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# Impact of Integrated Crop Management in Green gram under Rice fallows

**R. Saritha* and CH. Srilathavani**

***Regional Agricultural Research Station, Anakapalle, Andhra Pradesh, India***

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**ABSTRACT**

India accounts for 33 per cent of the world area and 22 per cent of the world production of pulses. Green gram (*Vigna radiate* L. Wilczek.) is the third important pulse crop in India after chick pea and red gram. It is grown in about 36 lakh hectares with the total production of about 17 lakh tonnes with a productivity of about 500 kg per hectare. The reasons for low productivity include non adoption of improved varieties and unawareness of recommended crop production and protection technologies. The extent of adoption of improved agricultural technologies is a crucial aspect under innovation diffusion process and is most important for enhancing vertical agricultural production. Keeping this in view, frontline demonstrations on green gram were conducted at 20 locations in Chodavaram block of Visakhapatnam district of Andhra Pradesh, with an objective to demonstrate the high yielding varieties (HYVs) and latest improved technologies to the farmers. The demonstrations included adoption of HYVs (WGG-42 and IPM-2-14), seed treatment, integrated nutrient management and timely plant protection in comparison to farmers practice. The incidence of Yellow vein mosaic was 0-5 per cent in improved varieties compared to 20-25 per cent in local variety. Both the varieties, WGG-42 and IPM-2-14 recorded 5.3 quintals per ha and 5.8 quintals per hectare, which was much higher than the local variety cultivated by farmer (3.8-4.0 q/ha). The cost economics also reflected the superiority of ICM practices which registered BC ratio of 3.53-3.56 when compared to farmers practice (2.76-3.10).

***Keywords:*** *Front Line Demonstration, Green gram, Integrated Crop Management*

## Introduction

India accounts for 33 per cent of the world area and 22 per cent of the world production of pulses producing 23.15 million tonnes of pulses from 28.34 million hectares area with the average productivity of 817 kg/ha (Agricultural Statistics at a glance 2020). Pulses so called as "Climate Change Smart Crops" or sometime it is also known as poor's man meat because of containing multi nutritionally enriched as they have high content of proteins, minerals like iron and zinc, vitamins, Ca, Mg. In addition to their nutritional content, there are several reasons that strongly support legume cultivation and adoption. Pulses are ideal foods for vegetarians/vegans and suitable for people with diabetes, most importantly it contains phyto estrogens chemical and free from gluten directly associated with the health prospects. It has also long shelf life. Besides pulses fixes the biological nitrogen which ameliorate the soil health and supply the nitrogen fertilizers to the companion crops. Overall pulses are the climate change resilient crops with diverse stress tolerance traits and require lesser water foot prints and have a great opportunity for income generations and enhance livelihood to support poor and marginal farmers. Pulses contribute 11 per cent of the total intake of proteins in India (Reddy, 2010). In India, frequency of pulses consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits (Ajeet Singh *et al.,* 2019). Green gram (*Vigna radiate* L. Wilczek.) is the third important pulse crop in India after chick pea and red gram. It is grown in about 36 lakh hectares with the total production of about 17 lakh tonnes with a productivity of about 500 kgs per hectare (FAOSTAT, 2019).

Though production technologies for higher yields in green gram have been formulated, farmers hardly adopted only a few and that too in an unscientific manner. The major reasons for low productivity include non adoption of improved varieties and unawareness of recommended crop production and protection technologies. The extent of adoption of improved agricultural technologies is a crucial aspect under innovation diffusion process and is most important for enhancing vertical agricultural production. To assess the gap between recommended technologies and technologies in practice, and also to demonstrate the high yielding varieties(HYVs) and latest improved technologies to the farmers, front line demonstrations (FLDs) on green gram were conducted.

## Materials and Methods

The present study carried out under village adoption programme of Regional Agricultural Research Station, Anakapalle, and Visakhapatnam at 20 locations in Chodavaram block of Visakhapatnam district of Andhra Pradesh during *rabi* 2018-19 and 2019-20 under rice fallow conditions. Each FLD was laid out on 0.4 ha area which included 0.2 ha of ICM demonstration plot and 0.2 ha of Farmers practice plot. The soils of the demonstration fields were sandy clayey loams of medium fertility status and with a pH range of 6.8-7.4. The integrated crop management (ICM) technology comprised the improved variety (WGG-42 at 10 locations and IPM-2-14 at 10 locations), seed treatment, recommended seed rate, pre emergence weedicide application, proper nutrient and pest management (Table 1)

The percentage of pest and disease incidence was calculated with the formula given by Sridhar *et al.*, 2013 and Singh *et al.*, 2020.

$$\text{Pest/Disease incidence(\%)} = \frac{\text{Total number of infested/infected plants}}{\text{Total number of plants examined}} \times 100$$

The yield data were collected from both the demonstration and farmers practice by random crop cutting method and was computed according to the following formula (Bondre *et al.*, 2017)

Yield, kg/ha = Factor × Seed yield (per plot)

Where,

$$\text{Where, Factor} = \frac{10000}{\text{Netplotsize}}, \text{m}^2$$

The gross returns, net returns and benefit cost ratio (B: C ratio) was calculated with respect to demonstration and farmers practice according to following formula (Bondre *et al.,* 2017)

**Table 1.** Improved production technology and Farmers practices of green gram under Front line demonstrations

| S.No. | Technology | Improved practices | Farmers practice | Gap |
|---|---|---|---|---|
| 1 | Variety | WGG-42 and IPM-2-14 | local | Complete gap |
| 2 | Seed Rate | 30 kg/ha | 20 kg/ha | Partial gap |
| 3 | Seed Treatment | Imidacloprid 600 FS @ 5 ml/kg of seed and mancozeb @ 3 gm/kg seed | Nil | Complete gap |
| 4 | Post Emergence herbicide | Imazethapyr 500 ml/ha at 20-25 days | One hand weeding | Partial gap |
| 5 | Fertilizer dose | Basal doses of 20 kg N+50 kg $P_2O_5$ per ha and foliar spraying 1% potassium nitrate at 35 days after sowing | Nil | Complete gap |
| 6 | Plant protection | IPM practicesErection of sticky traps 25/haNeed based spraying (Spraying of neem oil @5 ml/l at 20-30 DAS Spraying of acephate @1 ml/l at 50% flowering Spraying of Hexaconazole 2 ml/l at 35 DAS and 45 DAS) | Two sprays of monocrotophos @1.6 ml/l at 30 DAS and again at flowering along with mancozeb 3g/l. | Partial gap |

$$\text{B:C ratio} = \frac{\text{Gross returns}}{\text{Cost of cultivation}}$$

The extension gap, technology gap and the technology index were work out with the help of formulas given by Samui *et al*. (2000) as mentioned below.

Technology gap = Potential yield – Demonstration Yield

Extension gap = Demonstration yield – Farmers yield

Technology index = {(Potential yield - Demonstration yield) / Potential yield} X 100

## Results

The performance of green gram crop as contributed by adoption of integrated crop management practices was assessed through front line demonstrations as compared to the local farmers practice. The data on incidence of pests and diseases, yields obtained, cost of cultivation and returns generated were recorded and pooled for the two seasons. The yield data was statistically analyzed to calculate technology gap, extension gap, technology index and BC ratio.

The data on incidence of pests and diseases are presented in Table 2. It is evident from the data that the mean number of whiteflies per plant were lower in ICM plot (5.5/plant) compared to farmers practice (12.5/plant). The mean per cent infestation of leaf webber and pod borer was also much lower in ICM plot (2.5 %) compared to farmers practice (11%). The incidence of yellow mosaic virus (YMV) was also recorded and its mean incidence was only 2.5 per cent in ICM plots whereas it was 22.5 per cent in farmers practice. The mean incidence of leaf spots was also low in ICM plots (7.5%) compared to farmers practice (17.5%). Data was also recorded on per cent incidence of powdery mildew and its mean incidence was 4.0 per cent in ICM plots which was much lower than that in farmer's practice (12.5%). The yields achieved in the ICM plots were much higher when compared to the check plots with farmers practice owing to the adoption of HYV, ICM and IPM in the FLD plots. The results presented in Table 2 reveal that, plots of the integrated crop management practices recorded 28.3-31.0 per cent increase in the yield (530-580kg/ha) as compared to the farmers practices (380-400 kg/ha).

Yields of the ICM plots and potential yields of the

**Table 2.** Incidence of Pests and diseases of green gram under Front line demonstrations

| Practice | No. of white flies per plant | Per cent incidence of YMV | Per cent incidence of leaf webber/pod borer | Per cent incidence of leaf spots | Per cent incidence of powdery mildew |
|---|---|---|---|---|---|
| ICM | 5.5 | 2.5 | 2.5 | 7.5 | 4.0 |
| Farmers Practice | 12.5 | 22.5 | 11.0 | 17.5 | 12.5 |

**Table 3.** Productivity, Technology gap, Extension gap and technology index of green gram under Front line demonstrations

| Practice | Yield (kg/ha) | | | | Per cent increase in yield | Technology gap (kg/ha) | Extension gap (kg/ha) | Technology Index (%) |
|---|---|---|---|---|---|---|---|---|
| | Potential | ICM | Farmers Practice | Yield gap | | | | |
| ICM (WGG-42) vs local | 600 | 530 | 380 | 150 | 28.3 | 70 | 150 | 12.00 |
| ICM (IPM-2-14) vs local | 600 | 580 | 400 | 180 | 31.0 | 20 | 180 | 3.34 |

**Table 4.** Economics of green gram under Front line demonstrations

| Practice | Gross Returns (Rs) | | Cost of Cultivation (Rs) | | Net Returns (Rs) | | BC Ratio | |
|---|---|---|---|---|---|---|---|---|
| | ICM | Farmers Practice | ICM | Farmers Practice | ICM | Farmers Practice | ICM | Farmers Practice |
| WGG-42 vs local | 42,400 | 30,400 | 12,000 | 11,000 | 28,400 | 18,400 | 3.53 | 2.76 |
| IPM-2-14 vs local | 46,400 | 32,000 | 12,000 | 11,000 | 32,400 | 20,000 | 3.86 | 3.10 |

HYVs were compared to obtain the yield gaps which were in turn used to calculate technology and extension gaps. The yield gap was 150-180 kg per hectare between the ICM plots and farmers practice. The technology gap recorded was 20-70 kg/ha which indicates that the potential yield of the crop could not be achieved even in the demonstration plots. The extension gap calculated was 150-180 kg/ha and the technology index obtained was 3.4-12.0 per cent.

The cost economics of front line demonstrations on ICM in green gram were estimated and the results have been presented in Table 4. The cost of cultivation was slightly higher in ICM plots (Rs.12,000 per ha) compared to farmers practice (Rs.11,000 per ha) because of costs incurred for quality seed and other inputs for IPM. The gross returns obtained in ICM plots was however much higher (Rs.42,400-46,400 per ha) owing to greater yields achieved compared to farmers practice (Rs.30,400-32,000 per ha). These results were reinforced by the higher benefit cost ratio obtained in ICM plots (3.53-3.56) when compared to farmers practice which recorded benefit cost ratio of 2.76-3.10.

## Discussion

Front line demonstrations are a proven 'seeing is believing' tool in convincing farmers to adopt newer production and protection technologies as reflected by the lower pest and disease incidence, higher yields, lower technology index and better benefit cost ratio obtained in the demonstration plots. Plots of the integrated crop management practices recorded 28.3-31.0 per cent increase in the yield (530-580kg/ha) as compared to the farmers practices (380-400 kg/ha). The lower pest and disease incidence along with higher yields in ICM plots due to adoption of viable technologies was also observed by Lathwal (2010); Jat *et al*. (2015) and Goudappa *et al*. (2019). The small (20-70 kg/ha) of technology gap in the present studycan be attributed to climatic factors, soil fertility and biotic stresses. (Poonia and Pithia, 2011 and Raju Teggelli *et al.,* 2015). The extension gap calculated was 150-180 kg/ha which indicates the scope for improvement of yields by adoption of viable technologies through appropriate extension methods. The technology index obtained was 3.4-12.0 per cent which indicates that a small gap existed between technology imparted and technology adopted at field level. The lower value of technology index indicates higher feasibility of technology. The similar results were observed by Kumar *et al.* (2014) and Gangadevi *et al*. (2017). The cost economics analysis indicated higher returns to the extent of about Rs. 16,000 more than the returns obtained in the farmers practice. The results obtained are in consensus with the findings of Singh *et al*. (2014) and Neeraj *et al*. (2021).

## Conclusion

Front line demonstrations are an effective tool to bridge the gap between existing yields and potential yields and influence the participating as well as neighboring farmers. Based on study it may be concluded that enhanced yield of green gram can be attained through adoption of improved production technologies. Technological and extension gaps in achieving higher productivity can be spanned by imparting knowledge on integrated crop management practices with emphasis of usage of high yielding varieties, proper seed rate, balanced fertilizer application and timely plant protection measures. Thus, conducting of front line demonstrations contributed to the enhanced income of the farmers and also in popularizing the viable technology in the villages towards achieving higher yields in green gram under rice fallow conditions.

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