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Effect of Biofertilizer and Plant Spacing on Growth and Yield of Field Pea (*Pisum sativum* L.)

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ABSTRACT

A field experiment was conducted to study the "Effect of Biofertilizer and Spacing on Growth of Field Pea (*Pisum sativum* L.)" during *Rabi* season 2023-2024 was carried out in a plot which is located nearby Sunshine School of Dirang, West Kameng District of Arunachal Pradesh. The experiment was laid out in a Randomized Block Design (RBD) which have 7 treatments i.e. T0(control), T1 - B1 + S1(Seaweed + spacing) , T2 - B1 + S2(Seaweed + spacing), T3-B1 + S3(Seaweed + spacing), T4- B2 + S1 (*rhizobium* + spacing), T5- B2 + S2 (*rhizobium* + spacing), T6- B2 + S3 (*rhizobium* + spacing) with 3 replication, i.e R1, R2, R3. The Pea variety was WELCOME 2010 was sown for this experiment. Based on the mean performance of the treatment T4- B2 + S1 (*rhizobium* + spacing) at 25, 50 and 75 DAS was found the best treatment for plant growth. This obtained highest plant height (11.89cm, 36.78cm, 44.67cm), Dry weight (2.75g, 18.42g, 27.43g), Number of Root nodules (11.55, 24.22, 34.89), No. of pods plant^{-1} (22.33), No. of seeds plant^{-1} (9.33) and the lowest plant growth was observed in T0 (control). However seed inoculation of *Rhizobium* and spacing gave the promising results compared to control. This, shows that the seed treatment with biofertilizer (*rhizobium*) may be the good option for seed growers to achieve higher growth parameters and yield parameters in field pea. Biofertilizer are chosen over chemical fertilizer since they are non-toxic and contain organic elements. The biofertilizers helps to increase growth, yield and quality of fruits in addition to improve soil fertility. Biofertilizer are microorganisms that help plant to grow by increasing the quantity of nutrients.

Key words *: Field Pea, Biofertilizer (Rhizobium, seaweed), Spacing, Yield*

Introduction

Field pea (*Pisum sativum* L.) is an important vegetable crop grown throughout the world. In India, it is cultivated mainly as cool season crop in the plains of North India and as summer vegetable in the hills. It belongs to family leguminoceae (Fabaceae) and chromosome number 2n=14. It is native of Europe and Western Asia. Field pea (*Pisum sativum*) is a popular pulse crop of India. India is the second largest producer of pea in the world after Russia. Pea is rich in protein, carbohydrates, vitamin A and C, calcium and phosphorus. It is commonly used throughout the world in human diets and has high levels of amino acids, lysine and tryptophan, which are relatively low in cereal grains and contains approximately 21- 25% protein. Besides, maintaining soil fertility through nitrogen fixation in association with symbiotic *Rhizobium* prevalent in their root nodules, it plays a vital role in furthering sustainable agriculture (Bhat *et al*., 2013). Biofertilizer is an organic product that contains living cells of various types of microorganisms, which are capable of converting nutritionally important elements from unavailable to available form through various biological processes (Vessey, 2003). Biofertilizer application has shown bright results in case of leguminous crops, especially exclusive results have been ob-

tained in case of pea (Rather *et al*., 2010). *Rhizobium* inoculation increased the root nodulation through better root development and more nutrient availability, resulting in vigorous plant growth and dry matter production which resulted in better flowering, fruiting and pod formation and ultimately there was beneficial effect on seed yield (Sardana *et al*., 2006). *Rhizobium* is a biofertilizer that contains symbiotic *rhizobium* bacteria, which is an important nitrogen-fixing organism. The term "seaweed" itself does not have any taxonomic value, but is rather a popular term used to describe the common large attached (benthic) marine algae found in the groups of Chlorophyceae, Rhodophyceae, Phaeophyceae or green, red, and brown algae, respectively. Seaweed extracts have been marketed for several years as a fertilizer additives and beneficial results from their use have been reported. Many claims have been made for seaweed extracts including better seed germination and deeper root development, increased frost resistance, increased nutrient uptake and changes in plant tissue composition, increased resistance to fungal diseases, reduced incidence of insect attack, higher yields, longer shelf- life of produce and improved animal health when livestock is grazed on on treated crops or pasture. It has been shown that performance of seaweed manure is superior to the conventional organic *viz.,* farm yard manure. Planting spacing has significant effect on growth and development of pea. Closer spacing enhances the disease development and lower yield of pea.

Optimum spacing ensures the proper growth and development of pea. Quality of seed also depends on proper spacing of crop (Rahman *et al.,*2020).

Materials and Methods

The experiment was conducted during the *rabi* season of 2023 located at nearby Sunshine School of Dirang, West Kameng District of Arunachal Pradesh. The Crop plot Farm is situated at 27.3495^0 N latitude and 92.2782^0 E longitudes and at an altitude of 4910 m above mean sea level. The site comes under the Eastern Himalayan region and the agro climatic zone is under sub-Tropical zone of Arunachal Pradesh. The soil was sandy loam in texture with high acidic content and also rich in organic matter. The experiment was conducted in a Randomized Block Design (RBD) with 3 replication i.e R1, R2, R3. The treatment combination are T0(control), T1 - B1 + S1(Seaweed + spacing) , T2 - B1 + S2(Seaweed + spacing), T3 -B1 + S3(Seaweed + spacing), T4- B2 + S1 (*rhizobium* + spacing), T5- B2 + S2 (*rhizobium* + spacing), T6- B2 + S3 (*rhizobium* + spacing). Data was collected on crop growth parameters plant height (cm), plant dry weight (g/plant), crop growth rate (g/m^2 /day), relative growth rate (g/g/day).

Results and Discussion

The results show that significant and highest plant height (44.67cm), was recorded in treatment T4- B2 + S1 (*rhizobium* + spacing) might be due to increasing availability of in improving the aforesaid. Similar results was also reported by Kumar *et al.*(2011). Further increased with plant height was spacing (30cm x 20 cm) may be due to availability of free access of environmental resources like water, light and nutrients for wider spacing, resulted in increase in plant height. Similar results were also reported by Sibhatu *et al.* (2016).

The significant increase in number of root nodules (34.89) was recorded in treatment T4- B2 + S1 (*rhizobium* + spacing) might be due to increase number of *rhizobia* in the rhizosphere due to inoculation , which synergistically increase the amount of nodules/plant which enhances growth attributes.

The significant increase in plant dry weight (27.43g) was recorded in treatment T4- B2 + S1 (*rhizobium* + spacing) due to increase in the availability of enzymes and vitamins in the soil to this enzyme activity the number of microbial population increase and this population of bacteria, and the actinomycetes recharge the soil with conditioner, which ultimately increase plant dry weight. Similar results were also reported by Yadav *et al*. (2017). Further increased with plant dry weight with application of spacing (30cm x 20 cm) may be due to availability of free access of environmental resources like water, light and nutrients for wider spacing, resulted in increase in plant dry weight. Similar results were also reported by Bishnoi *et al.* (2021).

The significant and higher crop growth rate ($0.30g/m^2$ /day) was recorded in treatment T4- B2 + S1 (*rhizobium* + spacing) might be due to better accumulation of dry matter throughout the plants vegetative and reproductive phase, which enhances the physiological and metabolic activity and growth by assimilating the available nutrients at higher rate which resulting in higher crop growth rate. Similar

Treatment	Plant height (cm) 75 DAS	Plant dry weight (g) 75 DAS	CGR (g/m^2 /day) 75 DAS	RGR (g/g/day) 75 DAS	Root Nodules/plant 75 DAS
T0	38.22	26.11	0.30	0.1	32.00
T1	40.78	26.39	0.29	0.1	33.00
T2	41.55	26.57	0.30	0.1	32.89
T3	41.56	26.62	0.30	0.1	33.11
T4	44.67	27.43	0.30	0.1	34.89
T5	42.34	26.90	0.30	0.1	32.78
T6	43.78	27.31	0.30	0.1	33.89
F test	S	S	S	S	S
SEd (±)	0.80	0.17	0.01	0.00	0.54
CD (0=0.0)	1.71	0.37	0.02	0.00	1.16

reports were reported by Jayshree and Umesha (2021; 22). Further increased in crop growth rate with spacing (30cm x 20 cm) may be due to availability of free access of environmental resources like water, sunlight and nutrients were efficiently utilized by the plants and their by enhanced individual plant performance was observed. Similar results were also reported by Swargiary *et al.* (2021).

The significant and higher relative growth rate (0.1g/g/day) was recorded in treatment T4- B2 + S1 (*rhizobium* + spacing) might be due to better dry weight throughout the reproductive phase. Further increased in relative growth rate with spacing (30cm x 20 cm) may be due to availability of free access of environmental resources like water, sunlight and nutrients which were efficiently use by the plants which enhanced individual plant performance was observed.

Conclusion

Based on the above findings results of the experiment, it is concluded that the treatment T4- B2 + S1 (*rhizobium* + spacing) that is 20g/kg of seed and spacing 30cm x 20cm has performed better in growth and parameters and yield attributes of field pea and also proven profitable and this experiment also reveals that optimum spacing improves both growth and yield of pea.

Conflict of Interest - None

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