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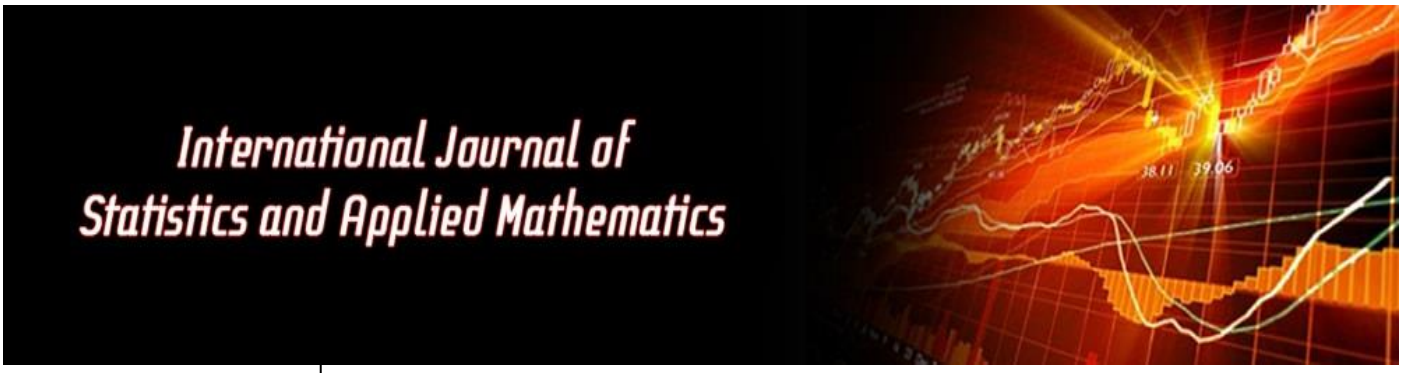

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Integrated pest management module demonstration to increase the livelihood of the Pigeonpea growers

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Abstract
Module on Integrated pest management (IPM) in Pigeonpea was demonstrated in farmers' field in Vellore and Tirupathur districts of Tamil Nadu during 2021 and 2022. The demonstrations on IPM recorded with an average grain yield of 1400 kg ha^{-1} and 1420 kg ha^{-1} during 2020 -21 and 2021-22, respectively as against the farmers' practice which recorded 885 and 980 kg ha^{-1}, respectively. The significant higher yield in case of demonstrated plots resulted in 36.78 and 31.42 per cent increase over farmers' practice due to lack of awareness and knowledge with the technology gap of 200 and 180 kg ha^{-1}. The technology index varied from 12.52-12.67 per cent and reflected the feasibility of the demonstrated technology in farmers' field. With the use of improved package of practices on an average additional investment of Rs.7500 ha^{-1} (2020-21) and Rs.7000/- ha^{-1} (2021-22) was made for demonstrations. The excess expenditure incurred results in the highest net return in demonstration plots of Rs. 77000/- ha^{-1} (2020-21) as compared to farmers' practice of Rs.48675/- ha^{-1} with 42.92 per cent increase in net return and Rs. 85200/- ha^{-1} (2021-22) as compared to farmers' practice of Rs.49000/- ha^{-1} with 51.95 per cent increase in net return over farmers practice.

Keywords: Demonstration studies, IPM module, pigeonpea, farmers practice

Introduction
Pigeonpea, (*Cajanus cajan* L.) is one of the important pulse crop and provides an indispensable source of supplementary protein to vegetarian diet and often referred as poor man's meat. Pigeonpea have a wide range of climatic adaptation and performs differently to changing agriculture scenario. India is the largest producer in the world with 26 per cent share in global production by producing 25.23 million tonnes of pulses with total area of 29.99 million hectares. The average productivity of country is about 841 kg ha^{-1} against average global productivity of 1023 kg ha^{-1} (DES, 2018) [2]. In Vellore district of Tamil Nadu, the area under pigeonpea occupies an area of about 14609 hectare with the state average yield of 720 kg ha^{-1}. Adoption of traditional farming system and non-adoption of recommended package of practices due to lack of awareness, knowledge and conviction about the latest technologies, abiotic and biotic stresses serve as the key factors for declining of potential yield in pigeonpea. Keeping this in view, the present study was focussed on demonstration of integrated pest management (IPM) module in pigeonpea to popularize the new high yielding variety as well as improved package of practices in farmers' field for transfer of recent production technologies so as to enhance the production potential of pigeonpea.

Materials and Methods
Frontline demonstration (FLD) in pigeonpea was conducted during the Kharif season for a period of two years (2020-21 and 2021-22) in the selected villages of Vellore and Tirupathur Districts of Tamil Nadu. Totally, thirty pigeonpea growers were adopted for demonstration in Serpadi village of katpadi block (15 ha), Vellore and kandili block, Tirupathur (15 ha) which covered 30 hectares area of pigeonpea. An improved new variety of pigeonpea *viz*., CO(Rg) 8, a long duration variety was demonstrated with full package of practices *viz*., Proper tillage, seed rate, seed treatment and flat bed sowing method along with the application of recommended dose of fertilizers, proper irrigation, weed management and plant protection measures with newer chemicals were demonstrated at farmers field (Table 1).

In order to study the impact of technology package, control plot was also kept where the farmers' practice were followed. The study was also aimed to identify the technology gap between demonstrated and control plot yield under existing farmers' practice. The yield data was obtained from demonstration and control plot (farmers' practice) by random crop cutting method. The technology gap, Extension gap and technological index (Samui *et al*., 2000) [7] were calculated by using the following formula as given below.

$$\text{Percent increase yield} = \frac{\text{Demonstration yield} - \text{Farmers' yield}}{\text{Farmers Yield}} \text{ X100}$$

Technology gap = Potential yield – Demonstrated yield

Extension gap = Demonstrated yield – Yield under existing practice

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstrated yield}}{\text{Potential Yield}} \text{X100}$$

Results and Discussion

1. Impact of Demonstration

The various gaps encountered between the farmers' practice and improved package of practices in pigeonpea under FLD was presented in table 2. Among the various improved technologies full gap (100 per cent) was observed in technology interventions *viz*., use of new and high yielding varieties, higher seed rate, seed treatment, method and time of sowing, weeding and partial gap of 50 per cent was observed in the usage of fertilizer and pesticide application leading to the definite yield reduction in the achievement of potential yield. Farmers were not much aware about the recent agricultural technologies. In general, farmers mainly rely on the usage of local or old varieties instead of new and high yielding varieties. In addition, the non-availability of the seeds in time and lack of knowledge and interest in obtaining the newer information might be the major reasons. Likewise, they use higher seed rate without seed treatment leading to the failure of better nodulation for nitrogen fixation and higher pest incidence. Besides this, apart from major interventions they give prior importance for sowing immediately after the onset of summer rains without proper agronomic practices with the available low yielding seeds.

Burman *et al*., (2010) [1] reported that there is a gap in adoption of technology in major pulse crop both in rainfed and irrigated cropping system. The results revealed that, an average grain yield of 1400 kg ha^{-1} and 1420 kg ha^{-1} was obtained in demonstrated plots during 2020-2021 and 2021-22, respectively as against the farmers' practice which recorded 885 and 980 kg ha^{-1}, respectively. The significant higher yield in case of demonstrated plots resulted in 36.78 and 31.42 per cent increase over farmers practice due to lack of awareness and knowledge. Similar trend of crop wise per cent increase in pigeonpea was also reported by Singh (2002) [9] and Singh *et al*., (2019) [8] with the use of high yielding varieties, production and protective measures that improve the yield in pulses.

The technology gap, the difference between potential yield with the demonstration yield was 200 and 180 kg ha^{-1} during 2020-21 and 2021-2022, respectively during the demonstration period. This technology gap observed may be attributed to the variation in soil structure, type, soil fertility, agricultural practices and local climatic conditions as reported by Singh *et al*. (2007) [10].

Extension gap was observed as 515 and 440 kg ha^{-1} which is almost double the technology gap in both the years tested during the demonstration period. The highest extension gap of 515 kg ha^{-1} was observed during 2020-21 and 2021-22 (440 kg ha^{-1}), which shows more emphasize to be given to educate the pigeonpea farmers through various means of adoption of improved production as well as protection technologies so as to reverse this trend of wider extension gap in the years to come. More and more use of latest crop production technologies with the high yielding varieties will subsequently results in the reduction in an alarming trend. Similar findings is also in corroboration with the findings of Pandey *et al*. (2017) [5].

The technology index shows the feasibility of the demonstrated technology in farmers field. The technology index varied from 12.52-12.67 per cent. Higher the technology index reflected the insufficient extension services for transfer of technology. Lower the value of technology index shows the efficacy of good performance of various technological interventions. The variation might differ according to the properties of soil, fertility status and local abiotic and biotic stresses as reported by Kumar *et al*. (2014) [3].

2. Impact of economics

Different technological inputs *viz*., introduction of new and high yielding variety, recommended dose of fertilizers, seed treatment, need based plant protection measures were absolutely considered as the strong interventions for an increase in yield with good return and the data was presented in table 3. With the use of improved package of practices on an average additional investment of Rs.7500 ha^{-1} and Rs.7000/- ha^{-1} was made for demonstration. The excess expenditure incurred results in the highest net return in demonstration plots of Rs. 77000/- ha^{-1} as compared to farmers' practice of Rs.48675/- ha^{-1} with 42.92 per cent increase in net return and Rs. 85200/- ha^{-1} as compared to farmers' practice of Rs.49000/- ha^{-1} with 51.95 per cent increase in net return over farmers' practice during 2020-21 and 2021-22, respectively. This variation in the per cent might be due to the existence of local market price fluctuations prevailed. The highest yield obtained under improved technologies compared to farmers' practice reflected in the addition return was also reported by Lathwal (2010) [4] and Raj *et al*. (2013) [6].

Table 1: IPM module Vs farmers' practice demonstration studies in Pigeonpea in Vellore and Tirupathur districts of Tamil Nadu

S. No	Particulars	Technology interventions	Farmers practice	Gap (%)
1.	Variety	TNAU variety: CO (Rg) 8	Local variety (LRG 41)	100
2.	Fertilizer dose (Kg/ha)	Basal application Farm yard manure: 5000 NPK: 25:50:25	Use of lower dose of fertilizers and non-application of Farm-yard manure as basl	50
3.	Seed rate (Kg/ha)	8	Higher seed rate	100
4.	Seed treatment	1.Rhizobium + Phosphobacteria+ Trichoderm: 25g/kg 2.Carbendazim: 3 g/kg	No seed treatment	100
5.	Sowing method	Flat bed sowing	Broadcasting and as intercrop in Ground nut ecosystem	100

6.	Weeding	Pre-emergence Pendimethalin: 1.25 kg/ha Hand weeding: 45 days after sowing	Hand weeding alone at a later stage	100
7.	Plant protection	Installation of pheromone traps for Gram podborer, *Helicoverpa armigera*:12 traps/ha Need based application of Indoxacarb @15.8 EC: 73 g a.i /ha	No judicious use	50

Table 2: Estimation of Yield and gap analysis in IPM Vs farmers' practices in Pigeonpea in Vellore and Tirupathur districts of Tamil Nadu

Study period	Location	Demo units	Demo Area (ha)	Average yield (kg/ha)		% increase	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index
				IPM	FP				
2020-21	Vellore	30	15	1400	885	36.78	200.00	515.00	12.52
2021-22	Tirupathur	30	15	1420	980	31.42	180.00	440.00	12.67

IPM: Integrated Pest management; FP: Farmers practice

Table 3: Economic impact of IPM Vs farmers' practices in Pigeonpea in Vellore and Tirupathur districts of Tamil Nadu

Study period	Cost of cultivation (Rs.ha)		Additional cost (Rs/ha)	Gross Income (Rs/ha)		Net return (Rs./ha)		Profit (Rs./ha)	Increase over FP (%)
	IPM	FP		IPM	FP	IPM	FP		
2020-21	28500	21000	7500	77000	48675	48500	27675	20825	42.92
2021-22	29000	22000	7000	85200	49000	56200	27000	29200	51.95

IPM: Integrated Pest management; FP: Farmers practice

Conclusion

The findings clearly reveals that demonstration influentially brought out, that the yield of pigeonpea could be increased with technical interventions *viz*., varietal improvement, seed rate, seed treatment, recommended fertilizer applicaion, timely weed management and need based application of insecticides. FLD produces a significant positive results and also provides an opportunity for the researcher to demonstrate the productivity potential under real-farming situation. The effective demonstration actually reduces the technological and extension gap as the farmers were not aware of improved package of practices. There is no doubt, in order to lower the technology index, technological and extension gap, demonstration acts as an accelerating tool in pigeonpea among the farming community for better production.

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