Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(6): 336-338
Received: 28-09-2019
Accepted: 30-10-2019

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Assessment of suitable redgram (*Cajanus cajan*) variety for yield and yield characteristics in rainfed region of Theni district

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Abstract
Red gram is one of the most important grain legumes in India with 90 % of global production confined within the country. It is largely cultivated and consumed in developing countries and this crop is widely grown in India. The present study has been undertaken to study the performance of different short duration and high yielding Red gram varieties that are suitable for rainfed region of Theni district. The ICAR introduce the on farm testing (OFT) for evaluation of suitable varieties for specific localities to enhance the yield and income of the farmers. A field experiment was conducted in the various farmers field of Theni district, Tamil Nadu during Kharif season 2017-2018. The experimental site is situated in subtropical region. The experimental plot was laid out in Randomized Block Design (RBD) and replicated in thrice with following treatments T_1 - Vellai thuvarai, T_2 - CO 7, T_3 - LRG 52 and T_4 - ICPL 14003. Three improved varieties that are suitable for rainfed region of Theni district was used in this experiment. The recommended dose of fertilizer (RDF) was applied as per crop production guide. The yield and yield attributes viz., number of branches per plant, number of pods per plant, test weight and yield (kg/ha) were recorded. In economics aspect the cost of cultivation (Rs/ha), Gross income (Rs/ha), Net income (Rs/ha) and B: C ratio was analyzed. Among the different varieties of Red gram CO 7 was recorded higher number of branches (13.40) number of pods per plant (255), test weight (9.8 g), lower incidence percentage of pest buildup (13.70) and higher yield (1440 kg/ha). Based on the experiment results, it could be concluded that the CO 7 red gram variety could be considered as a better option for achieving higher productivity and profitability improved quality of Red gram under the rainfed region of the Theni District.

Keywords: Red gram, yield, rainfed region, pods, yield and economics

Introduction
Red gram is one of the most important grain legumes in India with 90% of global production confined within the country. It is largely cultivated and consumed in developing countries and this crop is widely grown in India. India ranks first in the production and consumption of Red gram in the world. In India, Red gram is one of the most widely grown pulse crops. It was cultivated over an area of 4.36 million hectares with a production of 2.86 million tonnes and productivity of 655 kgs per hectare in 2010-11. Red gram accounts for about 20 per cent of the total production of pulses in the country. This crop is highly suitable crop for rainfed agriculture and needs minimum inputs and produces reasonable yields even under unfavorable agro-ecological conditions (Saroj *et al.* 2015) [5]. Its seeds contain about 20-22 % protein and reasonable amounts of essential amino acids. In a rainfed ecosystem, high protein content and multiple uses make it an ideal crop all smallholder farmers (Saxena. K. B. 2008) [6]. Red gram is consumed in the form of split pulse as dal, which is an essential supplement of cereal diet. It also plays a crucial role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen. It is resistant to drought and suitable for dry land farming and predominately grown as an intercrop with other crops. The ICAR introduce the on farm testing (OFT) for evaluation of suitable varieties for specific localities to enhance the yield and income of the farmers. The main objective of the trail is evaluating newly released varieties, technologies and management practices at farmers field under the real farming situation under different agro climatic regions. In Theni District, past one decade farmers using long duration varieties with yield of 750 kg/ha due to non adoption of good agricultural practices and non utilization of natural resources. Pest incidence also occurs higher in the farmers practice (Vellai thuvarai) due to routine cultivation of same variety. The present study has been undertaken to study the performance of different short duration and high yielding Red gram varieties that are suitable for rainfed region of Theni district.

Materials and Methods

A field experiment was conducted in the various farmers field of Theni district, Tamil Nadu during Kharif season 2017 - 2018. The experimental site is situated in subtropical region. The soil type of the trail plot is red sandy loam with low organic carbon (0.18-0.37 %), available N 247-291 (kg/ha), available P 10.43-12.70 (kg/ha) and available K 148- 175 (kg/ha). The experimental site received 910 mm of the rainfall and 320 mm of rainfall received during the cropping period. The experimental plot was laid out in Randomized Block Design (RBD) and replicated in thrice with following treatments T_1 - Vellai thuvarai, T_2 - CO 7, T_3 - LRG 52 and T_4 - ICPL 14003. Three improved varieties of red gram that are suitable for rainfed region of Theni district was used in this experiment. The trail plot comes under the southern zone of Tamil Nadu agro climatic region. The recommended dose of fertilizer was applied as per package of practices (TNAU Crop Production Guide, 2014). The seeds were treated with *Trichoderma viride* @ 4 g/ kg of seeds. Pulses wonder was applied through foliar spray @ 5 kg/ha during 50 percent flowering stage followed by 15 days after first spray. Each trail plot was conducted in 0.4 ha. Observations on yield attributes and yield were recorded in randomly selected plants. The data on various parameters were subjected to statistical analysis following the method of analysis of variance for the simple randomized block design (Panse and Sukhatme, 1978) [4].

Under the OFT, the testing varieties viz., CO 7, LRG 52 and ICPL14003 at the rate of 20 kg/ha was taken. Appropriate need based plant protection measures were taken up to control the pest and diseases following the recommended packages of practices as per the crop production guide (Anonymous, 2012).

Table 1: Difference between testing packages and farmers practices

Treatments	Variety releasing year	Duration	Characteristics
T_1 - Vellai Thuvarai (Local variety)	-	280 days	Susceptible to pod borer complex and Yellow Mosaic virus
T_2 - CO 7	2004	130 days	Photo insensitive, low incidence of pod borer, complex, green with purple streak pods
T_3 - LRG 52	2016	140 days	Yield : 2000kg/ha Resistant to *Helicoverba* Wilt and sterility mosaic virus
T_4 - ICPL 14003 (Ujwala)	2016	130 days	Yield : 2500 kg/ha Resistant to Terminal drought

Results and discussion

Growth and yield parameters

The growth and yield parameters such as number of branches, number of pods per plant and test weight with value of 13.4, 255 and 9.8 were higher with the CO 7 short duration Red gram variety (T_2) followed by, short duration Red gram variety ICPL 14003 (T_4) with number of branches (12.65), number of pods per plant (193) and test weight (9.5) (Table. 2). The lowest number of branches (11.06), number of pods per plant (165) and test weight (9.2) was recorded in Vellai thuvarai (long duration variety) (T_1). This might be due to failure of summer rainfall (planting during March-April) during vegetative period of long duration Red gram variety (Vellai thuvarai) which results reduce the flowering and pod formation. In short duration variety (CO 7), vegetative stage was almost reached during onset of north east monsoon its leads to production of flowering and pod formations were higher in short duration Red gram variety (CO 7). It was noticed that Pigeon pea varieties have different yield and yield characteristics according their duration in rainfed region (T.N**.** Dhanalakshmi 2017).

Table 2: Yield and yield parameters of different varieties of Red gram in rainfed region of Theni district

Treatments	No. of Branches/plant	No. of Pods / plant	Test weight (g)	Pest incidence percentage	Yield (kg/ha)
T_1 - Vellai thuvarai (Local variety)	11.06	165	9.2	18.20	816
T_2 - CO 7	13.40	255	9.8	13.70	1440
T_3 - LRG 52	10.21	189	9.6	16.20	1139
T_4 - ICPL 14003 (Ujwala)	12.65	193	9.5	12.40	1227
S Ed	0.13	0.84	0.19	0.12	61.03
CD (5%)	0.32	1.94	0.50	0.29	140.73

Yield

The highest yield of 1440 kg/ha (Table. 2) were recorded in CO 7 variety (T_2) followed by the ICPL 14003 variety (1227 kg/ha). This might be due to adoption of good agricultural practices with short duration variety resulted more number of branches and pods per plant. The application of pulse wonder increased the pod filling ratio and test weight which leads to higher yield compare to long duration variety (Vellai thuvarai). Also, the application micronutrient mixture during the critical stages of crop growth period reduced the flower drop which results increased the pod setting in Red gram. Regarding pest and disease incidence the improved variety (CO 7) has more resistant to the pod borer complex.

The lowest yield of 916 kg/ha were recorded in farmer practices (Vellai thuvarai). This might be due to occurrence of drought during the critical stages of crop growth period (flowering stage) which results reduce the fruit settings and pod formation (T.N**.** Dhanalakshmi 2017).

Economics

Economics of raising a particular crop plays a vital role in making recommendations for adoption of a technology to the farmers. The data pertaining to gross returns, net returns and B: C ratio as influenced by foliar spray of secondary and micronutrients are presented in Table 3. The highest gross return (Rs. 72000 ha^{-1}) and net return (Rs. 46360 ha^{-1}) were recorded in the treatment that received CO 7 variety (Fig. 1). The highest B: C ratio (2.8) was recorded in the treatment that received CO 7 variety. The higher gross, net returns and B: C ratio was due to more pod yield (cultivation of high yielding short duration variety with Integrated Crop Management Practices) other varieties (Venkata Lakshmi 2004) [7].

Table 3: Economic parameters of different varieties of Red gram in rainfed region of Theni district

Treatments	Gross cost (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	BCR
T_1 - Vellai thuvarai (Local variety)	21374	46600	25226	2.18
T_2 - CO 7	25640	72000	46360	2.80
T_3 - LRG 52	22450	56950	34500	2.53
T_4 - ICPL 14003 (Ujwala)	23513	61350	37837	2.60

Data statistically not analysed

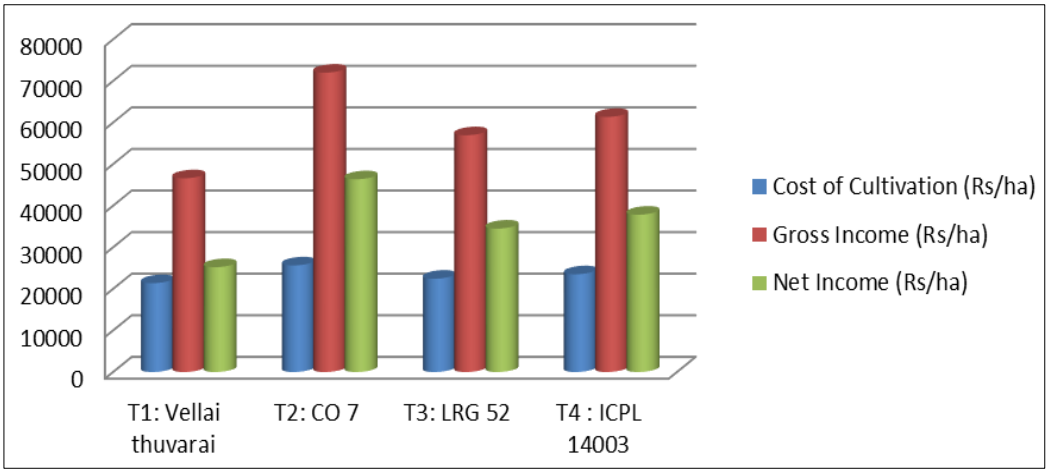

Fig 1: Yield and yield parameters of different varieties of Red gram in rainfed region of Theni district

Conclusion

Over all, from the experimental results, it could be concluded that CO 7 along with adoption of integrated good agricultural practices in red gram leads to higher yield. It could be considered as a better option for achieving higher productivity and profitability of Red gram under the rainfed region of Theni district.

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