INFLUENCE OF SEED SIZE AND BIO-FERTILIZER ON GROWTH, YIELD AND YIELD PARAMETER OF GROUNDNUT [*Arachis hypogaea* (L.)] CROP UNDER RAINFED CONDITION

ABSTRACT

A field experiment was conducted during *kharif* season 2021 to study the effect of seed size and bio-fertilizers on growth, yield and yield parameter of crop. The treatments include different categories of seed size viz., mixed (S_1), bold (S_2) and small seed size (S_3) and bio-fertilizer viz., control (B_1), *Rhizobium* + PSB + KMB (B_2) and *Trichoderma harzianum* + *Aspergillus niger* (B_3). Large seed size and bio-fertilizer shows significant effect on growth parameter viz., plant height, number of branches plant^{-1}, number of pegs plant^{-1} and root nodules plant^{-1} and yield parameter viz., number of pods plant^{-1}, number of seeds per pod^{-1}, seed index, shelling percentage and seed yield of groundnut except harvest index. Large seed size shows significant increase in number of pegs plant^{-1} and pods plant^{-1} which increase the yield of groundnut. In case of bio-fertilizer, *Rhizobium* + PSB + KMB shows significant effect on growth and yield parameter viz., plant height, number of branches plant^{-1}, number of pegs plant^{-1}, root nodules plant^{-1}, yield parameter viz., number of pods plant^{-1}, number of seeds per pod^{-1}, seed index, shelling percentage and seed yield of groundnut except harvest index.

Key words: Groundnut, seed size, bio-fertilizer, pod and yield

INTRODUCTION

Groundnut is an important oilseed crop in India which occupies first position in terms of area and second position in terms of production. Groundnut is harvested in October-November month in India.Seed size is an important physical indicator of seed quality that affects growth and is frequently related to yield, market grade factors and harvest efficiency. Seed size is one of the most important characteristics of seeds that can affect the seed development duration. The main purpose of seed grading is to understand the better physiological quality of the seed lot.Bio-fertilizers significantly improved plant growth characters may be due to increased nutrient availability throughout the growth period of groundnut crop.Some microorganisms in the soil are able to solubilize unavailable forms of potash bearing minerals such as micas, illite and orthoclase, by excreting organic acids which either directly dissolves rock phosphate or chelating silicon ions to bring the potash into solution. It is well known that, phosphate solubilizing bacteria (PSB) and *Rhizobium* have synergistic effect on legume crops. Keeping this in view, the present research work was undertaken to study effect of seed size and bio-fertilizer on growth and yield of groundnut.

MATERIALS AND METHODS

The field experiment was conducted at the College Farm, Navsari Agricultural University, campus Bharuch (South Gujarat Agro Climatic Zone - I) in the Plot No. 12 during the kharif season of 2021. The soil is clayey in texture and slightly alkaline in reaction. The soil was low in available N (242.5 kg ha^{-1}), low in available P_2O_5 (26.2 kg ha^{-1}) and high in available K_2O (330.21 kg ha^{-1}).

The nine treatments were selected with four replicates and each consisted of a Mixed seed + control (T_1), Mixed seed + *Rhizobium* + PSB + KMB (T_2), Mixed seed + *Trichoderma harzianum* + *Aspergillus niger* (T_3) , Bold seed + Control (T_4), Bold seed + *Rhizobium* + PSB + KMB (T_5) Bold seed + *Trichoderma harzianum* + *Aspergillus niger* (T_6), Small seed + Control (T_7), Small seed + *Rhizobium* + PSB + KMB (T_8) and Small seed + *Trichoderma harzianum* + *Aspergillus niger* (T_9) with groundnut (GJG -22) crop having a plot size 4.5 x 3.6 m. The experiment was laid out in FRBD with 9 treatment combinations with four replications.

Groundnut variety GJG-22 was sown by line sowing at a distance of 45 x 10 cm. For seed size, the seeds were initially graded into small, mixed and large seeds with the help of different sieve size and from each group 100-seed weight was determined. FYM was applied @ 5 t ha^{-1} in the open furrow. The 100 % recommended dose applied as basal dose. Nitrogen and phosphorus was applied in urea and SSP only. The seed rate of 100 kg ha^{-1} used for this experiment. The required quantity of seeds was worked out for each experimental area and seeds treated with bio-fertilizer as treatment before sowing. Then, seeds were dried under the shade and sown in the field on the basis of seed size as the treatment and keeping inter row spacing of 45 cm. After sowig, seeds were completely covered with the soil.

The analyzed data showed significant effect of seed size and bio-fertilizer on plant height, number of branches $plant^{-1}$, Number of pods $plant^{-1}$, Number of seeds pod^{-1}, Number of pegs $plant^{-1}$, Seed index, Seed Yield, Shelling percentage, haulm yield and Root nodules $plant^{-1}$. Whereas, harvest index does not show any significant effect by seed size and bio-fertilizer.

RESULTS AND DISCUSSION

Effect of seed size

Growth and Growth Attributes: The data can be recorded and analyzed (Table 1) for growth and growth attributing characters of groundnut. Among the different treatment growth parameter viz., plant height (38.02 cm) and no. of branches (7.06) of crop at harvest shows significantly higher value with large seed size which was at par with mixed seed size (36.83 cm and 6.93 respectively) whereas, no. of pegs $plant^{-1}$ (30.26) and root nodules (53.19) at 60 DAS shows significantly highest value with large seed size over control followed by mixed seed size. Similar results were obtained by Nagaraju S. (2001), Munir and Rahman (2002), Bicer T. (2009), Verma and Bajpai (2002), Gul *et al.* (2015), Ponnuswamy (1985) and Dobert and Blevins (1993).

Yield and Yield Attributes: The data can be recorded and analyzed for yield and yield attributing characters of groundnut. Yield parameter viz., pods per $plant^{-1}$ (18.50), seed yield (1184 kg ha^{-1}), haulm yield (2442 kg ha^{-1}), seed index (43.78 gm) and shelling percentage (70.20) of crop shows significantly higher value with large seed size (Table 2) which was at par with mixed seed size (18.01, 1098 kg ha^{-1}, 2335 kg ha^{-1}, 40.65 gm and 66.69 %

respectively) whereas, seed pod^{-1} (Table 3) shows significantly highest value with large seed size (2.10) over control followed by mixed seed size (1.94). Harvest index (Table 3) does not show any significant effect with the different seed size treatment. Similar results were reported by Knauft *et al*. (1990), Radhakrishna *et al.* (2001), Ramadevi and Rao (2005) Gul *et.al*. (2015), Rifaee *et al.* (2004) and Sulochanamma and Reddy (2007).

Effect of bio-fertilizer

Growth and Growth Attributes: From the Table 1 it can be concluded that different bio-fertilizer treatment shows significant effect on growth parameter viz., plant height at harvest and no. of branches. The plant height of groundnut was differed significantly due to application with different bio-fertilizers treatments in crop field. The bio-fertilizer treatment with *Rhizobium* + PSB + KMB recorded significantly the taller height (39.10) over control at harvest. The maximum number of branches plant^{-1} (7.14), pegs plant^{-1}(30.18), root nodules plant^{-1}(49.27) of groundnut were recorded significantly higher in *Rhizobium* + PSB + KMB which was at par with *Trichoderma harzianum* + *Aspergillus niger*. This result was in conformity with those Zalate and Padmani (2009), Donga and Mathukia (2021), Satpute *et al.* (2020), Rather *et al*. (2010) and Bhutadiya *et al*. (2019).

Yield and Yield Attributes: The number of pods plant^{-1} and 100 seed weight (Table 2) of groundnut was recorded during crop growth period and found that sowing with *Rhizobium* + PSB + KMB recorded significantly higher pods plant^{-1} (18.73) and seed index (43.03 gm) and remain at par with the treatment *Trichoderma harzianum* + *Aspergillus niger* (17.74 and 40.72 gm respectively). Similarly, seed yield (1227 kg ha^{-1}), haulm yield (2427 kg ha^{-1}) and shelling percentage (70.27) of crop found significantly higher with the treatment *Rhizobium* + PSB + KMB (Table 2) which was at par with the treatment *Trichoderma harzianum* + *Aspergillus niger* (1146 kg ha^{-1}, 2346 kg ha^{-1} and 65.98 % respectively) whereas, *Rhizobium* + PSB + KMB (Table 3) shows significantly highest seeds pod^{-1} (2.14) followed by *Trichoderma harzianum* + *Aspergillus niger* (1.95) and control (1.70). Harvest index (Table 3) of groundnut crop is found non-significant by bio-fertilizer treatment. These results were corroborating the finding of Donga and Mathukia (2021), Jaga and Sharma (2015), Mahakavi *et al.* (2020), Rather *et al*. (2010), Jain and Trivedi (2005) and Rajput and Pandey (2004).

CONCLUSION

In conclusion, the results from this study show that the farmer should screen and grade their groundnut seed and use large seed for getting more yield and profit. As large seed produce greater no of seed pod^{-1} and seed pod^{-1} which will increase the yield of crop. Bio-fertilizers based on microbial inoculants are attractive because they act in fixing nitrogen, phosphate, sulphate and solubilize nutrients and enhance plant growth by hormonal action or antibiosis and decomposing organic residues. The combined application of *Rhizobium* + PSB + KMB had much more favourable results than other application on the growth and yield of crop. Based on these findings, it may be recommended that the combined application of *Rhizobium* + PSB + KMB is found to be economical and suitable for the growth of groundnut.

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Table 1: Effect seed size and bio-fertilizer on plant height, number of branches, number of pegs and root nodule plant^{-1}of groundnut

Treatments	Plant heigh (cm)	Number of branches plant^{-1}	Number of pegs plant^{-1}	Root nodules plant^{-1}
(A) Seed size (S)				
S_1- Mixed	36.83	6.93	27.44	45.84
S_2- Bold seed	38.02	7.06	30.26	53.19
S_3- Small seed	34.58	6.49	26.82	41.87
S.Em. ±	0.86	0.16	0.94	1.44
CD at 5%	2.52	0.47	2.76	4.22
(B) Bio-fertilizer (B)				
B_1 - Control	34.25	6.45	26.24	44.02
B_2 - *Rhizobium* + PSB + KMB	39.10	7.14	30.18	49.27
B_3 - *Trichoderma harzianum + Aspergillus niger*	36.09	6.88	28.10	47.60
S.Em. ±	0.86	0.16	0.94	1.44
CD at 5 %	2.52	0.47	2.76	4.22
Interaction (S x B)				
S.Em. ±	1.49	0.27	1.64	2.51
CD at 5 %	NS	NS	NS	NS

Table 2: Effect seed size and bio-fertilizer on number of pods plant^{-1}, seed yield, haulm yield, seed index and shelling percentage of groundnut

Treatments	Number of pods plant^{-1}	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Seed index (gm)	Shelling (%)
(A) Seed size (S)					
S_1- Mixed	18.01	1098	2335	40.65	66.69
S_2- Bold seed	18.50	1184	2442	43.78	70.20
S_3- Small seed	16.88	1058	2174	37.10	63.34
S.Em. ±	0.44	32.89	69.00	1.10	1.73
CD at 5%	1.31	96.00	201.38	3.22	5.05
(B) Bio-fertilizer (B)					
B_1- Control	16.92	968	2177	37.79	63.98
B_2- *Rhizobium* + PSB + KMB	18.73	1227	2427	43.03	70.27
B_3 - *Trichoderma harzianum + Aspergillus niger*	17.74	1146	2346	40.72	65.98
S.Em. ±	0.44	32.89	69.00	1.10	1.73
CD at 5 %	1.31	96.00	201.38	3.22	5.05
Interaction (S x B)					
S.Em. ±	0.77	56.98	119.52	1.91	2.99
CD at 5 %	NS	NS	NS	NS	NS

Table 3: Effect seed size and bio-fertilizer on number of pods plant^{-1}, seed yield, haulm yield, seed index and shelling percentage of groundnut

Treatments	Number of seeds pod^{-1}	Harvest Index (%)
(A) Seed size (S)		
S_1- Mixed	1.94	31.45
S_2- Bold seed	2.10	32.48
S_3- Small seed	1.75	29.42
S.Em. $\pm$	0.04	0.92
CD at 5%	0.12	NS
(B) Bio-fertilizer (B)		
B_1- Control	1.70	29.74
B_2- *Rhizobium* + PSB + KMB	2.14	33.02
B_3 - *Trichoderma harzianum* + *Aspergillus niger*	1.95	30.59
S.Em. $\pm$	0.04	0.92
CD at 5 %	0.12	NS
Interaction (S x B)		
S.Em. $\pm$	0.07	1.602
CD at 5 %	NS	NS