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Effect of Improved Management Practices on Yield and Economics of *Rabi* Pulse Crops

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ABSTRACT

Chickpea, blackgram and greengram are important *rabi* pulse crops grown in Andhra Pradesh. Adoption gaps were identified in these crops indicating the need for the demonstration of the improved crop management practices. In chickpea the variety NBeG47, blackgram TBG 104, greengram variety WGG 42 were introduced in farmers fields in *rabi* season. Along with the varietal introduction the whole package of improved management practices were demonstrated. A total of 50 FLDs each in chickpea, blackgram and greengram were organized for two consecutive years 2016-17 and 2017-18 in Krishna district, Andhra Pradesh. Highest yield of 27.50 q/ha was recorded with NBeG-47 in the demo fields with an average yield of 25.50 q/ha. In blackgram a highest yield of 17.25 q/ha was recorded in the demo with an average yield of 14.59 q/ha as againstcheck with an average yield of 11.50 q/ha. In greengram a highest yield of 16.50 q/ha was recorded in the demo fields with an average yield of 15.12 q/ha as against check with an average yield of 10.00 q/ha. Paired t test of the economics of demo and check showed significant positive difference between improved practice and farmers practice.

Key words: Blackgram, Chickpea, Demonstrations, Greengram, Management practices.

INTRODUCTION

Pulses are vital sources of plant protein. The demand for pulses is greater than the supply. The challenge of meeting the demand through smarter farming and better technology is an essential part of national food security. Introduction of high yielding varieties can effectively boost the production to meet the challenges of supply. Farm productivity and farmers income could be increased through the introduction of high yielding varieties. Chickpea, blackgram and greengram are important pulse crops grown during *rabi* season in different farming situations in Andhra Pradesh. It was observed that farmers are still growing the varieties released decades back because of which the pest and diseases in crops increase as a result there would be hike in the cost of cultivation. The production and productivity of existing varieties are relatively low when compared with the recently released varieties. At this juncture Front Line Demonstrations were conducted to boost the production and productivity in these three crops.

MATERIALS AND METHODS

Front Line Demonstrations in cluster approach were organized in chickpea, blackgram and greengram during 2016-17 and 2017-18. In Chickpea the demonstrations were taken up with high yielding variety NBeG-47 with bold seeds, suitable for mechanical harvesting, having potential yield up to 30.00 q/ha. In blackgram the high yielding variety TBG-104 was choosen for FLDs in cluster approach. TBG 104 is tolerant to Yellow Mosaic Virus (YMV) and bud necrosis. It is bold seeded and medium polish variety with 75 days crop duration having potential yield of 22.50 q/ha. In greengram YMV tolerant bold seed and polish variety WGG 42 variety was chosen for FLDs. WGG 42 has 60 days crop duration with potential yield of 17.00 q/ha. Along with the varietal introduction the whole package of improved management practices were demonstrated and its impact was assessed. The demonstrated package of improved practices are as presented in Table 1.

A total of 50FLDs each in chickpea, blackgram and greengram were organized for two consecutive years in Nandigama, Kanchikacherla and Penugranchiprolu mandals of Krishna district in Andhra Pradesh. The soils are clay loam. The rainfall recorded in the demonstration area during 2016-17 was 200 mm and in 2017-18 it was 220 mm. Farmer's practices were compared with improved management practices to identify the adoption gaps. The gaps were categorized into three groups as no gap, partial gap and full gap. Adoption gap index was calculated using the formula given by Dubey *et al.,* (1981). Adoption gap index is the percent deviation in farmers practices as compared to the improved practices.

$$\text{Adoption Gap Index} = \frac{(R-A)}{R} \times 100$$

Where R = Total no. of improved practices
A = No. of improved practices actually adopted by the farmer

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Yield parameters of both demonstrations and check involving farmers practices were recorded. Using the yield parameters extension gap, technology gap, yield gap, technology index were calculated as procedure suggested by Samui *et al*. (2000).

Extension Gap (q/ha) =
Demonstrated Yield - Yield Under Existing Farmers Practice

Technology Gap (q/ha) = Potential Yield - Demonstration Yield

Yield Gap (%) =
(Extension Gap/ Yield under Existing Farmers Practice) × 100

$$\text{Technology Index (\%)} = \frac{\text{Technology Gap}}{\text{Potential Yield}} \times 100$$

Economics of the demos and check were recorded. Based on economics additional cost, effective gain, additional returns, incremental B: C ratio were calculated.

Additional cost (Rs.) =
Demonstration Cost (Rs.) - Farmers' Practice Cost (Rs.)

Additional returns (Rs.) =
Demonstration returns (Rs.) - Farmers' Practice returns (Rs.)

Effective (Rs.) =
Additional Returns (Rs.) - Additional cost gain (Rs.)

Incremental B: C ratio = Additional Returns/ Additional Cost

Paired t test was applied to know if there exists a significant difference in the economics of demo and check.

RESULTS AND DISCUSSION

Adoption Gap Index

In chickpea full gap was identified with varietal strategy, land preparation, seed treatment; weed management, irrigation, plant protection and harvesting. Partial gaps were identified with sowing time, seed rate and fertilizer management. In blackgram full gap was identified with varietal strategy, seed treatment, weed management, irrigation, plant protection. Partial gap was identified with fertilizer management, while no gap was identified with land preparation, sowing time, seed rate and harvesting. In greengram full gap was identified with varietal strategy, seed treatment, weed management, irrigation, plant protection; partial gap was identified with fertilizer management, while no gap was identified with land preparation, sowing time, seed rate and harvesting as presented in Table 1. The findings revealed that farmers need to be educated to fill the adoption gaps which are to an extent of partial to full gap. The adoption gap index was found to be cent per cent in chickpea and 60.00 per cent in blackgram and greengram crops, which indicates that there is urgent need for technological interventions by the scientists. Hence it was planned to take up the Front Line demonstrations in farmers fields using cluster approach.

Yield details

Chickpea NBeG-47 recorded highest yield of 27.50 q/ha in the demo fields, while the lowest yield recorded was 23.75 q/ha with an average yield of 25.50 q/ha. The check variety recorded an average yield of 17.50 q/ha. In blackgram a highest yield of 17.25 q/ha was recorded in the demo fields, while the lowest yield recorded was 11.93 q/ha with an average yield of 14.59 q/ha. The check variety recorded an average yield of 11.50 q/ha. In greengram highest yield of 16.50 q/ha was recorded in the demo fields, while the lowest yield recorded was 15.00 q/ha with an average yield of 15.12 q/ha. The check variety recorded an average yield of 10.00 q/ha as presented in Table 2. This indicates that the demo performed superior than check. Based on the yield details extension gap, technology gap, yield gap were calculated.

Extension gap

It is recorded as 8.00 q/ha in chickpea, 3.09 q/ha in blackgram and 5.12 q/ha in greengram. The findings are in line with that reported by Kulkarni *et al*. (2018); Jyothi and Subbaiah (2019).

Technology gap

It is recorded as 4.50 q/ha in chickpea, 8.09 q/ha in blackgram, 1.88 q/ha in greengram. The findings are in line with that reported by Vijaya Lakshmi *et al*. (2017). The technology gap and extension gap in chickpea, blackgram and greengram.

Yield gap

It is recorded as 45.71% in chickpea, 26.86% in blackgram 51.20% in greengram.

Technology index

It is recorded as 15.00% in chickpea, 35.95% in blackgram, 11.05% in greengram. The findings were in line with that reported by Balai *et al.* (2013), Raj *et al.* (2013).

Economics

The economics of the demonstrations indicated that in chickpea the gross cost recorded was Rs. 25000/ha, with an average gross return of Rs. 1,53,000/ha, accounting to the average net return of Rs. 1,28,000/ha with a benefit cost ratio of 6.12:1. In the check plot gross cost recorded was Rs. 29000/ha, with an average gross return of Rs. 1,05,000/ ha, accounting to the average net return of Rs. 76000/ha with a benefit cost ratio of 3.62:1 as presented in Table 3. Farmers practice incurred an additional cost of Rs.4000/ha as compared to demonstration. As a result of the demonstrations an additional returns of Rs.48,000/ha was recorded in demo plot. The effective gain noticed in demo was Rs.44,000 /ha with an incremental B:C ratio of 12:1. This might be due to reduced cost of harvest of NBeG-47 with combined harvester, due to its tall nature top bearing suited for mechanical harvesting. The harvesting and threshing of this variety was completed within 3 hours/ hectare.

In blackgram the gross cost recorded was Rs. 19,000/ ha, with an average gross return of Rs. 87540/ha, accounting to the average net return of Rs. 68540/ha with a benefit cost ratio of 4.61:1. In the check plot gross cost recorded

was Rs. 22500/ha, with an average gross return of Rs. 69000/ha, accounting to the average net return of Rs. 46,500/ha with a benefit cost ratio of 3.10:1. Farmers practice incurred an additional cost of Rs.3500/ha as compared to demonstration. As a result of the demonstrations an additional returns of Rs.18540/ha was recorded in demo plot. The effective gain noticed in demo was Rs.15040/ha with an incremental B:C ratio of 5.29:1. This might be due to tolerant nature of TBG 104 for bud necrosis and yellow vein mosaic virus as a result of which cost of cultivation is reduced and production is increased.

In greengram the gross cost recorded was Rs. 12000/ ha, with an average gross return of Rs. 75000/ha, accounting to the average net return of Rs. 63000/ha with a benefit cost ratio of 6.25:1. In the check plot gross cost recorded was Rs. 12,000/ha, with an average gross return of Rs.

Table 1: Identified adoption gaps in chickpea and blackgram.

Item	Improved Practice	Farmers Practice	Gap
Chickpea			
	NBeG-47	JG-11	Full gap
Land preparation	Deep ploughing with MB plough	No deep ploughing	Full gap
Seed treatment	Carbendazim 50% WP @ 2.5 g /kg of seed, Imidacloprid 18.6 SL @ 3.0 ml /kg seed, Rhizobium culture @ 10 ml /kg seed.	No seed treatment	Full gap
Sowing time	October-November	November-December	Partial gap
Seed rate	100 kg ha^{-1}	125 kg ha^{-1}	Partial gap
Fertilizer management	20-50-00-40 kg NPK and S ha^{-1}	20-50-00 No sulfur	Partial gap
Weed Control	Pendimethaline @ 1.0 kg a.i/ha pre-emergence	No weed management	Full gap
Irrigation	Light irrigation with sprinklers at moisture stress	No irrigation	Full gap
Plant protection	IPM management for pod borers	IPM not practiced	Full gap
Harvesting	Mechanical harvesting with combined harvester	Manual harvesting	Full gap
Blackgram			
Variety	TBG 104 (tolerant to YMV and bud necrosis)	LBG 752	Full gap
Land preparation	Ploughing and harrowing	Ploughing and harrowing	No gap
Seed treatment	Carbendazim 50% WP @ 2.5 g /kg of seed, Imidacloprid 18.6 SL @ 3.0 ml /kg seed, Rhizobium culture @ 8 ml /kg seed.	No seed treatment	Full gap
Sowing time	October-December(*Rabi*)	October-December(*Rabi*)	No gap
Seed rate	10-12 kg ha^{-1}	10-12 kg ha^{-1}	No gap
Fertilizer management	20-50-00	18-46-00	Partial gap
Weed Control	Pendimethaline @ 1.0 kg a.i/ha applied as pre-emergence. Post emergence application of imazythapyr @ 500 ml ha^{-1}	Manual weeding	Full gap
Irrigation	Light irrigation at flower bud, pod maturity stage	No irrigation	Full gap
Plant protection	IPM for YMV and Pod borer management	IPM not practiced	Full gap
Harvesting	Manual harvesting	Manual harvesting	No gap
Greengram			
Variety	WGG 42 (YMV tolerant)	LGG 460	Full gap
Seed treatment	Carbendazim 50% WP @ 2.5 g /kg of seed, Imidacloprid 18.6 SL @ 3.0 ml /kg seed, Rhizobium culture @ 8 ml /kg seed.	No seed treatment	Full gap
Land preparation	Ploughing and harrowing	Ploughing and harrowing	No gap
Sowing time	October-December(*Rabi*)	October-December(*Rabi*)	No gap
Seed rate/Spacing	10-12 kg ha^{-1}	10-12 kg ha^{-1}	No gap
Fertilizer management	20-50-00	18-46-00	Partial gap
Weed Control	Pendimethaline @ 1.0 kg a.i/ha applied as pre-emergence. Post emergence application of imazythapyr @ 500 ml ha^{-1}	Manual weeding	Full gap
Irrigation	Light irrigation at flower bud and pod maturity stage	No irrigation	Full gap
Plant protection	IPM practices for YMV, Pod borer management	IPM is not practiced	Full gap
Harvesting	Manual harvesting	Manual harvesting	No gap

Table 2: Yield details of chickpea, blackgram and greengram.

Crop	No.of Farmers /Demos	Area (ha)	Yield (q/ha)			Check variety	Per cent increase in Yield/ yield gap in (%)
			Demo				
			High	Low	Average		
Chickpea	50	50	27.50	23.75	25.50	17.5	45.71
Blackgram	50	50	17.25	11.93	14.59	11.50	26.87
Greengram	50	50	16.50	15.00	15.12	10.00	51.20

Table 3: Economics details of chickpea, blackgram and greengram.

Crop	Economics of Demonstration (Rs./ha)				Economics of check (Rs./ha)			
	Gross cost	Gross returns	Net returns	BC ratio	Gross cost	Gross returns	Net returns	BC ratio
Chickpea	25000	153000	128000	6.12	29000	105000	76000	3.62
Blackgram	19000	87540	68540	4.61	22500	69000	46500	3.10
Greengram	12000	75000	63000	6.25	12000	50000	38000	4.16

Table 4: Profit through improved management practices chickpea, blackgram and greengram by paired t test.

Item	Difference			t value		
	Chickpea	Blackgram	Greengram	Chickpea	Blackgram	Greengram
Yield (q/ha)	8.0	3.09	5.12	3.95*	4.45*	2.56*
Total return (Rs./ha.)	48000	18540	25000	2.98*	4.12*	3.23*
Profit (Rs./ha.)	52000	22040	25000	3.74*	2.98*	3.49*

50,000/ha, accounting to the average net return of Rs. 38000/ha with a benefit cost ratio of 4.16:1. As a result of the demonstrations an additional returns of Rs.25000/ha was recorded in demo plot. The increased returns might be due to higher production over check variety due to its tolerance to yellow mosaic virus.

The profits obtained through improved management practices was shown using paired t test as shown in Table 4. The demo was found to be superior in performance in terms of yield, total returns and profits over the check in case of chickpea, blackgram and greengram. The findings are in line with that reported by Tripathi (2016), Dubey *et al.* (2017), Subrata *et al.* (2019).

In chickpea an yield difference of 8 q/ha was observed between demo and check. The difference in total return observed was Rs. 48,000/ha and the profit recorded was Rs. 52,000/ha over check. The calculated t values showed significant positive difference between improved practice and farmers practice.

In blackgram an yield difference of 3.09 q/ha was observed between demo and check. The difference in total return observed was Rs. 18,540/ha and the profit recorded was Rs. 22,040/ha over check. The calculated t values showed significant positive difference between improved practice and farmers practice.

In greengram an yield difference of 5.12 q/ha was observed between demo and check. The difference in total return observed was Rs. 25,000/ha and the profit recorded was Rs. 25,000/ha over check. The calculated t values showed significant positive difference between improved practice and farmers practice.

FLDs in cluster approach created a considerable impact on the farmers in economic terms thus paving way for doubling of farmers income. However the information on improved crop management practices need to be disseminated to other farmers in the district and also state through various extension programmes. The increased awareness created by the extension functionaries and the success stories documented on theses FLDs in cluster approach would motivate the other farmers to adopt improved practices.

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