Demonstration of cluster bean variety MDU 1 for yield and economics in Cuddalore district of Tamil Nadu

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ABSTRACT

Cluster bean [*Cyamopsis tetragonoloba* (L) Taub] is one of the important leguminous vegetable crops grown for their tender pods and seeds. Frontline demonstrations on integrated crop management (ICM) practices in cluster bean were conducted to increase the yield and income of people in Cuddalore district of Tamil Nadu. Demonstrations on cluster bean variety MDU 1 with integrated crop management practices were conducted in ten farmers' fields belonging to Vridhachalm and Kammapuram blocks of Cuddalore district during 2019-2021 to spread the technology among the farmers. Two high yielding improved varieties of cluster bean viz MDU 1 and Pusa Naubahar were compared with the local variety. Each demonstration field was laid out in 0.4 ha while adjacent 0.4 ha was laid out with local variety and farmers' practice as control. The results revealed that the ICM practices plots registered the highest plant height, pod length, pod girth, number of pods, pod weight, yield per plant and yield per hectare. Similarly higher net income and benefit-cost ratio were also observed in ICM practices plots.

Kewords: Cluster bean; MDU 1; ICM practices; yield; economics

INTRODUCTION

Cluster bean [*Cyamopsis tetragonoloba* (L) Taub], commonly known as guar, is an important leguminous vegetable crop grown for its seeds. It is commercially cultivated for its tender pods as vegetable and seeds for gum and fodder. The tender pods of cluster bean are used as vegetable to prepare different types of curries. The pods are rich in nutrients and vitamins. It is rich in protein, calcium, iron and dietry fibre and vitamins like vitamin A and vitamin C. It has several health benefits like lowering cholesterol, blood sugar, body weight and helps to increase the hemoglobin content, strengthen the bones etc. Its seeds contain about 30-33 per cent gum in the endosperm. Cluster beans are the most important and the only source of guar gum which is 75 per cent of the dietary fibre. Because of its guar gum content, the plant is gaining importance as an industrial crop. While these being the only source of the guar gum, can be used as an additive to several foods and beverages. Moreover its gum is also used in many other industries like pharmaceuticals, cosmetics, mining, textile, paper, oil drilling, explosive industry etc. The plant has strong tap root system and can withstand drought. Owing to its drought hardy nature, it is an important commercial crop in arid and semi-arid regions. India became the leading producer of gaur with 60 per cent of the world production followed by Pakistan with 35 per cent (Rao 2001). It is also raised as a green manure and cover crop. Being a leguminous crop, it enriches the soil fertility by fixing the atmospheric nitrogen. Among pulse crops, cluster bean has a special contribution. It is mainly grown in Rajasthan, Gujarat, Haryana and Uttar Pradesh. In India Rajasthan stands first in terms of area and production. In Tamil Nadu, cluster bean is mainly cultivated for its tender pods as vegetable. Here it is cultivated on about 600 ha area mainly in Tirunelveli, Thoothukudi, Madurai, Theni, Dindigul, Namakkal, Coimbatore, Cuddalore, Ramanathapuram and Virudhunagar districts. Because of its wider adaptability, drought tolerance and high yield under minimum cultivation practices, the crop is highly preferred by marginal and small farmers. In Cuddalore district, it is grown commercially for its tender pods. However the people are unaware about improved

production technologies, new high yielding varieties and integrated crop management practices and are getting poor yield. Therefore frontline demonstrations on integrated crop management (ICM) practices in cluster bean were conducted to increase the yield and income of farmers of Cuddalore district of Tamil Nadu.

MATERIAL and METHODS

Cuddalore district of Tamil Nadu, one of the major cluster bean producing districts, was selected for the study. Demonstrations on cluster bean varieties MDU 1 and Pusa Navbahar with integrated crop management practices were conducted in ten farmers' fields belonging to Vridhachalm and Kammapuram blocks of the district during 2019-2021 to spread the technology among the farmers. Two high yielding improved varieties viz MDU 1 and Pusa Naubahar were compared with the local variety. Each demonstration field was laid out in 0.4 ha while adjacent 0.4 ha was laid out with local variety and farmers' practice as control. Seeds of MDU 1 were purchased from Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore and of Pusa Naubahar were purchased from Indian Agricultural Research Institute, Pusa, New Delhi.

Selected fields were thoroughly ploughed and the ridges were at a spacing of 60 cm. Before sowing, the seeds were treated with *Trichoderma* @ 4 g/kg and *Pseudomonas* @ 10 g/kg. Seeds of MDU 1, Pusa Naubahar and local variety were sown at a spacing of 30 cm. A basal dose of 2 kg *Azospirillum* and 2 kg *Phosphobacteria* per hectare was applied along with 25 tonnes of FYM at the time of last ploughing. Before sowing, the field was basal dressed with 25 kg N, 50 kg P_2O_5 and 25 kg K_2O per hectare and irrigated well. Top dressing was done with 25 kg N at 30 days after sowing. All other horticultural operations were carried out as per crop production guide 2020 (Table 1).

The trial was laid out in a randomized block design and replicated 10 times. Biometrical observations viz plant height, pod length, number of pods, pod girth, pod weight, yield per plant and yield per hectare were made and subjected to statistical analysis as per Panse and Sukhatme (1985). Gross income was calculated based on local market prices of cluster bean and net income by subtracting the total cost of cultivation from gross income. B-C ratio was computed by dividing gross return with cost of cultivation. To estimate the extension gap and technology index, the above formulae were used as suggested by Samui et al (2000), Sagar and Chandra (2004) and Dayanand and Mehta (2012).

$$\text{Per cent increase in yield} = \frac{\text{Demonstration yield} - \text{Farmers' yield}}{\text{Farmers' yield}} \times 100$$

$$\text{Extension Gap} = \text{Di (demonstration yield)} - \text{Fi (farmers yield)}$$

$$\text{Technology index} = \frac{\text{Potential yield} - \text{demonstration yield}}{\text{Potential yield}} \times 100$$

RESULTS and DISCUSSION

Mean values pertaining to growth and yield traits are presented in Table 2. The results showed that all the yield and yield attributing traits differed significantly. Demonstrated package recorded significantly higher values for all the growth and yield traits. Regarding different varieties of cluster bean, the improved high yielding varieties MDU 1 and Pusa Naubahar recorded higher values for plant height (112.82 cm and 94.91 cm), pod length (9.44 cm and 14.81 cm), number of pods/plant (98.68 and 78.72), pod girth (2.42 cm and 3.49 cm) respectively whereas the local variety (farmers' practice) recorded the lowest values for plant height (73.94 cm), pod length (8.85 cm), number of pods/plant (48.80) and pod girth (2.20 cm). Premalakshmi et al (2017) stated that plant height is an important trait by which growth and vigour of a plant is measured. Lokesha and Shivasankar (1990) reported that pod weight is strongly associated with fruit length and total yield. Fruit yield is a component trait which depends on number of fruits and fruit weight. Fruit yield is determined by the traits number of fruits per plant and fruit weight and their inheritance; any change in these would reflect on total yield (Premalakshmi et al 2017). The findings are in

accordance with the findings of Tamilselvan et al (2017). They found that demonstrated plot registered the highest plant height and fruit weight in brinjal as compared to local check in Nagapatinam district. Prabhu et al (2016) also reported that demonstrated plot recorded the highest plant height as compared to farmers' practice in brinjal in Vellore district. The highest pod weight (2.825 and 3.308 g), yield per plant (279.03 and 256.82 g) and yield per hectare (15.524 and 14.291 tonnes) were registered by MDU 1 and Pusa Naubahar respectively as compared to local variety (pod weight 2.472 g, yield per plant 120.71 g and yield per hectare 6.539 tonnes). Tamilselvan et al (2017) reported that the ICM plots registered the highest yield as compared to control plots (farmers' practice) in brinjal. Similar reports were also made by Prabhu et al (2016) and Desai et al (2018) in brinjal, Rameshkumar et al (2017) in watermelon and Hemalatha et al (2017) in chilli.

The improved varieties MDU 1 and Pusa Naubahar registered 15.524 and 14.291 tonnes/ha yield as compared to 6.539 tonnes/ha in the local variety (Table 1). This might be due to the inherent potential of the improved high yielding varieties (Premalakshmi et al 2017). Higher plant height, number of pods and pod weight registered by these improved varieties might have led to increase in yield. Premalaksmi et al (2017) reported that the Virudunagar Local registered the highest yield of 15.94 tonnes/ha. Deka et al (2015) recorded the highest yield of 12.46 tonnes/ha in Pusa Naubahar.

Economics of the present study is presented in Table 3. The results revealed that the ICM plots registered the highest net return of Rs 1,20,483.88 and 1,10,811.66 in variety MDU 1 and Pusa Naubahar respectively whereas the lowest net return of Rs 36,498.33 per hectare was registered in the farmers' practice with local variety. Results of benefit-cost ratio also showed the similar trend. The ICM practices received plots registered the highest benefit-cost ratio of 2.576 and 2.315 for MDU 1 and Pusa Naubahar respectively whereas the lowest-benefit cost ratio of 1.043 was registered by the farmers' practice. This can be attributed to the reason that ICM practices included improved high yielding varieties and scientific production technologies which increased the yield and led to higher net income and benefit-cost ratio. Similar reports were also made by Rajamanickam (2019) and Sivakumar et al (2020) in cluster bean.

Data on per cent increase in yield and extension gap are presented in Table 4. There was a wide gap among the varieties and farmers' practice and the demonstrated plots registered significantly higher yield income. An extension gap of 8.99 and 7.752 tonnes/ha in MDU 1 and Pusa Naubahar respectively in yield

Table 1. Demonstrated package of practices and farmers' practice for ICM in cluster bean

Component	Demonstration	Farmers' practice
Selection of high yielding variety	MDU 1 and Pusa Navbahar @ 10 kg/ha	Local variety @ 6 kg/ha
Seed treatment	Seeds treated with *Trichoderma* @ 4 g/kg and *Pseudomonas* @ 10 g/kg	Not known
Spacing	60 cm x 30 cm	60 cm x 60 cm
Application of farmyard manure	25 tonnes/ha at the time of last ploughing	10 tonnes/ha at the time of last ploughing
Ridges and furrows	Ridges and furrows formed at a spacing of 60 cm x 30 cm	Not known
Application of biofertilizers	Applied 2 kg *Azospirillum* and 2 kg *Phosphobacteria* per hectare	Not known
Application of recommended dose of fertilizers	Basal dressed with 25 kg N, 50 kg P_2O_5 and 25 kg K_2O per hectare and irrigated well	Application of complex fertilizers like 17:17:17 @ 100 kg/ha
Top dressing	Top dressing done with 25 kg N at 30 days after sowing	Not known
Irrigation	Furrow method of irrigation once in seven days	Flooding once in 10 days
Weeding	As per requirement	As per requirement
Plant protection measures	Need-based pesticides applied	Indiscriminate use of pesticides

Table 2. Effect of ICM practices on yield attributing traits and yield of cluster bean

Treatment	Plant height (cm)	Pod length (cm)	Number of pods /plant	Pod girth (cm)	Pod weight (g)	Yield/plant (g)	Yield/ha (tonnes)
MDU 1	112.82	9.44	98.68	2.42	2.825	279.03	15.524
Pusa Naubahar	94.91	14.81	78.72	3.49	3.308	256.82	14.291
Local variety	73.94	8.85	48.80	2.20	2.472	120.71	6.539
SED	0.945	0.258	1.258	0.061	0.151	11.186	0.600
$CD_{0.05}$	1.986	0.543	2.645	0.128	0.317	23.501	1.262

Table 3. Cost economics of ICM practices vs farmers' practice in cluster bean

Treatment	Gross expenditure (Rs)	Gross income (Rs)	Net income (Rs)	B-C ratio
MDU 1	47,870	1,68,353.88	1,20,483.88	2.576
Pusa Naubahar	47,870	1,58,681.66	1,10,811.66	2.315
Local variety	35,000	71,498.33	36,498.33	1.043

Table 4. Per cent increase in yield and extension gap in ICM practices vs farmers' practice in cluster bean

Treatment	Yield/ha (tonnes)	Per cent increase in yield	Extension gap
MDU 1	15.524	137.48	8.99
Pusa Naubahar	14.291	118.55	7.752
Local variety	6.539	-	-

over farmers' practice was noticed. It indicates that the farmers have to be trained in all aspects pertaining to introduction of improved varieties and adoption of improved production technologies in cluster bean to get higher yield and income.

It can be concluded from the study that ICP practices including improved high yielding varieties and scientific cultivation techniques increased the yield and net income over farmers' practice. The findings of economics and extension gap suggested that there was urgent need for proper training of farmers on newly developed high yielding varieties and improved production technologies which would increase the yield of cluster bean and thus livelihood of the farming community.

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