

## FRONT LINE DEMONSTRATIONS ON NEED BASED PLANT PROTECTION IN THE IMPORTANT SOLANACEOUS VEGETABLES IMPACT IN ENHANCING PRODUCTIVITY AND PROFITABILITY UNDER FARMERS' FIELD IN MAYURBHANJ DISTRICT OF ODISHA

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**Abstract:** One of the major reasons of low productivity in solanaceous vegetables is the lack of technical knowledge of the farmers about judicious and timely implementation of the management strategies against the major biotic stresses (insect pests and diseases) which ultimately reduce its return. Considering the fact front line demonstrations on need based plant protection in solanaceous vegetables were conducted in farmers' fields at different villages of the Mayurbhanj district, under north eastern plateau zones of Odisha, during 2011-12 and 2012-13 to show the productivity potential and profitability of Improved Technologies (IT). The results recorded higher mean productivity ranges from 19.7% to 38%, gross returns, additional net return, B: C ratio and ICBR value ranges from 6.4 for need based plant protection in solanaceous vegetables to 13.6 in the IT plots than the farmers' practice plots indicating the technical and economic feasibility of IT over FP (Farmers Practices).

**Keywords:** Farmers' practices (FP), FLDs, Improved practices (IP), Profitability and Solanaceous vegetables.

**Introduction:** The term "solanaceous crops" generally refers to plants in the nightshade family, Solanaceae, within the Genera most important vegetables include Capsicum (peppers), Lycopersicon (tomato), Solanum (eggplant and potato) and Abelmoschus (okra/bhendi). The solanaceous vegetables cover largest area and play an important role in total vegetable production in India. Odisha is one of the vegetable growing state of the country occupies total 0.37 mha under solanaceous vegetable with production of 42.90 (lakh MT). Out of this brinjal share 35%, okra 19%, tomato 23% and chilli 21% (Source: Horticulture in Odisha, 2013). The productivity of these four vegetables i.e. brinjal, okra, tomato and chilli are 16.77 q ha<sup>-1</sup>, 8.82 q ha<sup>-1</sup>, 14.19 q ha<sup>-1</sup> and 0.96 q ha<sup>-1</sup> respectively. In Mayurbhanj only 30 ('000 ha) area are under solanaceous vegetable cultivation but the productivity is slightly higher over the state with total production 4.02 (lakh MT) (Source: Horticulture in Odisha, 2013). Now most of the solanaceous vegetables are available throughout the year. However, there is a risk of severe damage by insect pests and diseases. Particularly, the insects that damage these crops range in their ability to reduce yields at different growth stages. Moreover, insects that transmit disease agents, such as whitefly or thrips vectored plant viruses, can also have similar devastating effects on yield. Vulnerability of the solanaceous vegetables to insect pests and diseases continues to be one of the major factors responsible for the lower productivity with wider fluctuation (Rabindra et al. 2007[1]). Considering the changing scenario in demand of vegetables, there is further need for increasing productivity and profitability along with the quality vegetables production in the country. There is a

potential to increase production of solanaceous vegetables by using best production practices and right combination of input at right time (Kumar and Chauhan, 2007[2]) to bridge the yield gap between demonstration trials and farmer's field. Several technologies and management options are developed for protecting the crops, that can significantly reduce the losses due to insect pests, but adoption of these technologies by the farmers has been far less than anticipated. Realizing the importance of extending these technologies for management insect pests in solanaceous vegetables at farmers' level, frontline demonstrations (FLDs) were conducted to show the productivity potential and profitability of need based plant protection.

**Material and Methods:** The improved technology (IT), i.e. need based plant protection included use of pheromone trap, neem oil and prophylactic spray with biological and safer pesticides as and when required based on nature of pest and its damage symptoms. The IT was demonstrated in comparison with the farmers practice (FP) of no spraying/indiscriminate use of pesticide, in order to provide farmers an opportunity to compare, evaluate and choose themselves the best practice based on their own criteria. The details of IT are presented in Table 1. The FLDs conducted at Mayurbhanj district of Odisha during 2011-12 and 2012-13 on four major solanaceous crops and most prevalent insects in this region were considered and natural epiphytotic condition allowed. A total of 40 FLDs were demonstrated to calculate the potential benefit of IT. The data on yield cost of cultivation and gross monetary returns were collected from IT plots and FP plots. The improvement in yield was estimated by the following formula.

Improvement in yield (%) = Yield gain in IT plot (q) - yield gain in FP plot(q)/ yield gain in FP plot (q) X 100

Table 1. Crop wise target insect pests and IT demonstrated.				
Crops	Target pests	Villages	Details of IT demonstrated	Farmer's Practice (FP)
Tomato	Tomato fruit borer	Kusmula, Raisuan	Installation of Pheromone trap, @ 8no./acre with Helilure, Prophylactic spray of Neem oil@ 5ml/lit and Bt @2gm/lit of water	Indiscriminate spraying of Monocrotophos
Chilli	Sucking pest like aphid, thrips	Sitarampur, Katalposi	Alternate spraying of Imidachloprid @ 4ml/10lt of water and propargite @ 1ml/lit of water	Spraying of chloropyriphos
Brinjal	Shoot and fruit borer	Badadhaurjajpur, Di mirimunda	Installation of Pheromone trap, @ 8no./acre with luclilure, Alternate spray of Thiodicarb 75% WP@ 2 gm/lit and Thiachloprid 21.7% SC @2ml/lit of water	Indiscriminate and higher doses of spraying of Chloropyriphos and cypermethrin
Okra	Okra fruit borer	Polsapokari, Tentuli, Kaniposi	Spraying of Emamectin Benzoate@ 200gm/ha	Spraying of monocrotophos at higher doses

Partial budgeting technique (Birthal, 2003 [3]) was used to estimate additional net return, cost benefit ratio (B:C ratio) and incremental cost benefit ratio (ICBR) of the demonstration. The technology is economically feasible if the profits are higher compared to those farmers' practice. This could be symbolically represented as follows:

$$TR(I) - TR(F) > TC(I) - TC(F)$$

$$DR(I) > DC(F)$$

$$TR = \sum P_i \cdot Y_i$$

$$TC = \sum P_j \cdot X_j$$

Where, TR (F) = Total returns from farmers' practice plot; TC(F) = Total cost recorded in farmers' practice plot; DR (I) = Change in the revenue due to improved technology; DC(F) = Change in the revenue due to farmers' practice; TR (I) = Total return from the improved technology plot; TC(I) = Total cost from the improved technology plot;  $P_i$  = Price of the  $i^{th}$  output ( $i= 1, \dots, n$ );  $Y_i$  = quantity of the  $i^{th}$  output ( $i= 1, \dots, n$ );  $P_j$  = Price of the  $j^{th}$  input ( $j= 1, \dots, n$ ) and  $X_j$  = quantity of the  $j^{th}$  input ( $j= 1, \dots, n$ ).

## Result and Discussion:

**Performance of FLD on productivity potential:** A comparison of productivity levels between improved practices in demonstration trials and farmers' practices is shown in Table 2. The results recorded the percentage increase in yield in IT plots over FP was 38.02% in Brinjal followed by 29.6% in Chilli, 28.82% in Okra and 19.7% in Tomato (Table 2). The productivity improvements were observed in all the crops tested in IT plots as compared to the FP plots. Singh et al. (2011) [4] reported increase in yield 28.22% in tomato, 29.17% chilli and 21.43% in brinjal in Rajasthan condition through FLDs on improved production technology. Raiet al. (2005)[5] also showed increase of productivity in tomato, brinjal and chilli due to adoption of improved varieties by the farmers' of eastern Uttar Pradesh through FLDs in the farmers' field. Afzal Ahmed et al. (2013) [6] observed 21.7% increase in seed yield in FLD plots due to management of aphid and Alternaria blight in Indian mustard.

**Table 2.** Productivity potential of need based plant protection in solanaceous vegetables at Mayurbhanj district of Odisha during 2011-13

Crop	No. Of Demonstrations	Mean yield(q/ha)*		Increase in yield over FP(%)
		IT	FP	
Tomato	10	318.0	265.6	19.70
Chilli	10	127.8	98.6	29.60
Brinjal	10	412.0	298.5	38.02
Okra	10	191.3	148.5	28.82

Averaged across the demonstrated villages for each crop, IT = Improved Technology, FP = Farmers Practice

Front line demonstrations on need based plant protection in the important solanaceous...

**Table 3.** Economic returns due to need based plant protection in solanaceous vegetables at Mayurbhanj district of Odisha during 2011-13

Crops	CoC(Rs./ha)		Increase over FP(%)		GMR(Rs./ha)		APP (Rs./ha)		ANR (Rs.)		B:C ratio		ICBR
	IT	FP	IT	FP	IT	FP	(Rs./ha)	(Rs.)	IT	FP			
Tomato	51400	48300	6.4	159000	132800	19.7	3100	23100	3.1	2.7	8.5		
Chilli	49800	47000	5.9	115020	88740	29.6	2800	23480	2.3	1.8	9.4		
Brinjal	73200	62500	17.1	247200	179100	38.0	10700	57400	3.8	2.9	6.4		
Okra	55400	53200	4.13	133910	103950	28.8	2200	27760	2.4	1.9	13.6		

CoC = Cost of cultivation; GMR = Gross monetary returns; APP = Additional cost on plant protection; ANR = Additional net returns; ICBR = Incremental cost benefit ratio.

**Economic Analysis:** The economics of solanaceous vegetable production under frontline demonstration were estimated and the results have been presented in Table 3. The cost of cultivation increased maximum 17.1% in case of brinjal with IT as compared to FP followed by tomato 6.4%. The comparative profitability of different solanaceous vegetable also revealed that among them brinjal produce maximum gross as well as net return i.e. Rs. 2,47,200 ha<sup>-1</sup> and Rs. 57,400 ha<sup>-1</sup> respectively which might be due to higher market price, longer fruiting period and profitable over other crops and lowest gross return was recorded in chilli. This results are in accordance with the findings of Sharma (2003) [7], Hiremath and Nagaraju (2009) [8] and Singh et al. (2011) [4]. In consequence, gross monetary return (GMR) increased by 38% and 29.6% in brinjal and chilli respectively indicating the importance of need based plant protection. The higher GMR realised by the farmers indicate the economic feasibility of the technology. The additional net return (ANR), which is the true indicator of economic worth of the practice was at Rs. 57,400 ha<sup>-1</sup> for brinjal followed by okra Rs. 27,760 ha<sup>-1</sup>, Chilli Rs. 23,480 ha<sup>-1</sup> and tomato Rs. 23,100 ha<sup>-1</sup>. The data presented in Table 3 also revealed the expenditure involved in the demonstrated plot is higher than the farmers' field due to additional cost involved for plant protection (APP) but the yield obtained is also higher in the demonstrated plot that

is confirmed by the comparative result obtained by calculating the cost benefit ratio. In all the cases, B:C ratio is higher in IT plots as compared to FP and maximum recorded in brinjal 3.8 in IT against 2.9 in FP. The incremental cost-benefit ratio (ICBR) was 13.6 and 9.4 for okra and chilli respectively, indicating a good return of around Rs. 14 and Rs. 9 for each additional rupee invested on IT for okra and chilli separately. Sharma and Lijo Thomas (2013) [9] calculated the ICBR value ranged from 3.2 for plant disease management to 6.2 in case of pest management technology in rapeseed-mustard. Kumar et al. (2014) [10] recorded ICBR value 3.1 to 10.3 for need based plant protection in oilseed under rainfed and irrigated condition through FLD.

**Conclusion:** Frontline demonstration is the most suitable method for assessing the performance of the improved technology as it directly involves the scientists in conducting the demonstrations at the farmers' field which enables them to have first hand information related to the technology. The FLDs conducted in Mayurbhanj district of Odisha on solanaceous vegetables showed the potential of IT (need based plant protection) to step up the productivity significantly by reducing losses due to insect pests and increasing the income of farmers. It is estimated that the solanaceous vegetable production can be improved 20-38 % by effective management of insect pest.

In order to scale-up the demonstration and speed up the dissemination of plant protection technologies there should be a multi-pronged strategy of educating the farmers on identifying the damaged symptoms of various insect pest including diseases of the solanaceous vegetables, identifying the suitable

time and stage of the crop for taking management strategies and ensuring timely availability of quality inputs (chemical and biological) will go a long way in preventing the losses from biotic stresses and definitely enhance its production and productivity.

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