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Evaluation of Green Gram (*Vigna radiata* L. Wilczek) Genotypes for Mechanical Harvesting

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ABSTRACT

The field experiment were carried out to study the "Effect of paraquat on mechanical harvesting of greengram (Vigna radiata L. Wilczek) genotypes" at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The field experiment was laid out in split- split plot design with two main plots (methods of harvesting), three sub plots (genotypes) and two sub sub plots (paraquat spray and control. All the three genotypes namely DGGV-2, DGG-1 and Nirmal recorded more than 50 cm height, bearing first pod at 30 cm above the ground and more than 11 pods were (all most all pods) found above 30 cm height, then registered higher values of yield attributes like number of branches (more than 7), length of pods (9 - 10 cm), number of pods plant^{-1} (12 - 17), test weight (4.4 - 5.2 g), grain yield plant^{-1} (3.20 - 3.53 g), pod weight (4.31 - 4.82 g), harvest index (0.29) and grain yield (1181 - 1156 kg ha^{-1}). Therefore, these three genotypes with all these set of traits were well suited for mechanical harvesting.

Key words: *Greengram, Mechanical Harvesting, Paraquat.*

INTRODUCTION

Greengram (*Vigna radiata*L. Wilczek) is an ancient and well known third most important pulse crop in India, on account of its nutritional quality, early maturing and the suitability in cropping systems. In India, greengram is grown on an area of about 3.54 million hectare with a total production of 1.22 million tonnes and average productivity of 345 kg per hectare. Important greengram growing states in India are Orissa, Andhra Pradesh, Maharashtra, Karnataka, and Bihar. In Karnataka, it occupies an area of 0.369 million hectare with a total production of 0.042 million tonnes and an average productivity of 231 kg ha^{-1} [1]. There is less scope for production of greengram because of many production constraints like determinant growth habit it should be harvested several times, non availability of quality seeds of improved, short duration varieties, unscientific postharvest practice and delay in harvesting due to shortage of labours which cause shattering of pods, mungbean should be harvested many times and short stature it's become problem for mechanical harvesting. For timely harvesting of greengram under scarcity of labour mechanical harvesting is advisable and it requires complete defoliation of plant. In this experiment we tried to study suitable green genotypes for mechanical harvesting.

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MATERIAL AND METHODS

The field experiment was conducted at Main Agricultural Research Station, Dharwad, *kharif* 2015.

The field experiment was laid out in split- split plot design with two main plots (methods of harvesting), three sub plots (genotypes) and two sub sub plots (paraquat spray and control). The soil was medium deep black soil with pH 7.10. The available N, P_2O_5 and K_2O contents were 240.5, 23.5 and 354.6 kg ha^{-1}, respectively. FYM (5 t ha^{-1}) was applied 15 days before sowing of the crop.

For sowing, two seeds per hill were dibbled 5 cm deep in furrows at a spacing of 30 cm x 10 cm. Recommended dose of N and P_2O_5 were applied as basal at the time of sowing. The crops were harvested at their physiological maturity. The data was analysed statistically based on mean values obtained. The level of significance used in 'F' and 'T' test was P = 0.05 [2].

RESULTS AND DISCUSSION

Growth parameters

All the three genotypes did not show any significant difference in plant height, branches $plant^{-1}$ and total dry matter production $plant^{-1}$. However, they evidenced higher height, branches $plant^{-1}$, total dry matter production $plant^{-1}$ at the time of harvest which range from 59.73 - 61.52 cm, 8.88 - 8.25, 11.15 g - 10.70 g. There was no significant difference among the methods of harvesting and paraquat spray with respect to plant height and branches $plant^{-1}$. Whereas non sprayed treatment recorded significantly higher total dry matter production $plant^{-1}$ (11.52 g $plant^{-1}$) than the paraquat sprayed treatment (10.31 g $plant^{-1}$). Among the interaction irrespective methods of harvesting and genotypes higher total dry matter production $plant^{-1}$ was recorded with non sprayed plot (11.20 - 11.90 g $plant^{-1}$) compared to paraquat sprayed plot (10.04 - 10.64 g $plant^{-1}$). Its due to application of paraquat three days before harvesting reduced the weight of leaf and stalk to greater extent and was resulted into reduction of drymatter at the time of harvest. However, none of the interactions showed significant differences with respect to plant height and total number of branches $plant^{-1}$. (Table-1) The results are in agreement with findings of Singh[4], Somanagouda[5] and Tuppad[7].

Yield and yield parameters

Among the genotypes, DGG-1 recorded significantly higher number of pods $plant^{-1}$ (16.2) over Nirmal (12.8) and DGGV-2 (12.6). With respect to pod length and test weight, genotype Nirmal recorded significantly higher pod length and test weight (10.30 cm and 5.17 g) than DGG-1 (9.06 cm and 4.36 g) and it was on par with DGGV-2 (10.17 cm and 4.98 g). Whereas DGGV-2 recorded significantly higher height of first pod from ground (38.35 cm) compared to DGG-1 (29.15 cm) and it was on par with Nirmal (37.39 cm). However, genotypes did not show significant difference with respect to pods above 30 cm, seed yield, haulm yield and harvest index. Method of harvesting and paraquat spray did not show any significant difference with respect to yield and yield parameters it's because of varietal characteristics. Among the interactions of methods of harvesting, genotypes and paraquat spray (H×G×D), mechanical harvesting of all the genotypes with paraquat recorded significantly higher seed yield and harvest index (1245 - 1304 kg ha^{-1} and 0.30 - 0.33) compared to mechanical harvesting of genotypes without paraquat spray (911 - 990 kg ha^{-1} and 0.25 - 0.26) and it was on par with manual harvesting of genotypes with paraquat and manual harvesting of genotypes without paraquat (Table-2). Because the control plot recorded higher harvest losses like threshing loss of about 56.4 %, damaged grains about 44.68 %, unthreshed pods about 55.29 % compared to paraquat sprayed plots. Whereas none of the interactions recorded significant difference with respect yield parameters (Table 3, 4 and 5). The similar results recorded by Thakar and Brar[6], Keith[3] and Tuppad[7].

Table 1: Plant height, Total dry matter production and Number of branches plant^{-1} of greengram as influenced by method of harvesting, paraquat spray and genotype

Treatment		Plant height (cm)			Total dry matter production (g)			Number of branches plant^{-1}		
		Spray								
Harvesting	**Genotypes**	**D_1**	**D_2**	**Mean**	**D_1**	**D_2**	**Mean**	**D_1**	**D_2**	**Mean**
H_1	**G_1**	62.5	60.5	**61.5**	10.07	11.48	**10.78**	8.41	7.71	8.06
	G_2	59.6	59.8	**59.7**	10.58	11.90	**11.24**	8.95	8.95	8.95
	G_3	62.5	60.8	**61.6**	10.05	11.58	**10.82**	8.82	8.29	8.56
	Mean	**61.5**	**60.3**	**60.9**	**10.24**	**11.65**	**10.94**	8.73	8.32	8.52
H_2	**G_1**	60.6	62.5	**61.6**	10.04	11.20	**10.62**	8.65	8.23	8.44
	G_2	59.6	60.0	**59.8**	10.64	11.46	**11.05**	8.89	8.72	8.81
	G_3	60.7	61.5	**61.1**	10.45	11.52	**10.98**	8.56	8.41	8.49
Mean of H	**Mean**	**60.3**	**61.3**	**60.8**	**10.38**	**11.39**	**10.88**	8.70	8.46	8.58
	G_1	61.5	61.5	**61.5**	10.06	11.34	**10.70**	8.53	7.97	8.25
	G_2	59.6	59.9	**59.7**	10.61	11.68	**11.15**	8.92	8.84	8.88
	G_3	61.6	61.1	**61.4**	10.25	11.55	**10.90**	8.69	8.35	8.52
Mean		**60.9**	**60.8**		**10.31**	**11.52**		**8.71**	**8.39**	
For comparison of Means			**S.Em±**	**CD at 5%**	**S.Em±**	**CD at 5%**		**S.Em±**	**CD at 5%**	
H			0.4	NS	0.08	NS		0.12	NS	
G			0.5	NS	0.16	NS		0.20	NS	
D			0.5	NS	0.13	0.39		0.21	NS	
H x G			0.7	NS	0.23	NS		0.29	NS	
H x D			0.7	NS	0.18	0.56		0.30	NS	
G x D			0.8	NS	0.22	0.68		0.37	NS	
H x G x D			1.1	NS	0.31	0.96		0.52	NS	

Main plot- Methods of harvesting (H) **Sub plot - Genotype (G)** **Sub sub plot- Defoliator chemical (D)**
H_1: Mechanical harvesting G_1: DGGV-2 D_1: Paraquat @ 4ml l^{-1}
H_2: Manual harvesting G_2: DGG-1 D_2: Control
G_3: Nirmal (popular local variety)

Table 2: Seed yield (kg ha^{-1}) and harvest index of greengram as influenced by method of harvesting, paraquat spray and genotype

Treatment		Seed yield (kg ha^{-1})			Harvest index		
		Spray					
Harvesting	**Genotypes**	**D_1**	**D_2**	**Mean**	**D_1**	**D_2**	**Mean**
H_1	**G_1**	1245	990	**1117**	0.32	0.25	**0.29**
	G_2	1304	920	**1112**	0.30	0.26	**0.28**
	G_3	1290	911	**1101**	0.33	0.25	**0.29**
	Mean	**1280**	**940**	**1110**	**0.32**	**0.25**	**0.28**
H_2	**G_1**	1224	1165	**1195**	0.31	0.27	**0.29**
	G_2	1294	1208	**1251**	0.32	0.28	**0.30**
	G_3	1256	1169	**1213**	0.29	0.29	**0.29**
Mean of H	**Mean**	**1258**	**1181**	**1219**	**0.30**	**0.28**	**0.29**
	G_1	1234	1078	**1156**	0.32	0.26	**0.29**
	G_2	1299	1064	**1181**	0.31	0.27	**0.29**
	G_3	1273	1040	**1157**	0.31	0.27	**0.29**
Mean		**1269**	**1061**		**0.31**	**0.27**	
For comparison of Means			**S.Em±**	**CD at 5%**	**S.Em±**	**CD at 5%**	
H			21	NS	0.009	NS	
G			18	NS	0.013	NS	
D			23	72	0.007	0.022	
H x G			25	81	0.018	NS	
H x D			33	101	0.010	0.032	
G x D			40	124	0.013	0.039	
H x G x D			57	176	0.018	0.055	

Main plot- Methods of harvesting (H) **Sub plot - Genotype (G)** **Sub sub plot- Defoliator chemical (D)**
H_1: Mechanical harvesting G_1: DGGV-2 D_1: Paraquat @ 4ml l^{-1}
H_2: Manual harvesting G_2: DGG-1 D_2: Control
G_3: Nirmal (popular local variety)

Table 3: Height of first pod above ground and test weight of greengram as influenced by method of harvesting, paraquat spray and genotype

Treatment		Height of first pod above ground			Test weight (g)		
		Spray					
Harvesting	Genotypes	D_1	D_2	Mean	D_1	D_2	Mean
H_1	G_1	38.11	38.78	**38.44**	5.03	4.89	**4.96**
	G_2	27.84	29.11	**28.48**	4.35	4.38	**4.37**
	G_3	37.43	37.34	**37.39**	5.11	5.24	**5.18**
	Mean	**34.46**	**35.08**	**34.77**	**4.83**	**4.84**	**4.84**
H_2	G_1	38.08	38.42	**38.25**	4.86	5.11	**4.99**
	G_2	29.33	30.33	**29.83**	4.37	4.35	**4.36**
	G_3	37.44	37.33	**37.39**	5.07	5.24	**5.15**
Mean of H	**Mean**	**34.95**	**35.36**	**35.16**	**4.77**	**4.90**	**4.83**
	G_1	38.09	38.60	**38.35**	4.95	5.00	**4.98**
	G_2	28.59	29.72	**29.15**	4.36	4.37	**4.36**
	G_3	37.44	37.34	**37.39**	5.09	5.24	**5.17**
Mean		**34.71**	**35.22**		**4.80**	**4.87**	
For comparison of Means			**S.Em±**	**CD at 5%**	**S.Em±**	**CD at 5%**	
H			0.516	NS	0.10	NS	
G			0.718	2.34	0.12	0.39	
D			0.646	NS	0.15	NS	
H x G			1.015	NS	0.17	NS	
H x D			0.913	NS	0.21	NS	
G x D			1.118	NS	0.25	NS	
H x G x D			1.582	NS	0.36	NS	

Main plot- Methods of harvesting (H) **Sub plot - Genotype (G)** **Sub sub plot- Defoliator chemical (D)**
H_1: Mechanical harvesting G_1: DGGV-2 D_1: Paraquat @ 4ml l^{-1}
H_2: Manual harvesting G_2: DGG-1 D_2: Control
G_3: Nirmal (popular local variety

Table 4: Haulm yield and number of pods above 30cm of greengram as influenced by method of harvesting, paraquat spray and genotype

Treatment		Haulm yield (kg ha^{-1})			Number of pods above 30cm		
		Spray					
Harvesting	Genotypes	D_1	D_2	Mean	D_1	D_2	Mean
H_1	G_1	2597	3031	**2814**	12.33	12.44	**12.39**
	G_2	3100	2653	**2876**	12.29	12.86	**12.58**
	G_3	2633	2846	**2740**	12.93	12.26	**12.59**
	Mean	**2777**	**2844**	**2810**	**12.52**	**12.52**	**12.52**
H_2	G_1	2807	3130	**2968**	12.11	13.11	**12.61**
	G_2	2823	3086	**2955**	15.33	13.78	**14.55**
	G_3	3131	3068	**3099**	12.28	12.27	**12.27**
Mean of H	**Mean**	**2920**	**3095**	**3007**	**13.24**	**13.05**	**13.14**
	G_1	2702	3081	**2891**	12.22	12.77	**12.50**
	G_2	2961	2870	**2915**	13.81	13.32	**13.57**
	G_3	2882	2957	**2920**	12.60	12.26	**12.43**
Mean		**2848**	**2969**		**12.88**	**12.79**	
For comparison of Means			**S.Em±**	**CD at 5%**	**S.Em±**	**CD at 5%**	
H			108	NS	0.30	NS	
G			195	NS	0.32	NS	
D			124	NS	0.27	NS	
H x G			276	NS	0.46	NS	
H x D			175	NS	0.38	NS	
G x D			214	NS	0.47	NS	
H x G x D			303	NS	0.66	NS	

Main plot- Methods of harvesting (H) **Sub plot - Genotype (G)** **Sub sub plot- Defoliator chemical (D)**
H_1: Mechanical harvesting G_1: DGGV-2 D_1: Paraquat @ 4ml l^{-1}
H_2: Manual harvesting G_2: DGG-1 D_2: Control
G_3: Nirmal (popular local variety

Table 5: Number of pods plant^{-1} and pod length (cm) of greengram as influenced by method of harvesting, paraquat spray and genotype

Treatment		Number of pods plant^{-1}			Pod length(cm)		
		Spray					
Harvesting	Genotypes	D_1	D_2	Mean	D_1	D_2	Mean
H_1	G_1	12.9	12.6	**12.8**	10.27	10.20	**10.23**
	G_2	15.9	16.3	**16.1**	8.93	8.90	**8.92**
	G_3	13.0	12.4	**12.7**	10.33	10.43	**10.38**
	Mean	**13.9**	**13.8**	**13.8**	**9.84**	**9.84**	**9.84**
H_2	G_1	12.4	12.3	**12.3**	10.27	9.93	**10.10**
	G_2	16.1	16.5	**16.3**	9.23	9.18	**9.21**
	G_3	12.9	12.8	**12.8**	10.27	10.17	**10.22**
Mean of H	**Mean**	**13.8**	**13.9**	**13.8**	**9.92**	**9.76**	**9.84**
	G_1	12.7	12.4	**12.6**	10.27	10.07	**10.17**
	G_2	16.0	16.4	**16.2**	9.08	9.04	**9.06**
	G_3	12.9	12.6	**12.8**	10.30	10.30	**10.30**
Mean		**13.9**	**13.8**		**9.88**	**9.80**	
For comparison of Means			**S.Em±**	**CD at 5%**	**S.Em±**	**CD at 5%**	
H			0.34	NS	0.06	NS	
G			0.34	1.1	0.24	0.79	
D			0.42	NS	0.26	NS	
H x G			0.48	NS	0.34	NS	
H x D			0.60	NS	0.36	NS	
G x D			0.73	NS	0.45	NS	
H x G x D			1.03	NS	0.63	NS	

Main plot- Methods of harvesting (H) H_1: Mechanical harvesting H_2: Manual harvesting

Sub plot - Genotype (G) G_1: DGGV-2 G_2: DGG-1 G_3: Nirmal (popular local variety

Sub sub plot- Defoliator chemical (D) D_1: Paraquat @ 4ml l^{-1} D_2: Control

CONCLUSION

In the present investigation, paraquat spraying reduced the moisture level in plant and facilitated early harvesting, reduced shattering loss, moreover, it increased the cutting efficiency of machine, increased the field efficiency, harvest per cent and reduced the unthreshed pods, damaged grains and threshing loss. The methods of harvesting did not record significant difference with respect seed yield (kg ha^{-1}) and yield parameters. Genotypes also did not show significant difference with respect to seed yield (kg ha^{-1}) However, Nirmal recorded significantly higher pod length (10.30 cm) and test weight (5.17 g) and it was on par with DGGV-2. Genotype DGG-1 recorded significantly higher number of pods (16.2) over the others. Spraying of paraquat recorded significantly higher seed yield (1,269 kg ha^{-1}) than control. Among the interactions, mechanical harvesting of all the three genotypes with paraquat recorded significantly higher seed yield (1,304 – 1,245 kg ha^{-1}) over mechanical harvesting of genotypes without paraquat spray. By the present investigation it was concluded that these three genotypes with all these set of traits were well suited for mechanical harvesting.

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