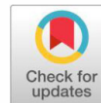


Research Article

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Impact of Integrated Pest and Disease Management (IPDM) Module in Bengalgram For Enhancing Yields



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ABSTRACT

The Front line demonstration was carried out during 2021-22 and 2022-23 Rabi seasons in farmers fields covering 0.4 ha each by the active participation of farmers with the objective to demonstrate the improved technologies to evaluate the efficacy of Integrated pest and disease management practices over farmer's practices against control over Gram podborer (*Helicoverpa armigera* Hubner), Dry root rot and Fusarium wilt damage as they were major concern to farmers for reducing the yields during crop season in the farmers fields. The results revealed that the incidence of gram pod borer, Dry root rot and Fusarium was recorded comparatively less in Integrated Pest and disease Management (IPDM) plot as compared to farmers' practices. The Seed yield was recorded higher in the IPDM plots (2035 kg ha⁻¹, 1830 kg ha⁻¹) compared to farmers' practices (1825 kg ha⁻¹, 1760 kg ha⁻¹). IPDM module also recorded higher gross return (Rs. 91,575 ha⁻¹, Rs. 96,990 ha⁻¹) with net profits (Rs. 66,825 ha⁻¹, 72240 ha⁻¹) as well as benefit-cost ratio (3.71:1, 3.93:1) as compared to farmers' practices (gross return of Rs. 82125 ha⁻¹, 93280 ha⁻¹) with net profits of Rs. 53,625 ha⁻¹, 61,530 ha⁻¹) and benefit-cost ratio of (2.89:1, 2.94:1) during the two consecutive years 2021-22 and 2022-23 of rabi seasons respectively. The improved technology gave higher gross returns, net returns with higher benefit cost ratio than farmer's practices with environmental friendly approach.

Keywords: Bengalgram, IPDM module, Yield, Cost-benefit ratio.

Introduction

Chickpea (*Cicer arietinum* L.) is a legume crop of the Fabaceae family and subfamily Faboideae commonly known as gram or Bengal gram is an important pulse crop of India. Although all the pulses occupy a unique in Indian agriculture as well as throughout the world, chickpea is considered as "king of pulses". India has 75 per cent of world acreage and production of gram. India produces 5.77 mt of chickpea from 7.29 m ha with an average production of 792 kg ha⁻¹ [1]. Nutritionally, it contains 59.6 percent carbohydrates, 24 percent protein, and 3.2 percent minerals [3]. Grain legumes play an important role in overcoming the quantitative and qualitative protein requirements for a large parts of humanity. India is the world's leading producer of chickpea with 68% of the total production. But the current productivity levels of pulses are low, 200- 700 kg/ha. It's productivity, however, is limited by a complex of interacting biotic and abiotic factors. Among diseases and pest Fusarium wilt and pod borer are the most major diseases and pest of chickpea. They cause 50-60 per cent losses of crops. Pod borer damage many crops like, tomato, Arhar and cotton also [6] due to pest infestation and destruction of natural enemies, the use of chemicals are not very effective against larvae of pod

borer. Hence, the present investigation i.e., Frontline Demonstrations (FLDs) is a novel approach based on integrated pest and disease management modules which is a highly desirable technology to reduce the chemicals and to get direct feedback from the farming community.

Materials and Methods

The present study was carried out by Krishi Vigyan Kendra, Nizamabad (Rudrur), Professor Jayashankar telangana State Agricultural University (PJTSAU), Hyderabad during Rabi seasons of 2021-22 and 2022-23 in farmers fields of Nizamabad district to for determination of the effect of Integrated pest and disease management (IPDM) practices on the Bengalgram, observations were made in two plots; one plot was treated with IPDM practices with NBeG-3 and another plot with conventional farmers' practices by sowing variety 'JG-11 in October-November months. Normal agronomic measures with row-to-row distance of 30 cm and plant-to-plant distance within the row of 10 cm along with recommended doses of fertilizers were followed in both cases. In general, the soils of the area under study were medium black clay with medium fertility status. The average rainfall of this area was during 2021-22 & 2022-23 were 1437.9 mm and 1760.6 mm with 56 and 88 rainy days respectively. In demonstration plots, critical inputs in the form of quality seed and treatment, plant-based botanicals Azadirachtin 1500ppm and agro-chemicals were provided by KVK. Materials for the present study concerning FLD were on following

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IPDM practices

- Seed treatment with Tebuconazole 2DS @ 1.5 g/kg and *Trichoderma asperillum* @ 10g/kg seed.
- Need based drenching with Tebuconazole +Trifloxystrobin@ 0.4g/l water.
- Installation of pheromone traps @ 4/ac
- Spraying of Azadirachtin 1500ppm @ 5ml/l, @ 2 g/l
- Based on ETL, last resort to Chemicals (chlorantraniliprole 18.5% SC @ 0.3 ml/l against pod borer.

Data on insect pest population in test plot was recorded following the methodology adopted by [4]. Afterwards, the mean population was calculated. All the plants were harvested to get the seed yield of each plot and afterwards those were converted to yield on a hectare basis. For economics study, the cost of treatments, gross return, net profit and cost: benefit ratio have been calculated considering each of the expenditures involved in both the practices viz. IPM module and farmers' practices.

Results and Discussion

During the two consecutive years i.e., 2021-22 and 2022-23 the yield analysis of gram in demonstrated field's and farmer's practice is presented in Table 1.

Table.1 Impact of frontline demonstrations on IPDM on yields of Bengal gram

Season & year	Technology interventions	Farmers practice	Number of farmers	Demonstrated area (ha) NBeG-3	Average yield (kg ha ⁻¹)		Percent (%) increase in yield
					Control plot (JG-11) (kg ha ⁻¹)	Demonstration plot (NBeG-3) (kg ha ⁻¹)	
Rabi, 2021-22	IPDM Practices: Seed treatment + Pheromone traps+ Azadirachtin+ Need based chemicals	Non Use of IPDM practices. Solely relying on chemicals	10	8	1825	2035	11.50
Rabi, 2022-23	IPDM Practices: Seed treatment + Pheromone traps+ Azadirachtin+ Need based chemicals	Non Use of IPDM practices. Solely relying on chemicals	10	8	1760	1830	3.97

The results revealed that the average grain yield of Bengalgram under frontline demonstrations was 2035 kg ha⁻¹ and 1830 kg ha⁻¹ found superior to farmers' conventional practice 1825 kg ha⁻¹ and 1760 kg ha⁻¹ during 2021-22, 2022-23 respectively. These results also supported by [2] in pulse crops. The observed yield gap may be attributed to dissimilarity in soil fertility status, soil moisture condition, disease, pest infestations and weed intensity as well as the change in the locations of frontline demonstration sites.

The results of the comparative evaluation of IPDM module and farmers' practices on insect pests of Bengalgram revealed that the incidence of the insect pests and diseases viz. *Spodoptera*, *Helicoverpa*, Fusarium Wilt and Dry root rot were recorded relatively less in the IPDM plots as compared to farmer's practices (Table 2).

Table 2. Variation in insect pest occurrence in IPDM module and Farmers' practices in Bengalgram

Adopted management practices	Pest and Disease observations (Mean of 10 observations in 10 different locations)			
	<i>Spodoptera litura</i> (Fabricius) (Adults/ Plant)	<i>Helicoverpa armigera</i> (Hubner) (Adults/ Plant)	Fusarium Wilt (Infested plant/sq.m)	Dry root rot (Infested plant/sq.m)
IPDM Practices	0.6	1.3	0.4	0.6
Farmers practices	4.7	3.1	1.8	2.1

In the IPDM plots, the incidence of *Spodoptera litura* is recorded less 0.6 (adults/plant) as compared to farmers practice (4.7 adults/plant). The incidence of *Helicoverpa armigera* were also recorded minimum (1.3 adults/plant) as compared to the farmer's conventional practice. Based on the infested plant count per square metre, the incidence of Fusarium wilt was recorded low (0.4 infested plant/sq.m) when compared to farmers practice (1.8 infested plant/sq.m). In IPDM plots Dry root rot was also recorded minimum (0.6 infested plant/sq.m) in comparison with farmers' practice (2.1 infested plant/sq.m). This finding is in conformity with the findings of [7] on the evaluation of IPM module with regard to the farmers practice confirming the merit of implementation of the integrated module in terms of lowering insect pest pressure as well as getting a higher return.

Apart from the pest and disease incidence scenario economics of the IPDM modules in comparison with farmer's conventional practices were studied. During the study IPDM module showed superiority with farmers practice (Table 3). The Seed yield was recorded higher in the IPDM plots (2035 kg ha⁻¹, 1830 kg ha⁻¹) compared to farmers' practices (1825 kg ha⁻¹, 1760 kg ha⁻¹) (Table 3). IPDM module also recorded higher gross return (Rs. 91,575 ha⁻¹, Rs. 96,990 ha⁻¹) with net profits (Rs. 66,825 ha⁻¹, 72240 ha⁻¹) as well as benefit-cost ratio (3.71:1, 3.93:1) as compared to farmers' practices (gross return of Rs. 82125 ha⁻¹, 93280 ha⁻¹) with net profits of Rs. 53,625 ha⁻¹, 61,530 ha⁻¹) and benefit-cost ratio of (2.89:1, 2.94:1) (Table 3) during the two consecutive years 2021-22 and 2022-23 of rabi seasons respectively. Therefore, the present experiment on the evaluation of IPDM module in bengalgram with regard to the farmers' practice confirmed the merit of the implementation of an integrated module in terms of lowering insect pest and disease

pressure as well as getting a higher return. These findings are in harmony with the observations made by [5] and [8]. A relatively higher cost-benefit ratio in IPM plots compared to farmers' practice was also recorded by [5], though their experimental crop was the black gram. It may be concluded from the study that IPDM practices significantly reduced insect pests and disease infestation and gave higher yields as well as Benefit: Cost ratio compared to farmers' practices.

Table 3. Economics of IPDM module in comparison with Farmers' practices in Bengalgram

Adopted management practices	Yield (kg ha ⁻¹)		Increased yield in IPM over Farmers' practices (kg ha ⁻¹)		Cost of Cultivation		Gross Returns		Net Returns		B:C ratio	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
IPDM Practices	2035	1830	11.50	3.97	24750	24750	91575	96990	66825	72240	3.71	3.93
Farmers Practice	1825	1760			28500	31750	82125	93280	53625	61530	2.89	2.94

Conclusion

It is concluded from the present investigation that, pests and disease incidence of viz., *Spodoptera litura* (Fabricius), *Helicoverpa armigera* (Hubner), Fusarium Wilt, and Dry root rot were comparatively low in IPDM plots when compared to farmers' conventional practices i.e., Non-use of IPDM components and relying solely on chemical pesticides. On the other hand, the plots treated with IPDM practices recorded higher yields as well as higher benefit-cost ratios as compared to farmers' practices with an environmentally friendly approach.

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