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Yield and Yield Components of Horsegram as Influenced by Genotypes, Plant Densities and Phosphorus Levels*

B.S. KESHAVA, A.S. HALEPYATI,B.T. PUJARI, AND B.K. DESAI

Department of Agronomy
College of Agriculture, Raichur-584 101,India

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Abstract: A field experiment was carried out during kharif, 2004-05 under rainfed conditions on medium black soil of Agricultural College Farm, Raichur. The significantly higher seed yield was recorded with genotype GPM-6 (988.45 kg ha^{-1}) due to higher number of pods per plant, number of seeds per pod, thousand seed weight and threshing percentage as compared to Hebbal huruli-2 and local cultivar. Plant density of 4.44 lakh ha^{-1} produced significantly higher seed yield (912.36 kg ha^{-1}) and it was 26 and 60 per cent higher than that produced at plant density of 3.33 and 2.66 lakh ha^{-1}, respectively. Application of 60 kg P_2O_5 ha^{-1} produced significantly higher seed yield (788.82 kg ha^{-1}) as compared to 0 kg P_2O_5 ha^{-1} and it was on par with the application of 30 kg P_2O_5 ha^{-1}.

Introduction

Pulses contribute a major source of protein in the average Indian diet. Following the recent advances in the enhanced production of cereals in our country, pulses have also been started to receive increasing attention. Horsegram is considered to be a poor man's pulse crop in southern India, where it is extensively cultivated on marginal lands as 'catch crop' or inter crop. It is a hardy and drought resistant crop which can be grown on all soil types. The information on important agronomic practices like selection of genotypes,standardization of optimum plant density and phosphorus application to obtain higher yield is lacking. Therefore, the experiment was initiated to evaluate the yield potentiality of different genotypes and their response to plant densities and phosphorus levels on medium black soil.

Material and Methods

A field experiment was conducted at Agricultural College farm, Raichur under rainfed conditions on medium black soil during kharif, 2004-05.The soil of the experimental site had 0.65 per cent organic carbon, 200.10 kg available N ha^{-1}, 26.40 kg available P ha^{-1} and 351.0 kg available K ha^{-1}. The experiment consisting of 27 treatment combinations of three genotypes, plant densities and phosphorus each at three levels was laid out in split-split design with three replications. The crop was sown on 15th July, 2004. The Rhizobium inoculated seeds were dibbled in the furrows opened in the plots with respective row spacing (37.5, 30 and 24.5 cm) in order to maintain the desired plant densities. The intra row spacing was maintained at 10 cm between two hills. The entire quantity of phosphorus fertilizer dose was applied as basal along with 20 kg N ha^{-1} to all the plots as common application in the form of DAP and urea respectively. A rainfall of 722.2 mm was received from sowing to harvest of the crop during 2004-05 and average annual rainfall of the location is 660 mm. The crop was harvested on 20th November 2004. Observations on yield and yield components were recorded.

Results and Discussion

The results revealed that all the three genotypes differed significantly in seed yield.

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Genotype GPM-6 produced significantly higher seed yield (982.45 kg ha^{-1}) and it was 40 and 92 per cent higher than Hebbal huruli-2 (704.37 kg ha^{-1}) and local cultivar (513.08 kg ha^{-1}), respectively . The increase in seed yield of GPM-6 was due to significant increase in number of pods per plant, number of seeds per pod, thousand seed weight and threshing percentage (Table 1).

Plant densities significantly influenced the seed yield. In general, increase in plant density from 2.66 lakh ha^{-1} to 4.44 lakh ha^{-1}, increased the seed yield significantly. Plant density of 4.44 lakh ha^{-1} produced significantly higher seed yield (912.36 kg ha^{-1}) and it was 26 and 60 per cent higher than that produced at plant density of 3.33 (723.94 kg ha^{-1}) and 2.66 lakh ha^{-1} (569.55 kg ha^{-1}), respectively (Table 1).

All the yield components viz., number of pods per plant, number of seeds per pod and thousand seed weight were significantly lower at higher plant density (4.44 lakh ha^{-1}) as compared to medium (3.33 lakh ha^{-1}) and lower (2.66 lakh ha^{-1}) plant densities (Table 1a). But, inspite of all the yield components not in its favour, the seed yield per hectare under higher plant density (4.44 lakh ha^{-1}) was significantly higher when compared to that recorded at medium and lower plant densities as it could compensate for the loss of yield due to increased plant population. These results are in accordance with the findings of Nagaraju et al. (1995). The higher threshing percentage recorded at higher (4.44 lakh ha^{-1}) plant density might be the another reason for higher seed yield produced at higher plant density (4.44 lakh ha^{-1}). The application of 60 kg P_2O_5 ha^{-1} registered significantly higher seed yield (788.82 kg ha^{-1}) when compared to the application of 30 (783.85 kg ha^{-1}) and 0 kg P_2O_5 ha^{-1} (633.23 kg ha^{-1}) and also it was on par with 30 kg P_2O_5 ha^{-1}. Application of 60 kg P_2O_5 ha^{-1} caused an increase in the seed yield by 25 and one per cent respectively, when compared to 0 and 30 kg P_2O_5 ha^{-1} (Table 1). Further, increase in the phosphorus level from 30 to 60 kg P_2O_5 ha^{-1} did not result in any significant additional yield, indicating no beneficial effect of phosphorus application beyond 30 kg P_2O_5 ha^{-1}. Similar results on horsegram were also reported by Patra and Nayak (2000).

Seed yield response to the application of phosphorus levels was mainly due to the similar kind of response noticed in case of yield components due to the application of phosphorus levels where, application of phosphorus beyond 30 kg P_2O_5 ha^{-1} did not cause any significant increase in yield components. Interaction of genotypes and plant densities with respect to seed yield was significant. Genotype GPM-6 recorded the highest seed yield (1241.03 kg ha^{-1}) at higher plant density of 4.44 lakh ha^{-1}. These results are in conformity with the findings of Nagaraju et al. (2002). The differences in seed yield per hectare among the different genotypes at different plant densities arose largely because of differences in yield components viz., number of pods $plant^{-1}$ and number of seeds per pod. The reduction in number of pods per plant and seeds per pod recorded by GPM-6 was eight and 14 per cent at plant density of 2.66 and 4.44 lakh ha^{-1}, respectively (Table 1a). So, at higher plant density of 4.44 lakh ha^{-1}, the reduction in number of pods per plant and seeds per pod was compensated by genotype GPM-6 by producing the highest seed yield on hectare basis due to its higher plant population.

Genotype GPM-6 produced significantly higher seed yield (1088.85 kg ha^{-1}) with the application of 60 kg P_2O_5 ha^{-1} and also it was on par with the application of 30 kg P_2O_5 ha^{-1} (1086.54 kg ha^{-1}) (Table 1b). Higher levels of phosphorus (beyond 30 kg P_2O_5 ha^{-1}) applied to GPM-6, though resulted in higher seed yield, did not bring any significant increase over 30 kg P_2O_5 ha^{-1}. The differences in yield with different phosphorus levels might be due to differences in assimilatory surface area.

Table 1. Yield parameters and yield of horsegram as influeced by genotypes,plant densities and phosphorus level

Treatments	No. of pods/ plant	No.of seeds/ pod	Thousand-seed weight (g)	Threshing percentage(%)	Seed yield (kg ha^{-1})
Genotypes					
Local cultivar	41.43	4.15	22.90	59.90	513.08
Hebbal huruli-2	47.05	4.23	23.90	66.31	704.37
GPM-6	56.25	4.86	26.61	68.42	982.45
Mean	48.24	4.41	24.47	64.75	735.30
S.Em±	0.15	0.04	0.05	0.31	12.84
C.D. at 5%	0.59	0.15	0.20	1.23	50.43
Plant densities					
2.66 lakh/ha	52.12	4.60	26.08	62.99	569.55
3.33 lakh/ha	48.12	4.42	24.43	65.47	723.94
4.44 lakh/ha	44.49	4.22	22.91	65.77	912.36
Mean	48.24	4.41	24.47	64.75	735.30
S.Em±	0.43	0.04	0.20	0.77	12.16
C.D. at 5%	1.31	0.11	0.62	2.37	37.50
Phosphorus levels					
0 kg P_2O_5/ ha	45.42	4.26	23.31	66.67	633.23
30 kg P_2O_5/ ha	49.20	4.44	24.66	64.30	783.85
60 kg P_2O_5/ ha	50.11	4.53	25.45	65.26	788.82
Mean	48.24	4.41	24.47	64.75	735.30
S.Em±	0.77	0.07	0.41	0.66	22.97
C.D. at 5%	2.21	0.21	1.16	NS	65.85

Table 1a. Number of pods per plant, seeds per pod and seed yield (kg ha^{-1}) of horsegram as influenced by interaction of genotypes and plant densities

	Number of pods/ plant				Number of seeds/ pod				Seed yield (kg ha^{-1})			
Treatments	2.66 lakh ha^{-1}	33.33 lakh ha^{-1}	4.44 lakh ha^{-1}	Mean	2.66 lakh ha^{-1}	33.33 lakh ha^{-1}	4.44 lakh ha^{-1}	Mean	2.66 lakh ha^{-1}	33.33 lakh ha^{-1}	4.44 lakh ha^{-1}	Mean
Local cultivar	50.20	39.82	34.27	41.43	4.26	4.24	3.96	4.15	346.02	522.45	670.78	513.08
Hebbal huruli-2	48.65	46.86	45.66	47.05	4.31	4.28	4.09	4.23	567.71	720.12	825.27	704.37
GPM-6	57.52	57.69	53.53	56.25	5.23	4.74	4.60	4.86	794.91	929.41	1241.03	988.45
Mean	52.12	48.12	44.49	48.24	4.60	4.42	4.22	4.41	569.54	723.99	912.36	735.30
	S.Em±		C.D. at 5% S.		Em±		C.D. at 5%		S.Em±		C.D. at 5%	
	0.74		2.27		0.05		0.15		21.07		64.94	

Table 1b. Seed yield of horsegram as influenced by interaction of genotypes and phosphorus levels

Treatments	Seed yield (kg ha^{-1})			
	0 kg $P_2 0_5$ / ha	30kg $P_2 0_5$ / ha	60 kg $P_2 0_5$ / ha	Mean
Local cultivar	482.71	523.08	533.46	513.08
Hebbal huruli-2	627.01	741.94	744.15	704.37
GPM-6	789.96	1086.54	1088.85	988.45
Mean	633.23	783.85	788.82	735.30
	S.Em±	C.D. at 5%		
	39.78	114.06		

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