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Assessment of cowpea (*Vigna unguiculata* L.) varieties for grain yield and profitability through on farm trial

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Abstract
Cowpea is one of the important food legume crops belonging to the Fabaceae family. Farmers lack of awareness about the latest cowpea varieties suitable for rainfed situations; therefore, an attempt was made to assess suitable varieties for enhancing yield and productivity under on farm trial. The present investigation was conducted in three villages of Virudhunagar district to assess the suitable variety of cowpea for rainfed conditions. Five farmers' fields were randomly selected and two high yielding improved varieties of cowpea (VBN 3 and DC 15) were sown along with one check variety (CO (CP) 7). The trial was conducted with five replications. During the course of study, observations like plant height (cm), days to 50% flowering, grain yield (q/ha) were recorded. Among the varieties assessed, VBN 3 variety recorded the plant height (68.9 cm), days to 50% flowering (53 days), maximum grain yield of 11 q/ha with high net return (Rs.49500) and Benefit-cost ratio (1:2.20) followed by DC 15 grain yield of 10 q/ha. Hence, it was concluded that the VBN 3 variety of cowpea proved superior followed by DC 15 under the rainfed condition.

Keywords: Cowpea, plant height, improved varieties, grain yield, net return

Introduction
Cowpea (*Vigna unguiculata* L.) is the most important protein-rich crop in the world and is also used for forage and soil enrichment and is also known as black-eyed peas. Cowpea contains protein, carbohydrates, fibre, ash and fat [1]. Cowpea is generally a heat-tolerant crop. Cowpea is an annual herbaceous food legume crop in the semi-arid tropics like Asia, Africa, Southern Europe and South America. It also fixes the atmospheric nitrogen through its root nodules, and it helps to enrich nutrients in poor soils. Non-availability of improved cowpea variety suited to rainfed condition was found to be thrust area/problem through participatory rural appraisal which need to be addressed. Farmers were cultivating low yielding variety of cowpea and lack of awareness about latest cowpea variety suitable for rainfed situation. Several biotic, abiotic and socio-economic constraints inhibit exploitation of the yield potential of cowpea. Therefore, it was proposed to assess the growth and yield parameters of two improved varieties of cowpea to identify the most suitable variety at the farmer's field for doubling the farmer's income.

Materials and Methods
A field experiment was conducted during the rabi season 2020-21 in three villages of Virudhunagar district. Five farmer's fields were randomly selected and two high yielding improved varieties of cowpea *viz.*, VBN 3 and DC 15 were sown in five replication along with one check variety. The recommended packages of practices were followed and the details of cultural practices were given in Table 1. The growth and yield parameters like plant height (cm), days to 50% flowering, grain yield (q/ha) were recorded during the investigation. From the collected data, gross returns, net profits and B:C ratios were worked out. The benefit-cost ratio was calculated by using the formula [2] of BCR= Gross return/Gross cost. To calculate the yield gap, technology gap, extension gap and technology index by using the formula [3] as follows

Yield gap (%)

$$\text{Yield gap (\%)} = \frac{\text{Demonstration yield (q/ha)-Control yield (q/ha)}}{\text{Control yield (q/ha)}} \text{ X } 100$$

Technology gap (q/ha)

Technology gap (q/ha) = Potential yield (q/ha) - Demonstration yield (q/ha)

Extension gap (q/ha)

Extension gap (q/ha) = Demonstrated yield (q/ha) - Control yield (q/ha)

Technology index

$$\text{Technology index} = \frac{\text{Potential yield (q/ha)-Demonstration yield (q/ha)}}{\text{Potential yield (q/ha)}} \text{ X } 100$$

Table 1: Package of practices of cowpea under OFT programme.

Sr. No	Cultural practice	Improved practice	Existing practice
1.	Variety	VBN 3 and DC 15	CO (CP) 7
2.	Land preparation	Ploughing and Levelling	Ploughing and Levelling
3.	Seed rate	10 kg/ac	10-12 kg/ac
4.	Seed treatment	Biofertilizers	No seed treatment
5.	Weed management	Two hand weeding on 15 and 30 days after sowing.	Two hand weeding on 15 and 30 days after sowing.
5.	Foliar application of nutrient	TNAU pulse wonder @ 5 kg/ha	DAP 2% Spray
6.	Plant protection	IPM	Indiscriminate application

Results and Discussion

In the present investigation, the data (Table 2) showed that VBN 3 recorded maximum plant height (68.9 cm) followed by DC 15 (65.7cm). The varieties VBN 3and DC15 took 53 and 55 days respectively for 50% flowering. The reason may be due to the genetic variability and varietal difference and environmental adaptability. Similar results were reported in cowpea [4]. The variety VBN 3 recorded maximum grain yield (11q/ha) which was significantly higher with than DC 15 (10q/ha) (Fig.1). The reason may be attributed to the genetic variability of varieties and the size of the grain. Farmers' check variety CO (CP) 7 recorded minimum plant height (50.5cm) and grain yield (8.9 q/ha). Thus, the local variety/farmers' practice may be replaced with high yielding varieties because of higher productivity. Similar findings were also observed in cowpea [5]. The gross cost of cultivation was almost similar for all the improved varieties. Cowpea VBN 3 recorded more grain yield compared to other varieties and market preferability was better in view of kidney shape with bold seed and brown colour. The benefit-cost ratio (1:2.20) was higher in VBN 3 due to higher market price followed by DC 15. (Table 3). The results obtained from these studies were in accordance with the earlier findings of several researchers [6, 7, 8]. The technology gap ranged between 1.0 and 3.0 q/ha. The observed technology gap was due to abiotic factors such as soil fertility, availability of low moisture content and climatic hazards *etc*. Hence, to reduce the yield gap, locationspecific recommendations for varieties, soil testing and timely sowing appear to be necessary. A value of 1.1 to 2.1 q/ha of the extension gap was found during the trial. There is a need to decrease this wider extension gap through the latest techniques. (Table 4). The technology index showed the suitability of varieties in farmer's fields. Lower technology values indicated that the feasibility of variety among the farmers is more. The technology index ranged from 8.3 to 23.7 per cent. These findings were similarly concluded in chickpea [9].

Table 2: Performance of cowpea varieties in farmer's field

Technology Option	Plant height (cm)	Days to 50% flowering (days)	Grain yield (q/ha)
Farmers Practice (CO (CP) 7)	50.5	48	8.9
Technology 1(VBN 3)	68.9	53	11
Technology 2(DC 15)	65.7	55	10
SEd	0.76	0.51	0.10
CD (P=0.05)	2.18	2.18	2.18

Table 3: Economics of cowpea varieties

VBN 3				DC 15				CO (CP) 7			
Gross Cost	Gross Return	Net Return	BCR (R/C)	Gross Cost	Gross Return	Net Return	BCR (R/C)	Gross Cost	Gross Return	Net Return	BCR (R/C)
41000	90500	49500	1:2.20	40500	88605	48105	1:2.18	31200	51400	20200	1:1:64

Table 4: Yield, technology gap, extension gap and technology index of cowpea

Name of the Variety	Yield (q/ha.)			Yield gap (%)	Technology gap (q/ha)	Extension gap (q/ha)	Technology index
	Potential yield (q/ha)	Demonstrated yield (q/ha)	Farmers practices (q/ha)				
VBN 3	12.0	11.0	8.9	23.5	1.0	2.1	8.3
DC 15	13.0	10.0	8.9	12.3	3.0	1.1	23.7

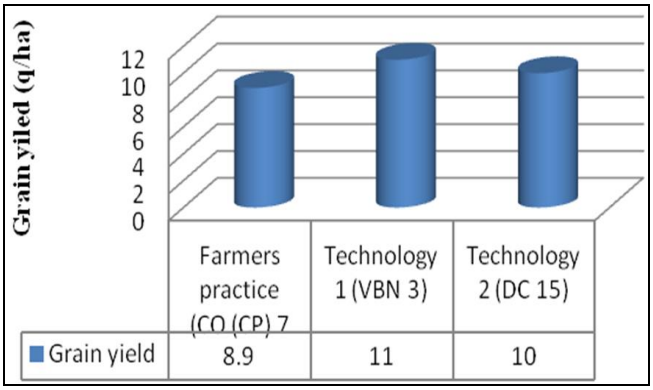

Fig 1: Assessment of cowpea varieties under rainfed condition

Conclusion

The findings of the study concluded that cowpea varieties, VBN 3 and DC 15 were more beneficial due to their yield contributing traits *viz*., plant height, grain yield compared to the check variety *i.e*., CO (CP) 7. The findings of the study concluded that the Cowpea VBN 3 is suitable for the rainfed conditions with the plant maturity in 75-80 days high yield compared to the local variety.

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