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Effect of Different Formulations of Bio Inoculants on Growth and Yield of Red gram

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ABSTRACT

In India Pigeon pea is next to gram. It is grown in almost all types of soils. It best grows in well drained sandy loam to clayey loam soil. Pigeon pea is an important pulse crop, which contains more protein and carbohydrates that is indispensible to nutrition of human diet. The study was taken to assess the effect of carrier-based bio fertilizers and water-soluble bio fertilizers in enhancing the productivity of redgram (*Cajanus cajan*). The following bio fertilizers were used in the study viz., *Rhizobium,* Vesicular Arbuscular Mycorrizha (VAM) in the formulations of both carriers based and water-soluble formulation (Freeze Dried). The trial was conducted in Randomized Block Design with 7 replications. The biometric and yield parameters were recorded. Growth and yield parameters influenced by the treatments was recorded and also worked out the cost of economics for different treatments. Results revealed that the growth parameters such as plant height, No. of branches, No. of nodules, root length, shoot length, Number of flowers were recorded higher with the applications of dual application of rhizobium and VAM in water soluble formulation (T3) and Yield parameters such as no. of pods and grain yield were recorded higher with application of water-soluble formulation. Similar trend was observed with regard to the cost of economics.

Key words :

Introduction

The legumes and grain families are by far the world's most important sources of food, grains supply starch while legume which include bean, peas supply protein and fat. Pigeon pea is an important pulse crop which contains proteins and carbohydrates that are considered indispensible in the nutrition of human diet. Wide use of pigeonpea products is noticed, the most important of which is 'dal' Pigeonpea seeds contain 20.5 per cent protein, 64.2 per cent carbohydrate, 3.8 per cent fat, 5 per cent fiber and 4.2 per cent ash besides vitamins and minerals like Ca, Fe, Mg . Pigeonpea also has a great potential as animal feed, fuel and soil ameliorant.

Nitrogen is a key element that influences the crop production. Considering the high cost of nitrogenous fertilizers and loss of applied nitrogenous fertilizer through leaching, volatilization and denitrification, an increasing demand for nitrogen in modern agriculture could, therefore be met by exploitaton of biologically fixed nitrogen. The pigeonpea have a well developed tap root system with numerous laterals. Abundant nodules are formed on roots. Biofertilizers, particularly Rhizobium, could be a bridge between removals and ad-

ditions to soil nutrients where farmers can scarcely afford costly inputs and that too in a risky environment. They belong to family Rhizobiaceae, symbiotic in nature, fix nitrogen 50-100 kg/ ha with legumes only. Biological N fixation (BNF) occurs in the free living states, in association or in symbiosis with plants.

Most of the Indian soils are low to medium in P status and the efficiency of phosphate fertilizers is also allowed due to fixation of large fraction of applied P into sparingly soluble inorganic phosphates. The mycorrhizal associations (VAM) alleviating Al toxicity, increasing N,P and micronutrient uptake, maintaining soil structure by the production of specific protein called Glomulin. Such dual inoculation is the most valuable now-a-days. It is also evident that mycorrhizal infection lead to increased nitrogen content of shoot and of fundamental significance and underlines the need for further studies on dual inoculation of *Rhizobium* and VAM and their effect on nitrogen and phosphorus uptake in legumes.

The cost of chemical fertilizers is very high due to which the cost of production increases. By utilization of VAM and *Rhizobium*, it may be possible to reduce the nitrogenous and phosphatic fertilizer dose. It was therefore, thought worthwhile to undertaken the present investigation with following objectives: To see the effect of inoculation of *Rhizobium* and Arbuscular mycorrhiza (*Glomus* sp) in red gram with the following parameters such as plant height, nodulation and yield under field condition .

Materials and Methods

Laboratory and field experiments were conducted at Agricultural College and Research Institute, Vazhavachanur to evaluate the effects of different treatments on the productivity of Redgram. Laboratory and field experiments were conducted in Randomised Block Design with seven replications. VAM and *Rhizobium* applied as seed treatment.

Treatments	Details
T	Uninoculated Control
T2	*Rhizobium* seed treatment + VAM soil application
T3	WSF (Water soluble Formulation) of *Rhizobium* and VAM seed treatment

Seed treatment procedure

For treatment 2, the 600g of *Rihizobium* (carrier based) fertilizer is treated with Rice kanji as a binder for one hectare of seeds. 20 Kg of VAM (Vesicular Arbuscular Mycorrihza) is recommended for soil application of one hectare. The seeds are sown after shade drying for 30 minutes. The carrier based biofertilizer will have the spore count of 1X10vcfu/ g.

For treatment 3, freeze dried biofertilizer is used which is known as Water Soluble Biofertilizer , both *Rhizobium* and VAM of each 10g is used . The seeds are sown after shade drying for 30 minutes. Water Soluble Biofertilizer will have the spore count of 1 x 10v cfu/g.

Fertilizer application

The fertilizers are applied as per the recommendations for all the treatment plots. The recommendation is 25:50:25 Kg NPK/ha. We calculated the fertilizer required for our area 5 cents and applied as both basal and top dressing.

Observations

The following observations were recorded

Growth parameters: Observations in different plots were taken. The growth parameters such as plant height. Root length and shoot length were recorded at 85 DAS . Root nodules/plant was recorded at 30 DAS and expressed in numbers.

Yield parameters : The yield parameters such as no. of pods/plant and grain yield were recorded and expressed in kg/ha.

Economics: Cost of economics for different treatments were worked out and analysed the efficient method.

Statistical analysis: Data on various characters were studied during the course of investigation was statistically analysed. Whenever statistical significance was observed , critical difference at 5% level of probability was worked out for the treatments.

Results and Discussion

The experimental results on various aspects of growth and yield parameters of red gram *Cajanus cajun*) influenced by different treatments are presented below.

The observations on the following parameters were recorded during growth stage, plant height, Plant emergence (%) 20th day, Plant height on 75th day (cm), Root length (cm), Shoot length (cm). No. of branches/ plant No. of flowers/plant. With regard

to plant height was recorded at 75th days after sowing, maximum plant height was recorded with the seed treatment of WSF of *Rhizobium* and VAM with 84.4 cm. Similar trend was observed with root length, Root length (cm), Shoot length (cm). No. of branches/ plant No. of flowers/plant with the application waste soluble formulation of Rhizobium and AM fungi in Redgram with 15 cm., 114 cm, 8 and 21 respectively (Table 1).

During the maturity stage the observations on the following parameters No. of pods/ plant, No. of seeds/ pod, 100 seed weight(g), Yield (Kg/ha) were recorded and B:C ratio was calculated. With regard to No of pods/plant the treatment applied with Water Soluble Formulation of *Rhizobium* and AM fungi performed better to the carrier based formulation with 23 No. of pods/plant and similar trend was observed with other parameters with 9 gm 100 seed weight, 885 kg yield/ha. With respect to cost benefit ratio T3 has recorded 2.17 as BC ratio.(Table 2).

In general, the dual application with mycorrhiza and Brady *Rhizobium* significantly increased nodule number of soybean when compared to control. Similar effect already recorded that, associative actions of mycorrhizal fungi in legumes improve phosphorus uptake which results in the enhancement of nodulation and nitrogen fixation (Albrecht *et al.*, 1999). It has also been reported that dual inoculation of AM fungi and *Rhizobium* had a significant effect on the nodulation in green gram (Singha and Sharma, 2013). There are many researches carried out in the past few decades on various aspects of root symbionts *viz*., *Rhizobium* and AM fungi and their dual interactions in many legume crops (Khan, 2008). Regarding the yield also, irrespective of the formulations, combined application of *Rhizobium* + AM fungi recorded significantly higher grain yield revealed that both *Rhizobium* + AM fungi are synergistically interacted. The result was in agreed with work, also revealed the synergistic effect in dual inoculation with micro-symbionts *viz*., *Glomus fasciculatum* and *Rhizobium* was remarkable in pigeon pea (Sujatha and Sharma, 2012). The results highlighted that mutualistic double symbiosis by *Rhizobium* and VAM fungi provided better growth than either of the single symbiotic microbial symbiosis with leguminous crop plants. Several workers have also examined the interactions between different AMF species and *Rhizobium* species strains, and

Table 1. Effect of Coinoculation of carrier based biofertilizer and water soluble formulaion of Rhizobium and AM fungi on growth parameters of Redgram.

Treatments	Plant emergence (%)20th day	Plant height on 75th day (cm)	Root length (cm)	Shoot length (cm)	No. of branches/ plant	No. of flowers/ plant
T1 – Control	84	61.3	8	93.5	4	5
T2 – Rhizobium seed treatment + VAM soil application	93	72.1	12	106	6	13
T3 – Rhizobium + VAM WSF)	98	84.4	15	114	8	21
Mean	91.6	72.6	11.66	104.5	6	13
SEd	7.09	11.55	3.518	10.33	2	8
CD(0.05)	9.69	6.71	0.90	17.4	18.9	2.96

Table 2. Effect of Co inoculation of carrier based biofertilizers and water soluble formulation of Rhizobium and AM fungi on yield parameters and economics of Redgram

Treatments	No. of pods/plant	No. of seeds/pod	100 seed weight(g)	Yield (Kg/ha)	B:C ratio
T1 – Control	5	3	6	642	1.17
T2 – Rhizobium seed treatment + VAM soil application	11	4	7	710	1.95
T3 – Rhizobium + VAM (WSF)	23	4	9	885	2.17
Mean	6.5	3.66	7.33	745.6	
SEd	9.1651	0.5773	1.5275	125.3	
CD (P= 0.05)	0.744	0.28	0.11		

concluded the growth and productivity of the legumes were dependent on the specific combination of AMF and rhizobia indicating that synergistic interactions between compatible micro-symbionts resulted in growth and yield increases.

Conclusion

The water soluble Formulation of (*Rhizobium* and VAM) treated plants have more no. of flowers and pods /plant than the carrier based *Rhizobium* seed treatment (T2) and control. Seedling emergence Plant growth, nodule formation, flowering and pod development is higher in Treatment (T3) plots. We also observed that the treatment plots with Bio Fertilizers is less affected with diseases.

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