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EFFECT OF VARIETY AND ROW SPACING ON QUALITY, NUTRIENT CONTENT AND UPTAKE OF SUMMER COWPEA [*Vigna unguiculata* (L.) Walp.] UNDER SOUTH GUJARAT CONDITION

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ABSTRACT

A field experiment was conducted during 2021 to study the effect of variety and row spacing on quality, nutrient content and uptake of summer cowpea [*vigna unguiculata* (L.) walp.] under south Gujarat condition. The results revealed that sowing of cowpea at 45 cm row spacing showed significantly higher seed yield (1421 kg ha^{-1}), stover yield (2405 kg ha^{-1}), crude protein yield (284.75 kg ha^{-1}), nutrients content and uptake (N, P, K) by seed and stover and maximum net realization of Rs.57978 ha^{-1} with BCR of 1.86. The variety GC-6 gave significantly higher crude protein yield (282.15 kg ha^{-1}), seed yield (1415 kg ha^{-1}), stover yield (2414 kg ha^{-1}), nutrients content, uptake by seed and stover and maximum net realization of Rs. 57717 ha^{-1} with maximum BCR 1.85.

(Key words: Cowpea, variety, row spacing, quality, nutrient content and uptake)

INTRODUCTION

Pulses are one of the important food crops globally due to higher protein content. Pulses in India have long been considered as the poor man's only source of protein. India is the largest producer as well as consumer of pulses (also referred to as grain legumes, peas and beans) in the world. In India, pulses are grown nearly on 28.34 M ha with an annual production of 23.15 MT and average productivity of 817 kg ha^{-1} (Anonymous, 2020). Cowpea is a member of the Leguminosae family. Due to its tolerance for sandy soil and low rainfall, it is an important crop in the semiarid regions and marginal area of the tropics and subtropics. In Gujarat, cowpea is cultivated in 0.52 M ha with an annual production of 0.35 MT and average productivity of 665 kg ha^{-1} (Anonymous, 2020). The spacing of planting is one of the most important factors, which in the first place influences the yields, the quality, and quite often the earliness of the respective cultivar. Consequently, the number of plants unit^{-1} has an indirect effect on the production costs and profitableness in general. Improved variety must show characters like disease and insect resistance, high yield, early maturity, plant height, should be economical to the farmers and should have superior quality and nutrient level. Seeds of improved varieties are important in raising yields and ensuring food security, proper nutrition and prosperity for not only smallholder farmers but the general population. Looking into importance of varieties and row spacing, a field experiment was conducted on effect of variety and row spacing on quality, nutrient content and uptake of summer cowpea.

MATERIALS AND METHODS

A field experiment was conducted during summer season of year 2021 at the Soil and Water Management, NARP Phase – II (NARP Farm), Cotton Research Sub Station, N.A.U., Achhalia (South Gujarat Agro Climatic Zone - II). The soil of the experimental field was clayey in texture having medium to poor drainage, soil pH 7.23, EC 0.265 dS m^{-1} and organic carbon content 0.44 per cent with medium in available nitrogen (282.2 kg ha^{-1}), medium in available phosphorus (36.01 kg ha^{-1}) and high in available potassium (318.9 kg ha^{-1}) and slightly alkaline in reaction. The experiment was laid out in RBD (factorial concept) design with 12 treatment combinations consisting of two factors i.e., varieties (V_1- GC-4, V_2- GC-5 and V_3- GC-6), row spacing (S_1- 30 cm, S_2- 45 cm and S_2- 60 cm). The entire dose of fertilizer was 20-40-00 N: P_2O_5: K_2O kg ha^{-1}.

The data on seed and stover yield was recorded from the net plot and converted on a hectare basis. The nitrogen content in cowpea seed was estimated by micro alkaline permanganate oxidation method as described by Subbiah and Asija (1956). The crude protein content of the seed was computed by multiplying the nitrogen percentage with 6.25 for each treatment. Chemical studies about nitrogen, phosphorus, potassium content and their uptake by seed and stover and available nitrogen, phosphorus,

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potassium status in the soil after harvest of the crop were determined as per different methods *viz.,* Modified alkaline permanganate oxidation method (for N), Spectro photometric (for P) and Flame photometric method (for K) (Jackson, 1973). The data were analyzed statistically by adopting the standard procedures described by Panse and Sukhatme (1967). The purpose of the analysis of variance was to determine the significant effect of treatments on green gram. Uptake of nutrients by seed and plant was calculated by using following formula:

$$\text{Nutrient uptake (kg ha}^{-1}\text{)} = \frac{\text{Nutrient content (\%) x seed / stover yield (kg ha}^{-1}\text{)}}{100}$$

RESULTS AND DISCUSSION

Effect of variety

Yield

The result pertaining to yield (Table 1) showed significant response for seed yield and stover yield of cowpea were influenced due to different variety. Significantly higher seed yield (1415 kg ha^{-1}) was recorded by variety GC-6 (V_3), which was at par with GC-5 variety (V_2) and stover yield (2414 kg ha^{-1}) was observed with variety V_3 (GC-6). This was due to better performance of variety GC-6 in terms of growth parameters and yield attributes resulted into higher seed yield and stover yield as compared to GC-4 and GC-5 varieties. These findings were in accordance with the results of Patel *et al.* (2022). They reported that GM-7 variety gave the highest seed yield (1318 kg ha^{-1}) and stover yield (2301 kg ha^{-1}) over GM-6 variety.

Quality parameters

The data of Table 1 indicated that protein content was not differed significantly due to different varieties. Numerically higher crude protein content (19.91 %) was recorded by variety GC-6 (V_3) and the lowest crude protein content (19.57 %) was recorded in variety GC-5 (V_2). However, crude protein yield was significantly influenced due to different variety. The variety V_3 (GC-6) recorded significantly higher crude protein yield over other varieties. It might be due to higher seed yield obtained by treatment GC-6 resulted in higher protein yield. Similar reasons have also been reported by Verma *et al*. (2011) for HUM-12 variety, this variety gave the highest protein content (22.81) and protein yield (297.89) as compared to K-851 and NDM-1 varieties.

Nutrient content and uptake

An appraisal of data given in Table 2 revealed that no significant difference was observed in nitrogen, phosphorus and potassium content in seed and stover due to different varieties. However, significantly higher nitrogen, phosphorus and potassium uptake by seed and stover was recorded by variety V_3 (GC-6) and lowest nitrogen, phosphorus and potassium uptake by seed and stover was recorded by variety GC-4 and GC-5. This might be due to higher seed and stover yield obtained by variety GC-6. These results are in accordance with these reported by Bobade *et al*. (2018) for BM-2 variety in green gram, This variety gave the highest N, P and K uptake by seed i.e. 42.30, 6.44, 15.33 kg ha^{-1}, respectively and N, P and K uptake by stover i.e. 6.33, 5.30, 20.33 kg ha^{-1}, respectively.

Available nutrient in soil after harvest

The data shown in Table 2 indicated that the effect of different variety on available nitrogen, phosphorus and potassium in soil after harvest of the crop was found non-significant. This might be due to adequate nutrient supply through fertilizer application and continuous transformation of nutrient from soil reserve. These results are in accordance with those reported by Patel *et al.* (2022) for GM-7. They reported that GM-7 variety gave the highest available nitrogen (219.01 kg ha^{-1}), phosphorus (25.37 kg ha^{-1}) and potassium (220.95 kg ha^{-1}) in soil.

Economics

It is obvious from the data reported in Table 1 that the maximum net realization (₹ 57717 ha^{-1}) and BCR (1.85) was obtained by variety V_3 (GC-6) and the minimum net income (₹ 48416 ha^{-1}) and BCR (1.55) was secured under variety GC-4 (V_1). This might be due to the higher yields produced by variety V_3 (GC-6) of cowpea. The results are close conformity to these obtained by Patel *et al.* (2022) for GM-6. This variety gave the highest net return (70490 ha^{-1}) and B:C ratio (3.19).

Mendhekar *et al.* (2019) reported that highest gross monetary returns of Rs. 56028 ha^{-1}and net monetary returns of Rs. 40303 ha^{-1} and B:C ratio of 3.56 was recorded with variety AKS-207 which was at par to variety Bhima and found significantly superior over PKV (Pink) and AKS-311 in safflower.

Effect of row spacing

Yield

The result pertaining to yield (Table 1) showed that seed and stover yield of cowpea were influenced significantly due to different row spacing. Significantly higher seed yield (1421 kg ha^{-1}) and stover yield (2405 kg ha^{-1}) found under row spacing of 45 cm (S_2) over other row spacing. This might be due to fact that proper row spacing or plant population might be attributed to minimum intra row species competition in crop plants and proper utilization of natural resources i.e. space, light, moisture and nutrients which might have remained underutilized due to mutual plant competition developed by more plants in closer row spacing. These results are also in agreement with finding of Sanap *et al.* (2019). They recorded that highest seed yield (26.64 q ha^{-1}) and stover yield (39.91 q ha^{-1}) with drilling distance of 25 cm and found significantly superior over drilling distance of 20 cm but at par with 30 cm drilling distance.

Quality parameters

The data presented in Table 1 showed that different row spacing of cowpea crop did not produced crude protein content in seed significantly, but it was significantly affected on crude protein yield. Significantly higher crude protein yield (284.75 kg ha^{-1}) was produced by row spacing of 45 cm

Table 1. Effect of variety and row spacing on quality parameter, yield and economics on cowpea

Treatments	Crude Protein content(%)	Crude Protein yield (kg ha^{-1})	Yield (kg ha^{-1})		Gross realization (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net realization (Rs. ha^{-1})	B: C ratio
			Seed	Stover				
Variety (V)								
V_1: GC-4	19.80	250.66	1266	2166	79577	31161	48416	1.55
V_2: GC-5	19.57	255.14	1310	2231	82256	31161	51095	1.64
V_3: GC-6	19.91	282.15	1415	2414	88878	31161	57717	1.85
S Em ±	0.32	7.51	41.41	62.41	—	—	—	—
C D at 5 %	-	21.92	120.85	182.13	—	—	—	—
Row Spacing (S)								
S_1: 30 cm	19.42	250.63	1297	2219	81501	31711	49790	1.57
S_2: 45 cm	20.02	284.75	1421	2405	89139	31161	57978	1.86
S_3: 60 cm	19.85	252.57	1273	2187	80071	30611	49460	1.62
S Em ±	0.32	7.51	41.41	62.41	—	—	—	—
C D at 5 %	-	21.92	120.85	182.13	—	—	—	—
Interaction								
V X S								
S Em ±	0.56	13.01	71.72	108.10	-	-	-	-
C D at 5 %	-	-	-	-	-	-	-	-
CV %	5.67	9.91	10.28	9.52	-	-		-

Table 2. Nutrient content, uptake and available nutrient status of soil by summer cowpea as influenced by variety and row spacing

Treatments	Nutrient content (%)						Nutrient uptake (kg ha^{-1})						Available Nutrients (kg ha^{-1})		
	Seed			Stover			Seed			Stover					
	N	P	K	N	P	K	N	P	K	N	P	K	N	P_2O_5	K_2O
Variety (V)															
V_1: GC-4	3.17	0.410	0.774	0.88	0.212	0.477	40.10	5.18	9.82	19.02	4.59	10.26	298.74	33.96	292.42
V_2: GC-5	3.13	0.398	0.787	0.90	0.218	0.460	40.82	5.22	10.31	20.09	4.83	10.32	311.14	34.41	303.23
V_3: GC-6	3.19	0.425	0.798	0.93	0.226	0.497	45.14	6.03	11.30	22.45	5.48	12.03	313.05	36.40	311.26
S Em ±	0.05	0.007	0.012	0.02	0.004	0.010	1.20	0.21	0.37	0.60	0.14	0.38	7.02	0.83	6.11
C D at 5 %	-	-	-	-	-	-	3.51	0.62	1.08	1.76	0.41	1.10	-	-	-
Row Spacing (S)															
S_1: 30 cm	3.11	0.402	0.762	0.87	0.213	0.482	40.10	5.24	10.07	19.14	4.72	10.70	303.39	34.83	298.00
S_2: 45 cm	3.20	0.416	0.808	0.93	0.222	0.487	45.56	5.95	11.47	22.33	5.34	11.76	314.29	36.97	306.65
S_3: 60 cm	3.18	0.413	0.789	0.91	0.221	0.464	40.41	5.25	9.89	19.81	4.85	10.15	305.26	34.96	302.26
S Em ±	0.05	0.007	0.012	0.02	0.004	0.010	1.20	0.21	0.37	0.60	0.14	0.38	7.02	0.83	6.11
C D at 5 %	-	-	-	-	-	-	3.51	0.62	1.08	1.76	0.41	1.10	-	-	-
C V %	5.67	6.27	5.50	5.84	6.78	7.44	9.91	13.34	12.24	10.18	9.91	12.03	7.91	8.25	7.01
Interaction															
V x S															
S Em ±	0.09	0.013	0.022	0.03	0.007	0.018	2.08	0.37	0.64	1.04	0.25	0.65	12.16	1.44	10.59
C D at 5 %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(S_2) over other row spacing. The increase in protein yield might be due to increase in seed yield. Mansur *et al*. (2009) in chick pea recorded highest crude protein content (23.7 %) and yield (210.02 kg ha^{-1}) by row spacing of 45 cm.

Nutrient content and uptake

An appraisal of data given in Table 2 revealed that different row spacing were not significantly influenced on N, P and K content in seed and stover. The result showed that row spacing of 45 cm (S_2) recorded significantly higher N, P and K uptake by seed i.e. 45.56, 5.95 and 11.47 kg ha^{-1}, respectively and N, P and K uptake by stover i.e. 22.33, 5.34 and 11.76 kg ha^{-1}, respectively as compared to row spacing of 45 cm (S_2) over other row spacing. This increase in N, P and K uptake by seed and stover might be due to cumulative effect of increased seed and stover yield. The findings are in accordance with those of Jnanesha *et al*. (2019) in mungbean. They recorded that the highest N, P and K content of i.e. 2.63, 1.05, 1.33 kg ha^{-1}, respectively and N, P and K uptake of i.e. 42.20, 5.27, 14.70 kg ha^{-1}, respectively under 45 cm row spacing.

Available nutrient in soil after harvest

The data shown in Table 2 indicated that the effect of different row spacing was influenced non-significant effect on available N, available P_2O_5 and available K_2O in the soil after harvest of green gram crop. Lone *et al.* (2009) recorded the highest available N (78.64 kg ha^{-1}), available P_2O_5 (14.53 kg ha^{-1}), and available K_2O (80.30 kg ha^{-1}), in the soil after harvest under 45 cm row spacing.

Economics

The result presented in Table 1 indicated that the maximum net realization (₹ 57978 ha^{-1}) and BCR (1.86) obtained from 45 cm row spacing. This might be due to higher yields of cowpea under 45 cm row spacing. The findings are in accordance with those of Mondal *et al*. (2014) in soybean. They reported that the maximum net return (₹ 36320 ha^{-1}) and BCR (3.10) was obtained in soybean under 45 cm row spacing.

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