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Table 2. Estimates of Genotypic (G) direct (diagonal and bold) and indirect (non diagonal) effects of component characters on seed yield in Safflower genotypes

Characters	Days to 50% Flowering	Days to Maturity	Plant Height	Number of effective capitula/ Plant	Number of Seeds / Capitulum	Test Weight (g)
Days to 50% Flowering	-1.131	0.877	-0.088	0.129	-0.043	0.138
Days to Maturity	-1.131	0.877	-0.088	0.129	-0.043	0.138
Plant Height	0.276	-0.213	0.360	-0.109	0.075	0.132
Number of Effective capitula / Plant	0.318	-0.246	0.086	-0.458	-0.003	0.957
Number of Seeds / Capitulum	0.309	-0.240	0.171	0.010	0.157	-0.088
Test Weight (g)	-0.121	0.094	0.037	-0.340	-0.010	1.291

*Significance at 5% level, ** Significance at 1% level

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FLDs on need based plant protection in oilseeds: impact in enhancing productivity and profitability under farmers' conditions

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(Received: December 30, 2022, Revised: December 31, 2022, Accepted: January 02, 2023)

ABSTRACT

Frontline demonstrations in oilseed crops were conducted on farmers' fields in different agro-ecological situations on need based plant protection during 2015-16 to 2021-22 to show the productivity potential and profitability of Improved Technologies (IT). The results indicated that, the IT plots recorded higher mean seed yield, gross returns, additional net returns and B:C ratio than the farmers' practice plots indicating the technical and economic feasibility of IT. To speed up the dissemination of plant protection technologies and scale-up the demonstrations, partnerships between extension agencies, state departments of agriculture and input agencies, must be established.

Keywords: FLDs, Improved technology, Pests and diseases, Partial budgeting technique

The major factors affecting the productivity of oilseeds are biotic and abiotic stresses. Among biotic constraints for oilseeds production, insect pests and diseases are of major concern causing severe losses at different growth stages. Vulnerability of majority of the cultivars of oilseed crops to insect pests and diseases continues to be one of the major factors responsible for the lower productivity and wider fluctuations in production (Rabindra *et al*., 2007).

The continuous cultivation of oilseed crops without proper crop rotation has led to depletion of soil nutrients as well as increase in pest and disease incidence causing upto 40% yield loss (Gowda *et a1*. 2007). FLDs conducted on need based plant protection in oilseeds recorded mean productivity improvement of 36% and 23% and ANR of Rs. 7222 ha^{-1} and Rs. 6372 ha^{-1} under rainfed and irrigated conditions respectively as compared to FP plots (Kumar *et al*., 2014).

Several technologies and management options have been developed by the respective All India Coordinated Research Projects (AICRP) on oilseed crops, that can significantly reduce the losses due to insect pests and diseases, but adoption of these technologies by farmers has been far less than anticipated. Realizing the importance of extending these technologies for managing insect pests and diseases in oilseed crops at farmers' level, frontline demonstrations (FLDs) were conducted to show the productivity potential and profitability of need based plant protection.

MATERIALS AND METHODS

The improved technology (IT) i.e. need based plant protection included seed treatment with pesticides (insecticides and fungicides) and prophylactic sprays (biological or chemical) and spray of safer pesticides as and when required based on the nature of the pest and its damage symptoms. The IT was demonstrated on 0.40 ha plot in comparison with farmers' practice (FP) of no spraying/indiscriminate use of pesticides, in order to provide farmers an opportunity to compare, evaluate and choose themselves the best practice based on their own criteria. The pests and diseases targeted were shoot webber and capsule borer and powdery mildew in sesame, safflower (aphids and alternaria leaf spot), sunflower (leaf hoppers, thrips and whitefly, powdery mildew and alternaria leaf spot in rabi irrigated conditions), castor (semilooper, capsule borer and wilt) and mustard (mustard aphid, painted bug and powdery mildew).The FLDs conducted on five oilseed crops at various locations in India during 2015-2022 were considered for analysis. A total of 401 FLDs were conducted to demonstrate the potential benefits of IT.

Partial budgeting technique (Birthal, 2003) was used to estimate additional net returns and benefit cost ratio (B:C ratio) of the demonstrations. The technology is economically feasible, if the profits are higher compared to those of farmers' practice.

RESULTS AND DISCUSSION

The results indicated that, IT plots recorded mean productivity improvement in the range of 13.7% to 45.9% compared to FP plots. Highest increase in the mean productivity was observed in safflower (45.9%) followed by sesame (45.1%), mustard (33.7%), sunflower (17.0%) & least increase was observed in castor (13.7%) (Table 1).

The cost of cultivation increased by 9.21% with IT (Rs. 23469 ha^{-1}) compared to FP (Rs. 21489 ha^{-1}). But, the Gross monetary returns (GMR) increased by 27.4% with IT (Rs. 69199 ha^{-1}) as compared to FP (Rs. 54327 ha^{-1}) indicating the importance of need based plant protection under rainfed conditions. The higher GMR realized by the farmers indicated the economic feasibility of the technology. The additional net return (ANR), which is a true indicator of economic worth of the practice was Rs. 12892 ha^{-1}. The benefit cost ratio was 2.95 in IT and 2.53 in FP (Table 1).

The FLDs have shown the potential of IT (need based plant protection) to step up the productivity significantly by reducing losses due to insect pests and diseases and increasing the income of farmers. Low adoption of insect pest and disease management by farmers was reported in groundnut (Kumar and Jain, 2011). Medium to high resource use management was observed for insect pests and disease management in castor (Venkattakumar et al., 2012).

To speed up the dissemination of plant protection technologies and scale-up the demonstrations, partnerships between extension agencies, state departments of agriculture and input agencies, must be established. A multifaceted approach to farmers' education on identifying the damage symptoms of various insect pests and diseases of oilseed crops, identifying the suitable time and stage of the crop for taking control measures and ensuring timely availability of quality inputs/ chemicals and biologicals will benefit the farmers in minimizing the losses from pests and diseases and enhancing the productivity of oilseeds.

ACKNOWLEDGEMENTS

The authors acknowledge the sincere efforts of all the AICRP centres in successfully conducting the FLDs and thankful to the farmers for their cooperation in conducting the FLDs. The authors are thankful to the NFSM for the financial support in conducting the FLDs.

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Table 1. Productivity potential and profitability of FLDs on need based plant protection

Crop	No. of FLDs conducted	Mean Seed Yield (kg/ha)		Increase over FP (%)	CoC (Rs/ha)		Increase over FP (%)	GMR (Rs/ha)		Increase over FP (%)	ANR (Rs/ha)	B:C ratio	
		IT	FP		IT	FP		IT	FP			IT	FP
Sesame (Five years)	76	531	366	45.1	17871	16222	10.2	40670	28315	43.6	10706	2.28	1.75
Safflower (Three years)	96	958	657	45.8	20794	17540	18.6	48056	33364	44.0	11438	2.31	1.90
Sunflower (Two years)	62	2159	1846	17.0	27368	27225	0.5	122916	104987	17.1	17786	4.49	3.86
Castor (Two years)	127	766	674	13.7	17592	17002	3.5	33455	29353	14.0	3511	1.90	1.73
Mustard (One year)	40	1571	1175	33.7	33719	29456	14.5	100898	75615	33.4	21020	2.99	2.57
Mean	**401**	**1197**	**943**	**26.9**	**234692**	**148992**	**57.5**	**69199**	**54327**	**27.4**	**12892**	**2.95**	**2.53**

IT-Improved Technology, FP-Farmer practice, CoC – Cost of cultivation, GMR - Gross Monetory Returns, ANR - Annual Net Returns, B;C ratio - Benefit cost ratio

Effect of the growth and yield attributes of sunflower and chickpea with response to different doses and methods of Phosphorus Solubilizing Bacteria in combination with different Phosphorus levels

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(Received: December 30, 2022, Revised: December 31, 2022, Accepted: January 02, 2023)

ABSTRACT

A study was conducted on sunflower and chickpea in sandy loam soils during *Rabi* 2020 at PJTSAU, Rajendranagar, Hyderabad. This study was focused to know the response of the liquid and powdered PSB on growth and yield attributes of sunflower and chickpea. For this experiment the treatment combination includes, different methods (liquid and powdered) and doses (@ 3 and 6 kg ha^{-1} for soil application and 50 ml L^{-1} for drenching) of Phosphorus Solubilizing Bacteria (PSB) along with different phosphorus levels. Phosphorus plays a key role in photosynthesis, metabolism of sugars, energy storage and transfer, cell division, cell enlargement and transfer of genetic information. Inoculation with PSB known to produce the growth hormones like Indole - Acetic Acid and Gibberillic Acid which might favour to increase plant height. The results reported that there was a significant effect of PSB on the plant height, Head diameter, number of pods/plant and non-significant effect on plant stand and test weight. Among, all the treatments the highest plant height (124.33 cm) and head diameter (16.23 cm) at maturity stage in sunflower was seen with 75% P + PSB @ 6 kg/ha and the highest plant height (51.13 cm) and number of pods/plant (26.07) at maturity stage in chickpea was seen with 50% P+ PSB @ 6 kg/ha. There was a non significant effect of PSB on plant stand and test weight. With the application of the PSB there was a reduction of the application of the phosphorus fertilizer to the extent of 25% in sunflower and 50% in chickpea.

Keywords: Drenching, Plant height, Soil application, Test weight

India is the largest producer of oilseeds in the world and oilseed sector occupies an important position in the agricultural economy of the country. Oilseeds are among the major crops that are grown in the country apart from cereals. Sunflower is one of the oil seed crop in India. It is a potential source of high quality edible oil, ranges second next to soybean. India during yasangi (rabi) 2020-21 sunflower crop has occupied 1.041 lakh hectares (2.572 lakh acres) as against 1.050 lakh ha (2.595 lakh acres) during the same period in 2019-20. In Telangana state, yasangi (rabi) 2020-21area covered under sunflower was about 7,596 ha (18,770 acres). Chickpea is one of the major rabi pulse crop. Among, the pulses chickpea is known as "King of Pulses". In Telangana the area contribution for chickpea was 1.03 lakh hectares.

Phosphorus (P) is one of the essential elements that are necessary for plant development and growth; it makes up about 0.2% of a plant's dry weight. It is second only to nitrogen among mineral nutrients most commonly limiting the growth of crops. On average, the phosphorus content of soil is about 0.05% (w/w); however, only 0.1% of this phosphorus is available for plant use (Zhu *et al.*, 2011). Traditionally, the challenge of soil phosphorus deficiency is addressed by the application of phosphorus fertilizers. However, the majority of the applied fertilizer phosphorus is not available to plants and the addition of inorganic fertilizers in excess of the amount that is commonly employed to overcome this effect can lead to environmental problems.