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Front line demonstrations-appropriate extension methodology for sustainable crop production and socio economic impact development

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Abstract

Tamil Nadu ranking 4th important state for producing banana. Conventional farming is one of the major issues leads to lesser productivity due to lack of available package of practices and high yielding varieties. To replace this difficulties, Krishi Vigyan Kendra, Madurai conducted Front Line Demonstrations (FLDs') in the farmer's field. The FLDs' was done in the farmers fields of Kottaipatti village, Kottampatti Block and Melanedungulam village, Thriupanangundrum Block and were provided with all the inputs with improved package of practices. The foliar nutrient spray of Banana Sakthi @ 2% on 4th, 5th and 6th month's interval from the date of planting. The higher yield in demonstration field (160 t ha^{-1}) was noticed than that of receiving farmer's practices (145 t ha^{-1}). The average percent of increase over farmers practice through this demonstration was recorded to be 10.3 during 2019-20 and 12.5 during 2020-21. The average BC ratio was recorded in the demonstration was more than the farmers practice i.e. 1.36 percent during 2019-20 and 2.50 during 2020-21. The sustainable area increased as well as sustainable yield was recorded during 2020-21 and 2021-22. The B: C wass also significantly higher i.e. 2.5 during 2020-21 and 2.8 during 2021-22 at Kottaipatti village. The same trend was attained i.e. 1.8 during 2020-21 and 2.6 during 2021-22 at Melanedungulam village. The farmers were experienced the technologies and very well adopted in the field and attained the socio economic benefits.

Keywords: Banana – front line demonstrations – nutrients foliar spray – area – yield - economics

Introduction

Best extension studies is to give a hand to farm people, through improved crop production technologies, farm mechanization, and income of the farmers and their levels of living and finally it will reflect in the socioeconomic benefits of rural people (Maunder,1973) [6]. Swanson *et al*., 1997 [14] has defined agricultural extension studies as the extending of related and agricultural information to farm people. Agricultural extension as a process of helping farmers to be aware and adopt the good technologies to enhance the production efficiency, income, and welfare of the farmers (Purcell and Anderson, 1997) [10]. The main objective of agricultural extension is to enhance the socio – economic benefits of the farmers. This findings itself to improve the living standard of rural people through appropriate extension studies (Famuyiwa, 2013) [2]. This will provides enough technologies for their agricultural activities. The main objective of the Front Line Demonstrations is to spread the high yielding varieties and their improved production technologies to the farmers.

Tamil Nadu is the 4th highest banana producing state in the country. There has been 32% increase in banana production in the state in last five years. Theni and Dindigul are the two regions from Tamil Nadu exports the fruits to foreign countries (Padmini Sivarajah, 2022) [9]. Banana has occupied in the home in everyone table. Immediate energy or nutrition to the human body systems when the banana eaten by people and rectify the heart related problems and thereby reduced malnutrition. Samui *et al*., 2000 [11] reported that banana is the fourth most dietary staple food for human. Small and marginal farmers utilizing the improved varieties and their production technologies positively get the regular income, and ultimately reducing poverty in nation (Wossen *et al*., 2017) [15]. Ayenew *et al*., 2020 [1]; Mendola, 2007 [7] reported that implementation of improved production technologies has a important effect on the welfare of households and tt improved food security (Justice and Tobias, 2016) [5]

Materials and Methods

Ten farmers were selected in Kottaipatti and Melanedungulam villages, Kottampatti and Thiruparangundrum blocks of Madurai district and conducted the Front Line Demonstration (FLD) during

2019-20 and 2020-21. Totally 20 Nos. of front line demonstration on cultivation of Banana (Muppattai) was laid out in one acre each totaling 8 hectares correspondingly under irrigated condition. Many number of training programmes to the small and marginal farmers related to improved varieties and crop production technologies *viz*., integrated nutrient management, weed management, irrigation schedule, integrated pest management and harvesting as a part of demonstration. Based on the trainings and other positive activities, farmers got awareness to increase productivity of banana. Foliar nutrients (Banana Sakthi) spray @ 2% on 4th, 5th and 6th month's interval from the date of planting.

Plant growth and yield attributes were collected from the farmer's field. Sustainable area and yield increase also calculated the consecutive years. Finally Cost and economics were analysed.

Percent increased over farmers practices = Improved practices (IP) – Farmers practices (FP) / farmers practices (FP) x 100

Benefit Cost ratio = Net income (Rs. / ha) / cost of cultivation (Rs. / ha)

Results and Discussion

Initial soil analysis

The initial soil samples were collected from all the twenty experimental farms and analyzed for available macro and micronutrients in soil (Table 1). Initial soil samples are shown that soil was neutral to slightly alkaline in pH (7.0 to 8.0) and low in organic carbon status (3.5 to 4.9 g kg^{-1}). All the experimental farms are low in available nitrogen (200 to 239 kg ha^{-1}), medium in available P (11 to 19 kg ha^{-1}) and high in available K (280 to 360 kg ha^{-1}). The DTPA extractable Fe, Zn, Mn and Copper were showed deficient soil micronutrient status. The cation exchange capacity (CEC) of the soil varies from 15.0 to 16.0 C mol (p^{+}) kg^{-1}. It shows the illite type of clay minerals are dominant in the experimental farm soil (15-40 C mol (p^{+}) kg^{-1}).

Front Line Demonstration

A front line demonstration is an ideal way to present to farmers a comparison between traditional and new practices. The traditional method of farmers practice shown the lesser yield of 145, 144 and 158 q ha^{-1} during 2019-20, 2020-21 and 2021-22 respectively. Whereas improved method of crop production ie foliar nutrition of Banana Sakthi Special having the higher yield of 160, 162 and 209 q ha^{-1} during 2019-20, 2020-21 and 2021-22 respectively at Melavlavu village, Thiruparangundrum Block (Fig. 1). The same trend of results was noticed in Nedungulam village. farmers practice shown the lesser yield of 142, 140 and 154 q ha^{-1} during 2019-20, 2020-21 and 2021-22 respectively. Improved practice have shown higher yield of 168, 169 and 200 q ha^{-1} during 2019-20, 2020-21 and 2021-22 respectively (Fig. 2). It can also help to establish confidence in more scientific farming methods and increase the farmers' confidence in ideas originating from research stations. Wayne *et al*. 2017 reported that result demonstration is also a one of the tool to establish confidence and faith among farmers in a new area.

Technological Applicability

Technology improvement is also an indication of developmental activities. Applicability, adaptability and acceptability are the factors regularly faced by the farmer. Innovations created by the farmers which make adoption of improved technologies. Farmers' Participatory Approach (FPA), has so far yielded better results. Krishi Vigyan Kendra, Madurai has arranged hands on training programme to the village people and field level demonstration with foliar spray nutrients (Banana Sakthi). This approach promotes the involvement of the small and marginal farming community for sustainable adoption of the innovation.

Economic Feasibility

This experiment shown that benefit cost ratio increased over the year 2020-21 (2.5) and 2021-2022 (3.4). In farmers' practice *ie*., without foliar spraying of nutrient (Banana Sakthi) the B: C ratio is only 1.08. Economic feasibility is very important for agricultural system. The cost effectiveness of the particular method and its approach will leads to increase the adoptability of the farmers. This will be profitable to the farmers and increase the sustainable are and yield in the consecutive years. Technology or innovation adopted by farmers, adds to the income of farmers, either by cost reduction or by yield increase.

Environmental Safety

Excess use of fertilizers, pesticides and other chemicals on the cultivable land have been identified by different mechanisms (Sosan and Akingbohungbe, 2009; Ogunjimi and Farinde, 2012 and Famuyiwa, Torimiro, and Adesoji, 2013) [13, 8, 3]. Scientific crop production management technologies such as soil test based fertilizer application, integrated weed, pest and disease management results positive impact on sustainable soil health management. This front line demonstration will reduce the fertilizer application simultaneously reduce the cost of fertilizer. With the limited use of fertilizer, herbicides, insecticides the sustainable soil health management and crop production has achieved. Ecosystem is made up of Biotic and Abiotic organisms. These interactions need to be studied to enhance environmental safety. Serious of environmental issues have developed due to excess fertilizers and pesticides in emerging economies because of farmers high illiteracy level and lack of awareness.

Yield

The average yield of banana under improved practices was 160 q/ha during 2019-20 and 162 q/ha during 2020-21 and it was shown in Table 2 and Fig. 1. The yield was much elevated than compared to that of farmer's practices which was only 134 q/ha during 2019-20 and 135 q/ha during 2020-21. The average percentage of increase in the yield over farmer's practices was 19.4% and 20% respectively during 2019-20 and 2020-21. The results shows that the Frontline Demonstration gives better impact on higher productivity due to adopting new improved cultivation practices (Santhosha *et al*., 2020) [12]. The sustainable yield increase was obtained through front line demonstration is 160, 162 and 289 q ha^{-1} during 2019-20, 2020-21 and 2021-

22 respectively at Kottaipatti village, Kottampatti Block (Fig. 3) and 167, 168 and 306 q ha^{-1}during 2019-20, 2020-21 and 2021-22 respectively at Nedungulam village, Thiruparangundrum Block (Fig. 4).

Economic returns

The inputs and outputs cost of produce exists during the study of demonstration were taken for calculating cost economics. The percentage increase over farmers practice is 10.3 during 2019-20 12.5 during 20202-21 at Kottaipatti village (Table 2). Simultaneously the percentage increase over farmers practice is 18.3 during 2019-20 and 19.5 during 2020-21 at Melanedungulam village (Table 4). The demonstration of banana under improved practices gave higher net return and B: C ratio of Rs. 24846/- and 1.36 during 2019-20 and of Rs. 97970/- net returns and 2.50 B:C ratio during 2020-21 at Melavalvu village (Table 3). The demonstration of banana under improved practices gave higher net return and B: C ratio of Rs. 24846/- and 1.36 during 2019-20 and of Rs. 67250/- net returns and 1.89 B:C ratio during 2020-21 at Nedungulam village (Table 5). This might be due to higher yield attained from positively improved technology as compared to farmer's practices

Table 1: Initial soil physico – chemical properties of experimental farm

Soil properties	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
pH	7.5	7.2	7.9	7.4	7.6	8.0	7.8	7.7	7.1	7.0
EC (dS m^{-1})	0.5	0.4	0.5	0.3	0.6	0.3	0.8	0.7	1.0	0.5
Organic C (g kg^{-1})	4.9	3.5	4.5	4.3	3.9	3.8	4.0	4.6	4.8	3.7
Available Nitrogen (kg ha^{-1})	210	200	220	225	236	235	200	239	228	218
Available Phosphorus (kg ha^{-1})	12	11	15	21	17	13	16	11	12	19
Available Potassium (kg ha^{-1})	282	290	320	325	360	285	280	324	340	305
DTPA Iron (mg kg^{-1})	3.0	3.2	3.1	3.0	3.5	3.6	3.0	3.7	3.4	3.2
DTPA Zinc (mg kg^{-1})	0.5	0.8	0.9	0.4	0.5	0.6	0.4	0.8	1.0	0.6
DTPA Manganese (mg kg^{-1})	4.1	4.5	4.6	4.7	4.5	4.9	4.8	5.0	5.1	4.9
DTPA Copper (mg kg^{-1})	1.1	1.3	1.4	1.9	1.2	1.5	1.6	1.4	1.0	1.5
CEC (C mol (p^{+}) kg^{-1})	15.5	16.0	15.2	15.4	15.6	15.3	15.6	15.0	15.9	15.0

Table 2: Area and yield increase in demonstration at Kottaipatti

Crop	Variety	Planting method	Area (ha)	Yield (q/ha)		Increase over FP
				IP	FP	
2019-20						
Banana	Muppattai	Line Planting	4.0	160	145	10.3
2020-21						
Banana	Muppattai	Line Planting	4.0	162	144	12.5

Table 3: Economic impact of the demonstration at Kottaipatti

Economics of demonstration (Rs./ha)				Economics of check (Rs./ha)			
Gross Cost	Gross Return	Net Return	BCR (R/C)	Gross Cost	Gross Return	Net Return	BCR (R/C)
2019-20							
65104	89950	24846	1.36	67500	140600	73100	1.08
2020-21							
64550	162520	97970	2.50	67300	137750	70450	1.04

Table 4: Area and yield increase in demonstration at Nedungulam

Crop	Variety	Planting method	Area (ha)	Yield (q/ha)		Increase over FP
				IP	FP	
2019-20						
Banana	Muppattai	Line Planting	4.0	168	142	18.3
2020-21						
Banana	Muppattai	Line Planting	4.0	169	140	19.5

Table 5: Economic impact of the demonstration at Nedungulam

Economics of demonstration (Rs./ha)				Economics of check (Rs./ha)			
Gross Cost	Gross Return	Net Return	BCR (R/C)	Gross Cost	Gross Return	Net Return	BCR (R/C)
2019-20							
75104	102500	27396	1.36	75104	98990	23886	1.32
2020-21							
75500	142750	67250	1.89	76300	151600	70450	1.04

Table 4: Sustainable area, yield and economic analysis of Banana ((2019-20 to 2021-22)

S No.	Name of Farmer	Village	District	Variety	Crop	Area (ha)	Yield (q/ha)	B:C Ratio	Sustainable area (ha)		Sustainable yield (q/ha)		B:C Ratio	
									2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
1	Karupanan	Kottaipatti	Madurai	Mupattai	Banana	0.41	160	1.32	0.45	0.80	161	220	2.5	2.1
2	Gopalan	Kottaipatti	Madurai	Mupattai	Banana	0.40	165	1.38	0.50	0.60	166	168	2.6	2.0
3	Bhavani	Kottaipatti	Madurai	Mupattai	Banana	0.41	159	1.33	0.55	0.80	168	240	2.6	4.0
4	Ramesh	Kottaipatti	Madurai	Mupattai	Banana	0.40	155	1.38	0.45	0.55	157	160	2.4	1.9
5	Ayyanar	Kottaipatti	Madurai	Mupattai	Banana	0.41	160	1.32	0.45	0.75	161	228	2.5	4.0
6	Sridhar	Kottaipatti	Madurai	Mupattai	Banana	0.41	165	1.38	0.55	0.80	167	245	2.6	2.1
7	Karuppayee	Kottaipatti	Madurai	Mupattai	Banana	0.41	156	1.38	0.40	0.80	156	212	2.4	4.1
8	Chellakannu	Kottaipatti	Madurai	Mupattai	Banana	0.40	155	1.38	0.55	0.65	155	160	2.4	1.9
9	Thangaraj	Kottaipatti	Madurai	Mupattai	Banana	0.41	160	1.34	0.60	0.80	162	230	2.5	3.9
10	Perumall	Kottaipatti	Madurai	Mupattai	Banana	0.40	167	1.42	0.45	0.80	168	227	2.6	2.1
	Mean					0.4	160	1.36	0.50	0.74	162	209	2.5	2.8

Table 5: Sustainable area, yield and economic analysis of Banana ((2019-20 to 2021-22)

S No.	Name of Farmer	Village	District	Variety	Crop	Area (ha)	Yield (q/ha)	B:C Ratio	Sustainable area (ha)		Sustainable yield (q/ha)		B:C Ratio	
									2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
1	Pandian	Melanedungulam	Madurai	Mupattai	Banana	0.41	167	1.43	0.45	1.00	169	210	2.3	2.6
2	Nadarajan	Melanedungulam	Madurai	Mupattai	Banana	0.42	171	1.45	0.40	0.50	170	172	1.0	2.0
3	Rajangam	Melanedungulam	Madurai	Mupattai	Banana	0.41	168	1.45	0.40	1.00	167	210	2.4	2.8
4	Nallakannu	Melanedungulam	Madurai	Mupattai	Banana	0.41	162	1.49	0.45	1.00	165	225	2.4	2.6
5	Mohan	Melanedungulam	Madurai	Mupattai	Banana	0.42	164	1.37	0.40	0.40	164	163	1.1	2.1
6	Boopathi	Melanedungulam	Madurai	Mupattai	Banana	0.41	172	1.49	0.40	0.50	172	174	1.0	2.0
7	Kani	Melanedungulam	Madurai	Mupattai	Banana	0.41	163	1.47	0.40	1.00	163	244	2.5	2.9
8	Veluchamy	Melanedungulam	Madurai	Mupattai	Banana	0.42	164	1.49	0.40	0.55	164	164	1.0	1.9
9	Karuppan	Melanedungulam	Madurai	Mupattai	Banana	0.41	166	1.41	0.45	1.00	167	218	2.3	4.5
10	Kandasami	Melanedungulam	Madurai	Mupattai	Banana	0.41	174	1.54	0.45	1.00	176	226	2.3	2.7
	Mean					0.4	167	1.46	0.42	0.795	168	200	1.8	2.6

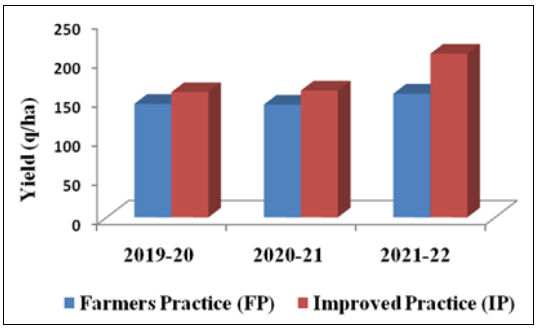

Fig 1: Effect of Banana Sakthi foliar nutrient application on sustainable yield increase over farmers practice at Kottaipatti, Kottampatti Block

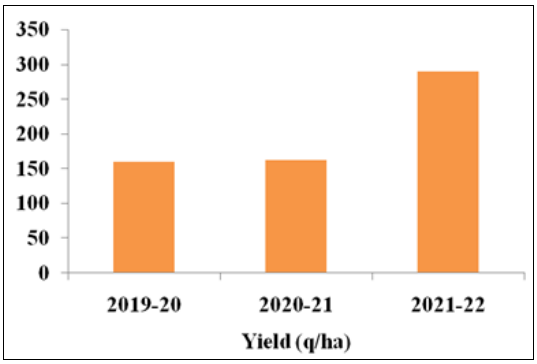

Fig 3: Effect of Banana Sakthi foliar nutrient application on sustainable banana yield at Kottaipatti, Kottampatti Block

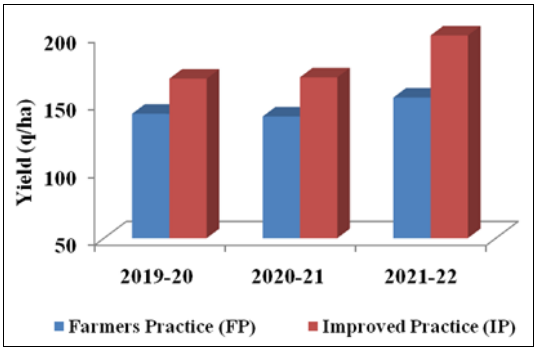

Fig 2: Effect of Banana Sakthi foliar nutrient application on sustainable yield increase over farmers practice at Nedungulam, Thiruparangundrum Block

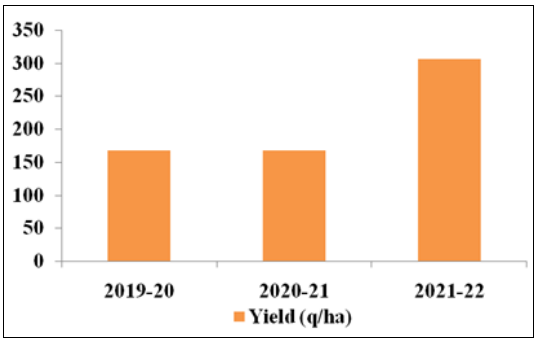

Fig 4: Effect of Banana Sakthi foliar nutrient application on sustainable banana yield at Nedungulam, Thiruparangundrum Block

Conclusion

The integrated crop management techniques *viz*., quality banana suckers, application of RDF fertilizers along with two foliar spary of banana sakthi during fruit development stage can be adopted as a package of practice to increase the soil fertility and banana productivity under irrigated *vertisol*s of Madurai District. This will reduce the environmental issues and also improves the sustainable area and yield. Scientific application methods and proper management, these practices can ensure productivity, profitability and sustainability in a long run.

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