



E-ISSN: 2278-4136

P-ISSN: 2349-8234

www.phytojournal.com

JPP 2020; 9(2): 1749-1753

Received: 18-01-2020

Accepted: 20-02-2020

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Response of cowpea (*Vigna unguiculata* L.) varieties to under Malwa region of Madhya Pradesh

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Abstract

A research trial was carried out during *Kharif*, 2018 at Experimental Field at Department of Vegetable Science, College of Horticulture, Mandsaur is situated in Malwa Plateau in Western part of Madhya Pradesh. The treatments consisting of eight variety: V1 (Pusa Sukomal) V2 (Arka Garima) V3 (Kashi Gauri) V4 (Kashi Shyamal) V5 (Kashi Kanchan) V6 (Kashi Nidhi) V7 (Kashi Unnati) V8 (Arka Suman) and space S1 (45 x 15 cm) S2 (30 x 15 cm). The design of experiment was Factorial Randomized Block Design. The results of the study indicated that out of the varieties tried, the cowpea produced Maximum Plant height 114.13(cm), Number of leaves per plant (69.9), Number of branches per plant (5.73), SPAD value (54.18), Fresh weight of plant (158.33 g), Days to first flower appearance (51.50 days), Days to 50 % flowering (51.50 days), Number of pods per plant 22.97, Pod length (3028 cm), Average Pod weight (8.72 g), Pod yield/plant (125.15 g), Pod yield (229.52 q/ha), Protein content (3.10%), Fiber content (0.97 %). Based on the experimental findings it was concluded that variety V₂ (Arka garima) be recommended as best variety under the Western Malwa Plateau condition of Madhya Pradesh.

Keywords: Cow pea, different varieties like pusa sukomal, arka garima, kashi gauri, kashi shyamal, kashi kanchan, kashi nidhi, kashi unnati, arka suman, pod length, protein content

Introduction

Cowpea (*Vigna unguiculata* L.) belonging to family Fabaceae, sub-family papilionaceae. It is one of the important legume vegetable crops. It is known by different name as black eye pea, southern pea and yard long bean. The tender pods are rich source of minerals, vitamins and protein. It is used as vegetable, pulse, green manuring and fodder crops in dry and semiarid of the world. Cowpea is an important source of nutrients and provides high nutritive quality inexpensive protein to diet based on cereal grain and starchy food. 100 g of green tender pods contain 4.3 g protein, 2.0 g fiber, 8.0 g carbohydrates, 74 mg phosphorus, 2.5 mg iron, 13.0 mg vitamin-C, 0.9 mg minerals, etc.

It is a versatile crop possessing high adaptability to extreme conditions of temperature, drought, tolerate alkaline soil conditions and posses high potential of biological nitrogen fixation. Therefore, introduction and evaluation of different cowpea varieties performing better in rainfed as well as irrigated conditions and its improvement for yield and its contributing traits are of pivotal importance to get self-sufficiency in pulses. Cowpea it thrives very well under moisture stress condition it has multipurpose uses and having wide ranges of adoptability to different agro climatic condition prevailing in India. Mostly, it is grown *Kharif* season in India and best suited as inter crop. The poor yield may be due to unavailability of high yielding and stable genotypes along with appropriate advance agronomic management practices (Srinivas *et al.*, 2017) [13].

In India, despite the fact that a large number of varieties and agro-techniques have been developed, the productivity of cowpea has still not reached the optimum level. So, there is urgent need to evaluate the cowpea varieties released from states and national levels and made a certain recommendation to generate research evidences of different varieties with respect to their suitability under certain conditions to benefits the cowpea growers. Cowpea is well adapted to arid and semi-arid areas due to its morphological as well as biochemical characteristics. The deep rooted system and its short duration life cycle are some of the factors that make cowpea very adaptable to hostile environments (Patel *et al.*, 2018) [8].

It has two types i.e. one that grows erect and other has spreading type of growth habits. It is therefore very important to develop cowpea varieties that are high and stable yielding, early maturing and insect pest resistant (Srinivas *et al.*, 2017) [13].

Proper planting density and arrangements are essential in optimizing plant growth,

development and yield per unit land area. It is important to plant at optimum spacing or density per unit area, which will give the maximum economic yields. The optimum density partly depends on the soil and climate, but will also be influenced by other factors, particularly the variety (Muoneke *et al.*, 2013) ^[11]

Material and Methods

Present investigation was carried out Factorial Randomized Block Design with 8 varieties as treatments and three replications during the year 2018-2019 at Experimental Field at Department of Vegetable Science, College of Horticulture, Mandsaur is situated in Malwa Plateau in Western part of Madhya Pradesh. Mandsaur belongs to sub-tropical and semi-arid climatic conditions having a temperature range of minimum 4 °C and maximum 45 °C in winter and summer respectively. The soil of the experiment plot was well prepared by repeated ploughing followed by planking to obtain a fine tilth. The soil of the experimental field was light alluvial soil and sandy loam texture with uniform topography. Soil samples were collected randomly up to a depth of 20 cm from the experimental field with the help of soil auger before sowing of seeds. All the soil samples were mixed to prepare a homogenous sample, which was then oven dried, sieved through 2 mm sieve and finally used for soil analysis.

Seeds were immersed in holes at 45 x 15 and 30 x 15 cm spacing of soil. Plots were 1.8 m x 1.5) m on 15 cm high raised beds. Optimum soil moisture was maintained in the field by the protective irrigation 2 times during crop period. The site was fertilized according to soil test recommendations. herbicides were applied and any weed escapes were controlled by bi-weekly hand weeding. The pure healthy, disease and insect free vigorous and good quality cowpea seeds (Pusa Sukomal, Arka Garima, Kashi Gauri, Kashi Shyamal, Kashi Kanchan, Kashi Nidhi, Kashi Unnati and Arka Suman) were used for sowing. Seed were treated with Mancozeb 2g + Carbendazim 1 g per kg seeds. Seed was sown in lines at a spacing of 45 x 15 and 30 x 15 cm and covered with soil. Seeds were sown at a depth of 2 cm.

The gap filling was carried out after 10 days to maintain plant population in spacing first (S1) 60 plants and in spacing second (S2) 40 plants in each plot.

Observations were recorded on the basis of five random competitive plants selected from each treatment separately for morphological, phenological, Quality attributes and yield characters were evaluated.

Result and Discussion

Plant height (cm)

The plant height was significantly differed at all the growth stages of cowpea. Variety V2 (Arka Garima) of cowpea recorded maximum plant height i.e. 55.23, 83.43, and 114.13 cm, followed by V8 (Arka Suman) and V7 (Kashi Unnati) at all the growth stages. Minimum plant height was recorded in variety V3 (Kashi Gauri) i.e. 35.33, 55.17, and 76.40 cm at 30, 45 and 60 DAS, respectively. Variety V2 (Arka Garima) of cowpea recorded maximum plant height. It was followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the growth stages under study. Minimum plant height was recorded in variety V3 (Kashi Gauri) at 30, 45 and 60 days after sowing. Variation in plant height might be attributed due genetic constitutions and growth habit of cowpea varieties. These results are in conformity with the findings of Bhattarai *et al.* (2017) ^[3] and Patel *et al.* (2018) ^[8].

Table 1.1: Effect of varieties on plant height (cm) of cowpea

Treatment	Plant height (cm)		
	30 DAS	45 DAS	60 DAS
Varieties			
V ₁	45.37	68.53	94.30
V ₂	55.23	83.43	114.13
V ₃	35.33	55.17	76.40
V ₄	37.37	57.93	80.57
V ₅	42.83	65.63	89.17
V ₆	40.67	62.63	86.30
V ₇	48.30	73.30	95.60
V ₈	50.47	81.00	111.70
S.Em ±	1.60	1.69	2.18
CD at 5%	4.61	4.88	6.29

Number of leaves per plant

The data showed that different varieties having significant effect on number of leaves per plant at 30, 45 and 60 DAS. Variety V2 (Arka Garima) observed maximum number of leaves per plant i.e. 25.8, 47.9 and 69.9. It was followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the growth stages under study. Minimum number of leaves per plant was recorded in case of variety V3 (Kashi Gauri) i.e. 19.87, 37.73 and 56.57 cm at 30, 45 and 60 days after sowing, respectively. The data showed that different varieties having significant effect on number of leaves per plant at 30, 45 and 60 DAS. Variety V2 (Arka Garima) maximum number of leaves per plant was recorded. It was followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the growth stages under study. Minimum number of leaves per plant was counted in case of variety V3 (Kashi Gauri) at 30, 45 and 60, days after sowing. This could be due to the genetic makeup of varieties. These results are in close conformity with findings of Imran *et al.* (2012), Odedina *et al.* (2014) and Asati *et al.* (2018) ^[4, 7, 2].

Table 1.2: Effect of varieties, on number of leaves of cowpea

Treatment	Number of leaves per plant		
	30 DAS	45 DAS	60 DAS
Varieties			
V ₁	23.25	42.80	62.13
V ₂	25.80	47.90	69.90
V ₃	19.87	37.73	56.57
V ₄	20.40	39.00	58.67
V ₅	22.20	41.00	59.70
V ₆	21.07	40.30	59.13
V ₇	23.57	43.57	63.63
V ₈	24.37	45.13	65.57
S.Em ±	0.78	0.89	1.31
CD at 5%	2.24	2.58	3.78

Number of branches per plant

The data indicated that there was a progressive increase in number of leaves of per plant with the advancement of crop age. The number of leaves of per plant was significantly differed at all the growth stages. Variety V2 (Arka Garima) of cowpea recorded maximum number of branches per plant i.e. 4.23, 4.73 and 5.73 followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the stages under study. Minimum number of branches was recorded in case of variety V3 (Kashi Gauri) i.e. 3.40, 3.47 and 4.47 at 30, 45 and 60 days after sowing, respectively. The data indicated that there was a progressive increase in number of branches per plant with the advancement of crop age. The number of branches per plant was significantly differed at all the growth stages. Variety V2 (Arka Garima) of cowpea recorded maximum

number of branches followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the stages under study. Minimum number of branches per plant was recorded in case of variety V3 (Kashi Gauri) at 30, 45 and 60 days after sowing. Significant variation in number of branches per plant among different varieties might be due to difference in their genetic setup (Patel *et al.*, 2018) [8]. These results are in close conformity with findings of Nwofia *et al.* (2014) [6] and Asati *et al.* (2018) [2].

Table 1.3: Effect of varieties on number of branches per plant in cowpea

Treatment	Number of branches per plant		
	30 DAS	45 DAS	60 DAS
Varieties			
V ₁	3.97	4.17	5.17
V ₂	4.23	4.73	5.73
V ₃	3.40	3.47	4.47
V ₄	3.50	3.80	4.80
V ₅	3.80	4.07	5.07
V ₆	3.73	4.00	5.00
V ₇	4.00	4.27	5.27
V ₈	4.10	4.47	5.47
S.Em ±	0.11	0.11	0.11
CD at 5%	0.32	0.31	0.31

SPAD value in leaves

Maximum SPAD values in leaves were recorded with variety V2 (Arka Garima) i.e. 42.86, 50.36 and 54.18 at 30, 45 and 60 DAS, respectively. It was followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the stages under study. Minimum SPAD value of 37.12, 43.96 and 60.47.96 was observed under variety V3 (Kashi Gauri) at 30, 45 and 60 DAS, respectively. Maximum SPAD values in leaves were recorded with variety V2 (Arka Garima) at 30, 45 and 60 DAS. It was followed by V8 > V7 > V1 > V5 > V6 and V4 in descending order at all the stages under study. Minimum SPAD value was observed under variety V3 (Kashi Gauri) at 30, 45 and 60 DAS. Similar results were reported by Saleh *et al.* (2018) [12].

Table 1.4: Effect of varieties, spacing and their interactions on SPAD value of cowpea

Treatment	SPAD value		
	30 DAS	45 DAS	60 DAS
Varieties			
V ₁	39.91	46.91	50.84
V ₂	42.86	50.36	54.18
V ₃	37.12	43.96	47.96
V ₄	38.26	44.76	48.76
V ₅	39.19	46.19	50.19
V ₆	38.90	45.73	49.73
V ₇	40.20	47.36	51.36
V ₈	41.78	49.11	53.03
S.Em ±	0.94	1.35	1.36
CD at 5%	2.70	3.90	3.93

Fresh weight of plant (g)

The findings indicated significant effect of varieties on fresh weight of plant. Maximum fresh weight of plant (158.33 g) was found with variety V2 (Arka Garima). It was followed by V8 (Arka Suman) and V7 (Kashi Unnati) i.e. 155.50 and 152.17g, respectively. Minimum fresh weight of plant (136.67 g) was recorded with variety V3 (Kashi Gauri) at harvesting stage, respectively. The findings indicated significant effect of varieties on fresh weight of plant. Maximum fresh weight of plant at harvesting time was found with variety V2 (Arka

Garima). It was followed by V8 (Arka Suman) and V7 (Kashi Unnati). Minimum fresh weight of plant was recorded with variety V3 (Kashi Gauri) at harvesting stage. These findings are corroborated with those of Saleh *et al.* (2018) [12].

Table 1.5: Effect of varieties on fresh weight of plant (g) in cowpea

Treatment	Fresh weight of plant (g)
	Varieties
V ₁	148.00
V ₂	158.33
V ₃	136.67
V ₄	141.17
V ₅	145.50
V ₆	144.83
V ₇	152.17
V ₈	155.50
S.Em ±	4.23
CD at 5%	12.22

Days to first flower appearance

Maximum days to first flower appearance (51.50 days) were taken by variety V8 (Arka Suman). It was followed by V2 > V5 > V3 > V6 > V1 and V7 in descending order. Earliest first flower appearance (34.83 days) was recorded in case variety V4 (Kashi Shyamal). Maximum days to first flower appearance were taken by variety V8 (Arka Suman). It was followed by V2 > V5 > V3 > V6 > V1 and V7 in descending order. Earliest first flower appearance was recorded in case variety V4 (Kashi Shyamal). The difference in flowering days might be due to the varietal character, sowing time and growing environment. Similar results were observed by Patel *et al.* (2018) [8].

Table 1.6: Effect of varieties on days to first flower appearance of cowpea

Treatments	Days to first flower appearance							
	Varieties (V)							
	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈
	35.67	49.67	37.00	34.33	39.33	36.67	34.67	51.00
	37.00	51.67	38.33	35.33	40.67	38.00	35.33	52.00
Mean	36.33	50.67	37.67	34.83	40.00	37.33	35	51.50
S.Em ±	0.86							
CD at 5%	2.48							

Days to 50% flowering

Maximum days to 50% flowering (57.50 days) were taken by variety V8 (Arka Suman). It was followed by V2 > V5 > V3 > V6 > V1 and V7 in descending order. Minimum days to reach 50% flowering (40.67 days) were noted with variety V4 (Kashi Shyamal). Maximum days to 50% flowering were taken by variety V8 (Arka Suman). It was followed by V2 > V5 > V3 > V6 > V1 and V7 in descending order. Minimum days to reach 50% flowering were noted with variety V4 (Kashi Shyamal). This could be due to difference the genetic potential in phenological and growth parameters of the varieties. These findings are corroborated with those of Asati *et al.* (2018) [2].

Table 1.7: Effect of varieties on days to 50% flowering of cowpea

Treatments	Days to 50% flowering							
	Varieties (V)							
	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁
	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
	44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00
Mean	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
S.Em ±	0.99							
CD at 5%	2.85							

Number of pod per plant

Variety V8 (Arka Suman) resulted in the highest number of pods per plant (22.97). It was followed by V3 > V4 > V6 > V1 > V7 and V2 in descending order at all the stages under study. Minimum number of pods per plant (13.70) found with the variety V5. Variety V8 (Arka Suman) resulted in the highest number of pods per plant. It was followed by V3 > V4 > V6 > V1 > V7 and V2 in descending order at all the stages under study. Minimum number of pods found with the variety V5. Thus the number of pods per plant could be assumed to be under genetic control and varied among cowpea varieties (Addo-quaye *et al.*, 2011) [1]. Similar results were observed by Bhattarai *et al.* (2017) [3].

Table 1.8: Effect of varieties on number of pods per plant of cowpea

Treatments	Number of pods per plant							
	Varieties (V)							
	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁
	14.93	14.93	14.93	14.93	14.93	14.93	14.93	14.93
	14.07	14.07	14.07	14.07	14.07	14.07	14.07	14.07
Mean	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
S.Em ±	0.41							
CD at 5%	1.19							

Pod length (cm)

Varieties imposed significant influence on pod length (cm). The maximum pod length (30.28 cm) was measured under the variety V6 (Kashi Nidhi), which was followed by V5, V4, V3, V7, V2 and V1 with the pod length of 27.38, 26.35, 25.80, 25.37, 23.20 and 22.20 cm, respectively. The minimum length of pod (18.60 cm) was recorded with variety V8 (Arka Suman). Varieties imposed significant influence on pod length (cm). The maximum pod length was measured under the variety V6 (Kashi Nidhi), which was followed by V5, V4, V3, V7, V2 and V1 with the pod length. The minimum length of pod was recorded with variety V8 (Arka Suman). These variations may be attributed to the inherent transferable parental trait differences in the varieties as well as environmental influence (Nwofia *et al.*, 2014) [6]. Similar observations were reported by Addo-quaye *et al.* (2011) [1] and Bhattarai *et al.* (2017) [3].

Table 1.9: Effect of varieties on pod length (cm) of cowpea

Treatments	Pod length (cm)							
	Varieties (V)							
	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁
	22.63	22.63	22.63	22.63	22.63	22.63	22.63	22.63
	21.47	21.47	21.47	21.47	21.47	21.47	21.47	21.47
Mean	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05
S.Em ±	0.63							
CD at 5%	1.83							

Average pod weight (g)

Variety V7 (Kashi Unnati) resulted in the maximum average green pod weight (8.72 g). It was followed by V5 > V1 > V2 > V6 > V4 and V3 in descending order. Minimum average pod weight (4.79 g) was found with the variety V8 (Arka Suman). Variety V7 (Kashi Unnati) resulted in the maximum average pod weight (g). It was followed by V5 > V1 > V2 > V6 > V4 and V3 in descending order. Minimum average pod weight was found with the variety V8 (Arka Suman). These results are in line with the findings of Peksen (2004) and Khan *et al.*, (2010) [10, 5].

Table 2: Effect of varieties on average pod weight (g) of cowpea

Treatments	Average pod weight (g)							
	Varieties (V)							
	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁
	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56
	8.16	8.16	8.16	8.16	8.16	8.16	8.16	8.16
Mean	8.36	8.36	8.36	8.36	8.36	8.36	8.36	8.36
S.Em ±	0.31							
CD at 5%	0.89							

Pod yield (g) per plant

Among the varieties, maximum pod yield per plant (125.15 g) was recorded in the variety V7 (Kashi Unnati), while the minimum pod yield per plant (94.94 g) was recorded under variety V3 (Kashi Gauri). Among the varieties, maximum pod yield per plant was recorded in the variety V7 (Kashi Unnati). It was followed by V1 > V5 > V8 > V2 > V6 and V4 in descending order, while the minimum pod yield per plant was recorded under variety V3 (Kashi Gauri). It may be due to its inherent genetic set up, suitability of climate, atmospheric condition and soil conditions of this region (Patel and Kumari, 2018) [9]. Among the varieties, maximum pod yield per plant was recorded in the variety V7 (Kashi Unnati). It was followed by V1 > V5 > V8 > V2 > V6 and V4 in descending order, while the minimum pod yield per plant was recorded under 76 variety V3 (Kashi Gauri). It may be due to its inherent genetic set up, suitability of climate, atmospheric condition and soil conditions of this region (Patel and Kumari, 2018) [9].

Table 2.1: Effect of varieties on pod yield (g) per plant

Treatment	Pod yield (g) per plant
V ₁	120.49
V ₂	107.27
V ₃	94.94
V ₄	100.46
V ₅	116.16
V ₆	103.99
V ₇	125.15
V ₈	110.39
S.Em ±	4.89
CD at 5%	14.12

Pod yield (q) per hectare

Among the varieties, maximum pod yield (229.52 q/ha) was recorded in the variety V7 (Kashi Unnati). It was followed by V1 > V5 > V8 > V2 > V6 and V4 in descending order with the values of 220.85, 212.52, 202.40, 195.11, 189.21 and 184.46 q/ha. The minimum pod yield (174.75q/ha) was recorded under variety V3 (Kashi Gauri). Among the varieties, maximum pod yield (q) per hectare was recorded in the variety V7 (Kashi Unnati). It was followed by V1 > V5 > V8 > V2 > V6 and V4 in descending order, while the minimum pod yield per hectare was recorded under variety V3 (Kashi Gauri). The peculiarity of genotypes is of great importance when we evaluate/ develop genotypes for stability. However, variation in yield was noted, which may be attributed to climatic diversity and genetic makeup of the genotypes (Srinivas *et al.*, 2017) [13]. These results are in line with the findings of Patel and Kumar (2018) [8].

Table 2.2: Effect of varieties pod yield (q) per hectare of cowpea

Treatment	Pod yield (q) per hectare
Varieties	
V ₁	220.85
V ₂	195.11
V ₃	174.75
V ₄	184.46
V ₅	212.52
V ₆	189.21
V ₇	229.52
V ₈	202.40
S.Em ±	8.60
CD at 5%	24.83

Protein content (%)

Varieties exhibited significant effect on protein content (%) in fresh pods of cowpea. Maximum protein content (3.10%) in fresh pods was recorded under variety V₇ (Kashi Unnati). It was followed by V₁ > V₅ > V₈ > V₂ > V₆ and V₄ in descending order with the values of 2.92, 2.80, 2.72, 2.44 and 2.43 %, respectively. Minimum protein content (2.32%) was recorded under V₃ (Kashi Gauri). Varieties exhibited significant effect on protein content (%) of fresh pods of cowpea. Maximum protein content in fresh pods was recorded under varieties V₇ (Kashi Unnati). It was followed by V₁ > V₅ > V₈ > V₂ > V₆ and V₄ in descending order with the values, respectively. Minimum protein content was recorded under V₃ (Kashi Gauri). Similar results were observed by Srinivas *et al.* (2017) [13].

Table 2.3: Effect of cowpea varieties on protein content (%) in cowpea

Treatments	Protein content (%)							
	Varieties (V)							
	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁
	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96
	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
Mean	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
S.Em ±	0.07							
CD at 5%	0.21							

Fiber content (%)

Varieties indicated significant variation for crude fiber content (%) in fresh pods. Maximum crude fiber content (0.97 %) was recorded under V₈ (Arka Suman). It was followed by V₇ > V₁ > V₂ > V₅ > V₆ and V₄ in descending order with the values of 0.94, 0.92, 0.89, 0.85, 0.84 and 0.79 %. Maximum crude fiber content (0.75 %) was determined under variety V₃ (Kashi Gauri). Varieties indicated significant variation for crude fiber content (%) in fresh pods. Maximum crude fiber content was recorded under V₈ (Arka Suman). It was followed by V₇ > V₁ > V₂ > V₅ > V₆ and V₄ in descending order. Maximum crude fiber content was determined under variety V₃ (Kashi Gauri). Srinivas *et al.* (2017) [13] also reported significant variation for fiber content in cowpea varieties.

Table 2.4: Effect of varieties on crude fiber content (%) in cowpea pods

Treatments	Crude fiber content (%)							
	Varieties (V)							
	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁	V ₁
	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Mean	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
S.Em ±	0.02							
CD at 5%	0.05							

Conclusions

On the basis of present experiment, it may be concluded that among the different varieties, V₂ (Arka Garima) recorded highest growth attributes, while variety V₄ (Kashi Shyamal) had taken minimum days to first flower appearance, days to 50 % flowering and earliest harvesting. Variety V₈ (Arka Suman) observed Maximum no. of pods per plant, V₆ (Kashi Nidhi) best in pod length, V₇ (Kashi Unnati) recorded highest green pod yield and protein content.

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