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Response of Improved Production Technologies (IPT) on Productivity and Economics of Green Gram *(Vigna radiata* L. Wilczek*)* in Nichabanadhi Sub Basin of Tamil Nadu

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ABSTRACT

One hundred and seventeen (117) on-farm demonstrations on improved production technology (IPT) for green gram were carried out in eighty (80) hectares of farmer's fields in Sankarankovil, Vasudevanallur and Kuruvikulam blocks of Tirunelveli district of Tamil Nadu from 2010-11 to 2012-13 under Tamil Nadu – Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWARM) project. Two methods *viz.,* improved production technology (IPT) and conventional method (CM) were compared. The results revealed that the adoption of improved production technology (IPT) favorably influenced yield attributes and yield of green gram. The maximum seed yield (1,087 kg ha^{-1}) obtained from IPT which was higher than conventional method (748 kg ha^{-1}). The best net income (₹ 27,317) and benefit : cost ratio (2.69) were also associated with IPT than conventional method of green gram cultivation. The additional income of 12,295 ha^{-1} was obtained from IPT over conventional method of green gram cultivation.

Key words: *Conventional method, Economics, Green gram, IPT, Seed yield, Yield attributes.*

Pulse crop occupy a pivotal position in ensuring national security to world population and especially to the undernourished masses in arid and semi arid region. They are rich in protein and found to be main source of protein to vegetarian people of India. It is the second important diet after cereals. The United Nations, declared 2016 as "International Year of Pulses" (IYP) to heighten public awareness of the nutritional beneûts of pulses as part of sustainable food production aimed at food security and nutrition. India is the largest producer, consumer and importer of the pulses in the world. Pulses, being legume, fix atmospheric nitrogen into the soil and play important role in sustainable agriculture by maintaining the soil fertility. In India pulses are cultivated over an area of 24.78 million ha with the production of 17.21 million tonnes (DAC, New Delhi, 2015).

Green gram *(Vigna radiata* L. Wilczek*.)* is one of the widely grown pulse crop in India. In Tamil Nadu the production is 47673 tonnes from the area of 138138 hectares with the productivity of 345 kg ha^{-1} (DES, 2015). The productivity of green gram is low and this is due to the fact the crop mainly grown in rainfed condition and poor management practices. The constraints in green gram production are lack of integrated management practices involving land, labour, crop and inputs such as seeds of improved / hybrid variety, fertilizers, optimum plant population etc. Increasing the green gram productivity by adapting location specific improved production technologies (IPT) become an essential component of green gram cultivation. The traditional cultivation system comprises conventional method with local varieties, improper management practices and imbalanced application of fertilizers are the important factors limiting green gram yield. Broad costing sowing without proper spacing is also one of the constraints in obtaining low yield under conventional planting. Hence, improved production technologies of green gram cultivation must be tried aiming at higher crop productivity. Improved production technology (IPT) a new production technology is found to increase the productivity and profitability of green gram growers. It has its own components *viz.,* improved / hybrid variety, seed treatment with rhizobium culture, soil test based balanced or recommended dose of

nutrients, foliar nutrient of DAP and urea at critical stage and herbicide application for weed control.

Nichabanadhi originates in Vasudevanallur reserve forest on the eastern slopes of Western Ghats in Sivagiri Taluk of Tirunelveli District. Ullatrumottai and Pudumalai Kavu are the other two hills on the other side of Kerala State. This sub basin area is 565 sq.km out of which the hilly area is 62 sq.km. There are 18 anicuts, 15 system tanks, and 151 non-system tanks in this sub basin. The command area is 5684 ha. The taluks covered by this sub basin are Sivagiri and Sankarankoil in Tirunelveli District and Sivakasi in Virudhunagar District of Tamil Nadu. The sub basin area is fully benefited by the North East Monsoon and marginally by South East Monsoon. The objective of this study was to adapt location specific improved production technologies (IPT) to get maximum productivity and profitability of green gram.

MATERIAL AND METHODS

One hundred and seventeen (117) on-farm demonstrations on green gram by adapting improved production technologies (IPT) were carried out in eighty (80) ha of farmer's fields in Sankarankovil, Vasudevanallur and Kuruvikulam blocks of Tiruvelveli district of Tamil Nadu from 2010-11 to 2012-13 under Tamil Nadu – Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWARM) project during September to January**.** The mean annual rainfall of this sub basin was less than 700 mm. South west monsoon contribute 150 mm (27%), while North east monsoon contributes 550 mm (73%). This basin receives a major share on its rainfall during NE monsoon. The mean maximum and minimum temperature ranges from 34-37º C and 20-23º C, respectively. Relative Humidity ranges from 65-70 %. The soil types were in combination of Inceptisol, Alfisol and Vertisol. More prominent type was Vertisol. The textural range of the soil was from sandy clay loam to clay. The soil fertility status of the study area was usually low in organic matter low in available nitrogen, medium in available phosphorus and high in available potassium (Table 2). The soil reaction was neutral to slightly alkaline. The details of on farm demonstrations in study area is furnished in Table 1. The fertility status of the demonstration fields were estimated by standard procedures. Soil samples were analysed for organic carbon following Walkley and Black (1934), alkaline permanganate oxidizable N as described by Subbiah and Asija (1956), 0.5 M $NaHCO_3$-extractable P (Olsen *et al.,* 1954) and available potassium by flame photometry after extracting 1 N NH_4OAC (Schollenberger and Simon, 1965). Two methods of green gram cultivation viz., IPT and conventional were compared by using the improved varieties *viz.,* VBN 3 and VBN 4. In IPT, the recommended dose of fertilizer as 25:50:25 kg NPK/ha with split doses of N, foliar spray of DAP @ 2%, seed treatment with Rhizobium culture @ 3 packets ha ^{1}, line sowing at 30 x 10 cm spacing, pre emergency herbicide pendimethalin @ 2 litres ha^{-1} followed by hand weeding at 30 DAS. Nitrogen in the form of urea, phosphorus as single super phosphate and potassium as muriate of potash were applied. The local verities being practiced by the farmers at adjacent field were considered as conventional method / farmers practice for control. The biometric observation on growth, yield attributes, seed and stover yield were recorded.

RESULTS AND DISCUSSION

Yield attributes

Adoption of the improved production technologies (IPT) increased the plant height, seed and stover yield. The results on yield attributes (Table 3) revealed that IPT showed a favorable influence on all the growth and yield attributes of green gram during all the study period. Adoption of IPT recorded maximum of 48.2 cm of plant height which was higher than that of conventional method of green gram cultivation (41.4 cm).This finding are in agreement with those of Bairwa *et al.,* (2012) and Nandan *et al.,* (2012). The maximum number of pods (33.8 $plant^{-1}$), length of pod (7.4 cm) and number of seeds (8.5 pod^{-1}) were observed in the fields adopted IPT. The minimum number of pods (21.4 $plant^{-1}$), length of pod (6.7 cm) and number of seeds (7.4 pod^{-1}) were noted in the fields followed the traditional conventional method (CM) of green gram cultivation. The maximum test weight (3.8 g) was also recorded in the IPT adopted fields compare to conventional method (CM) of cultivation (3.2 g). Bhuiyan *et al*., (2008) and Arunachalam (2011) also observed similar results in black gram and green gram under recommended production technology.

Table 1. Details of field demonstrations of IPT on green gram in the study area.

S. No.	Particulars	2010-11			2011-12			2012-13			Total		
1.	Area of demonstration (ha)	20			30			30			80		
2.	Number of farmers	32			45			40			117		
3.	Number of villages	4			5			5			14		
4.	Name of the variety used	VBN 4 and VBN 5			VBN 4 and VBN 5			VBN 4 and VBN 5			-		
5.	Soil fertility status (No. of samples)	L	M	H	L	M	H	L	M	H	L	M	H
	N	18	8	6	30	13	2	31	5	4	79	26	12
	P	20	8	4	2	15	8	25	10	5	67	33	17
	K	0	8	24	4	7	34	0	5	35	4	20	93

N-Nitrogen P-Phosphorus K- Potassium L-Low M- Medium H-High

Table 2. Properties of the soils of the study area (Mean values in each block).

Name of block	Texture	pH	EC (dSm^{-3})	OC (%)	N	P ($kg\ ha^{-1}$)	K
Sankarankovil	Sandy clay loam	7.2	0.11	0.46	215	12.5	316
Vasudevanallur	clay loam	7.6	0.23	0.33	232	10.8	347
Kuruvikulam	clay	7.4	0.18	0.51	248	13.2	402

Seed yield

The production of green gram was much influenced in IPT over CM (Table 3). The effect of different improved production technologies in green gram influenced seed and haulm yield in three blocks. The IPT recorded maximum seed yield (1,087 kg ha^{-1}) and haulm yield (1,762 kg ha^{-1}) in all three blocks over conventional method (CM) (748 and 1,510 kg ha^{-1}, respectively). The increased seed yield in IPT was 45.2 % over conventional method (CM). The higher yield of green gram under IPT was mainly due to use of proper quality seeds and adoption of scientific practices like proper nutrient management, weed management and use of growth regulators at critical growth period recorded higher yield. These findings are supported by the earlier results of field experiment with respect to nutrient management practices through organic and recommended doses inorganic of fertilizers on productivity potential and profitability of black gram by Sharma *et al.,* (2009) and Shaukat Ali *et al.,* (2011). Adoption of IPT with hybrid varieties, recommended fertilizer application, proper management practices on irrigation and weeding increased the plant growth, yield attributes and yield of green gram. These results on higher seed yield in IPT corroborate with the earlier findings of Sipai *et al.,* (2015).

Economics

The input and output prices of commodities prevailed during each year of demonstrations were taken from calculating cost of cultivation, net return and benefit : cost ratio. The economic feasibility of both method of green gram cultivation (Table 3) revealed that the cost of cultivation was comparatively slightly higher in IPT due to efficient use of inputs *viz.,* improved varieties of seed and fertilizers than that of conventional method. The mean cost of cultivation over the study period for IPT and conventional method was ₹ 16,150 ha^{-1} and 14,912 ha^{-1}, respectively. The best gross income, net profit and benefit : cost ratio were also associated with IPT than conventional method of

Table 3. Comparison of IPT and conventional method (CM) on yield attributes, seed yield, and economic of green gram. (Mean of three years).

Sl. No	Parameters	Sankarankovil		Vasudevanallur		Kuruvikulam		Pooled Mean	
		IPT	CM	IPT	CM	IPT	CM	IPT	CM
1.	Plant height (cm)	48.8	41.4	45.7	39.3	50.2	43.5	48.2	41.4
2.	No. of pods plant^{-1}	33.5	21.8	31.5	20.2	36.5	22.1	33.8	21.4
3.	Pod length (cm)	7.4	6.7	7.2	6.5	7.7	7.1	7.4	6.7
4.	No. of seed pod^{-1}	8.8	7.7	8.3	7.2	8.5	7.3	8.5	7.4
5.	100 seed of test weight (g)	3.8	3.2	3.6	3.0	4.1	3.4	3.8	3.2
6.	Seed yield (kg ha^{-1})	1080	760	1030	710	1150	775	1087	748
7.	Per cent yield increase	42.1	-	45.1	-	48.4	-	45.2	-
8.	Haulm yield (kg ha^{-1})	1770	1565	1705	1385	1810	1580	1,762	1510
9.	Cost of cultivation (₹ ha^{-1})	16,150	14,835	16,150	14,850	16,150	15,050	16,150	14,912
10.	Gross returns (ha^{-1})	43,200	30,400	41,200	28,400	46,000	31,000	43,467	29,933
11.	Net income (ha^{-1})	27,050	15,565	25,050	13,550	29,850	15,950	27,317	15,022
12.	B:C ratio	2.67	2.05	2.55	1.91	2.84	2.06	2.69	2.01

cultivation. Averaging the three years of study, IPT registered a total income of 43,467 ha^{-1} and net profit of 27,317 ha^{-1} as compared to 29,933 ha^{-1} and 15,022 ha^{-1}, respectively under conventional method. Regarding benefit : cost ratio (BC ratio), higher BC ratio was also associated with IPT (2.69) than conventional method (1.93). Effective utilization of inputs as cost of cultivation coupled with higher gross and net income under IPT resulted additional economic benefit. Adoption of IPT gained an additional net profit of 12,295 ha^{-1} as compared to traditional method of cultivation. The present findings of the results are conformity with the findings of Bairwa *et al.,* (2012) and Chandawat *et al.,* (2014).

CONCLUSION

The present study concluded that the improved production technology (IPT) is effective to maximize the production of green gram (1,087 kg ha^{-1}) and to bring better economic benefit (27,317) for black gram growers of Nichabanadhi sub basin.

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