the soils vary in number, effectiveness in nodulation and N-fixation.

It has been argued that usual native soil rhizobial populations are inadequate and are ineffective in biological nitrogen fixation. To ensure an optimum *rhizobial* population in the rhizosphere, seed inoculation of legumes with an efficient *rhizobial* strain is necessary. This helps to improve nodulation, N2 -fixation solicits crop growth and yield of leguminous crops (Henzell, 1988). Inoculation of groundnut with efficient competitive rhizobia was considered as a beneficial practice since the native rhizobia were not able to supply the

total nitrogen requirements of groundnut (Hadad *et al.,* 1998). Similarly, the low yield of groundnut in India was suggested to be due to low nodulation and to comptetition from indigenous ineffective strains (Basu and Bhadoria, 2008). Hence the present study was conducted to know the response of seed inoculation along with fertilizer levels in groundnut varieties under rice fallow situation.

Materials and Methods

A field experiment was conducted during *rabi* seasons of 2016 and 2017 at Agricultural Research Station, Utukur, Kadapa on Alfisols. The experimental soil was low in available nitrogen (139 kg/ha), high in available phosphorus (87 kg/ha) and potassium (460 kg/ha) with P^H 8.27 and EC 0.06 dS/m. The experiment was laid out in split plot design where in two popular groundnut varieties viz., dharani and K-6 were assigned to main plots and six fertilizer treatments 75% RDF(recommended dose of fertilizer), 100% RDF (12-16-20 kg NPK ha^{-1}), 125% RDF,75% RDF + rhizobium, 100% RDF + rhizobium, 125%RDF + rhizobium to subplots.

In rhizobium treatments seed is treated with rhizobium. Groundnut was sown on December 27^{th} in 2016 and Jan 4^{th} in 2017 with a spacing of 22.5 cm x 10 cm in the plot of 4.5 m x 3.6 m size. All the cultural practices were followed as per recommendation except nutrition. At the end of cropping season, yield was recorded from net plot area and computed to per hectare.

Results and Discussion

Effect of varieties

Groundnut variety K-6 recorded taller plants compared to dharani during 2016 only. Number of branches per plant was non-significant between the varieties dharani and K-6 in both the years. Number of pods per plant was not significantly influenced by the varieties during 2016 whereas in the second year, K-6 variety recorded higher number of pods per plant compared to dharani. Shelling percentage was not influenced significantly between the varieties. Dharani variety has bold seeds which has higher 100 kernel weight in both the years compared to K-6.

The two test varieties dharani and K-6 recorded on par pod yields in both the years. The varietal characters were influenced greatly by genes and environment. Little changes may be due to the difference in degree of adaptation by the varieties (Sajid *et al.,* 2011)

Effect of fertilizers and rhizobium

Different fertilizer levels did not significantly influence the plant height except 75% RDF which recorded lower plant height. The number of branches per plant was not influenced by the fertilizer levels in both the years. Application of 100% RDF + rhizobium in 2016 and 125% RDF + rhizobium in 2017 recorded higher number of pods which was on par with other treatments except 75% RDF in both the years.

Maximum pods per plant with inoculation of *rhizobium* strain might be due to favorable effect of rhizobium on improvement of nodulation which increased the supply of nitrogen and proper vegetative growth which later converted to reproductive phase resulting to more number of pods per plant and viable seed. Shelling percentage was not influenced significantly by fertilizer levels. Application of 100% RDF + rhizobium recorded higher 100 kernel weight (39.83) which was on par with other rhizobium inoculated treatments and 125% RDF in 2016. But, it is not influenced significantly during 2017.

Table.1 Growth and yield attributes of rice fallow groundnut as influenced by rhizobium

Treatments	Plant height (cm)		No. of branches/plant		No. of pods/plant		Shelling percentage (%)	
	2016	2017	2016	2017	2016	2017	2016	2017
Varieties								
Dharani	27.17	30.29	3.54	4.18	19.72	14.14	72.22	70.00
K-6	27.98	36.24	3.70	4.42	20.08	15.00	73.33	70.89
SE m ±	0.09	2.3	0.08	0.09	0.84	0.12	1.05	0.21
CD at 5%	0.58	NS	0.14	NS	5.11	0.78	6.43	NS
Fertilizer levels								
75% RDF	26.96	31.64	3.88	4.36	18.06	13.50	72.33	70.00
100% RDF	27.59	33.97	3.53	4.53	20.40	15.83	71.50	69.67
125% RDF	27.58	36.05	3.75	4.06	19.48	14.60	72.00	72.67
75% RDF +Rhizobium	30.18	32.37	3.50	4.30	19.81	14.60	73.00	71.33
100% RDF + Rhizobium	28.36	32.42	3.55	4.36	21.33	14.40	73.83	70.17
125% RDF+ Rhizobium	27.81	33.16	3.53	4.20	20.35	16.00	73.83	70.13
SE m ±	0.88	1.29	0.54	0.17	0.86	0.60	1.29	1.39
CD at 5%	2.59	3.81	NS	NS	2.55	1.77	NS	NS
CV	7.81	9.53	9.77	10.20	10.67	9.92	4.36	4.83

Table.2 Yield of rice fallow groundnut as influenced by rhizobium

Treatments	100 kernel weight (g)		Pod yield (kgha-1)		Haulm yield (kgha-1)	
	2016	**2017**	**2016**	**2017**	**2016**	**2017**
Dharani	38.79	35.61	3660	4077	5845	6929
K-6	36.99	32.45	4129	3825	5962	6371
SE m ±	0.61	0.11	98	90	59	444
CD at 5%	3.72	0.71	NS	NS	361	NS
75% RDF	36.51	31.00	3744	3693	5560	6268
100% RDF	36.00	32.83	3718	3910	5562	6735
125% RDF	37.79	33.17	4179	3955	6374	6400
75% RDF +Rhizobium	37.96	31.50	3803	3928	5934	6841
100% RDF + Rhizobium	39.83	33.17	4017	4124	5800	6797
125% RDF+ Rhizobium	39.25	34.00	3904	4098	6188	6859
SE m ±	0.69	1.01	178	127	186	286
CD at 5%	2.05	2.99	NS	376	549	NS
CV	7.81	7.61	11.22	7.90	7.734	10.55

Fertilizer levels either with or without rhizobium did not significantly influence pod yield in 2016. Application of 100% RDF + rhizobium recorded higher pod yield in 2017 which was on par with 100 and 125% RDF either with or without rhizobium and 75% RDF with rhizobium. Explicit role of rhizobium in furnishing better rhizosphere for plant growth and supply of nitrogen might be the reason for the higher yield of groundnut. Maximum yield is attributed to the symbiotic relationship of rhizobium with the roots of the leguminous plants which fix the atmospheric nitrogen in to the roots of the groundnut (Ahmad *et al.,* 2009). The yield and uptake of N and P by groundnut were significantly higher in the treatments receiving both inoculants and phosphorus than individual application of either inoculants or phosphorus Many researchers carried out experiments on rhizobium inoculation with and without fertilizers on legume crops (Muhammad *et al.,* 2004) and found increased nitrogen contents of seed, number of nodules, yield and yield components.

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