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Popularization of improved production technology in maize - as an alternate crop during *kharif* season under Cauvery delta zone of Tamil Nadu

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Abstract
Maize has emerged as one of the most suitable alternative to rice in Cauvery delta zone of Tamil Nadu. The field demonstrations were conducted in Mayiladuthurai and Kuthalam blocks of Nagapattinam district of Tamil Nadu during *kuruvai* 2017 (June 2017 –August 2017). Because of the inventions on maize as alternate crop for kuruvai season is effectively motivated the farmers and changed their diversified farming from rice cultivation. In this case farmers wanted an alternate means of income from rice crop. Cultivation of Maize will pave a new road towards self-sufficiency and sustainability.

Keywords: Maize, Production Technology, Demonstration

Introduction
Maize is the most important cereal crop and known as queen of cereal due to unparallel productivity among cereal crops. In India, maize occupies third position both in area and production after rice and wheat. Tamil Nadu has done extremely well in irrigated agriculture particularly in paddy, cholam, cumbu, maize, ragi which are the major cereal crops of the state. Maize occupies a good place among coarse cereals not only in terms of demand and productivity but also in occupying better lands under more favorable conditions and around 20 per cent irrigation. The demand for maize is increasing during the last decade due to the value added product in the industry besides the increasing poultry industry. Most of the maize growing areas are in assured rainfall and on soils which are more fertile than those where other millets are grown. The area under maize is showing tremendous increase from 27466 hectare in 1990-91 to 380429 hectare in 2013-14. Its productivity has increased insignificantly from 1595 kg/ha. in 1990-91 to 5902 kg/ha. in 2013-14. These increased area and productivity are mainly because for increased demand of maize in the feed and other industrial fields. In case of Cauvery Delta zone, the farmers are facing water scarcity, especially during the *kharif season* every year and most of them have to solely rely on Cauvery water which is released from Mettur dam. In the past several years, those farmers who do not have access to sub-surface water had to leave the land fallow during the *kharif* season due to water scarcity.
The existing cropping system of Rice – Rice - Pulse in Cauvery Delta Zone requires sufficient irrigation either through canal or filter points of bore well. Generally, the release of canal water is delayed every year which leads to failure of *kharif* rice. Under such a circumstances, Cultivating maize as an alternative to *kharif season* in Nagapattinam District has introduced maize as crop diversification and also alternate to rice crop during *kuruvai* season.

Materials and Methods
The field demonstrations were conducted in Mayiladuthurai and Kuthalam blocks of Nagapattinam district of Tamil Nadu during *kuruvai* 2017 (June 2017 –August 2017). To introduce and popularize the improved maize production practices, constrains in maize production were identified though participatory approach. Preferential ranking technique was followed to identify the constraints faced by the respondent farmers in maize production. Farmers were also asked to rank the constraints they perceive as limiting maize protection in order of preference. The quantification of data was done by first ranking the constraints and then calculating the Rank Based Quotient (RBQ) as given by Sabarathnam (1988), which is as follows:

$$R.B.Q. = \frac{\Sigma fi\ (n+1-i)}{N \times n} X\ 100$$

Wherein,
fi = Number of farmers reporting a particular problem under ith rank
N = number of farmers
n = number of problems identified

Based on top rank farmers problems identified, field demonstrations were planned and conducted at the farmers' field under Tamil Nadu – Irrigated Agriculture Modernization Project (TNIAMP). The demonstration on maize as alternate crop with improved production technologies was conducted in 100 acres in Nagapattinam. The technologies demonstrated are such as ***Application of FYM:*** 12.5 t/ha of FYM applied evenly on the unploughed field along with 10 packets of Azospirillum (2000 g/ha) and incorporate in the soil. ***Field Preparation:*** Plough the field with disc plough once followed by cultivator ploughing twice, after spreading FYM or compost till a fine tilth is obtained. ***Ridges and Furrows or Beds:*** The ridges should be 6 m long and 60 cm apart providing sufficient irrigation channels. ***Fertilizer application:*** Apply recommended dose of NPK @ 135:62.5:50 kg/ha. Apply quarter of the dose of N; full dose of P2O and K2O basally before sowing along with micro nutrient @ 12.5 kg/ha. ***Seed Rate:*** Adopt the seed rate of 20 kg/ha ***Spacing:*** Adopt a spacing of 25 cm between plants in the rows which are 60 cm apart. ***Weed management:*** Apply atrazine @ 0.25 kg/ha as pre-emergence on 3-5 DAS using Backpack/ Knapsack/ Rocker sprayer fitted with a flat fan nozzle using 500 litres of water/ha followed by one hand weeding on 30-35 DAS. ***Thinning and gap filling :*** leave only one healthy and vigorous seedling per hole and remove the other on the 12-15 days after sowing and gap filling with dibble presoaked seeds at the rate of 2 seeds per hole and immediately irrigate. ***Top dressing with nitrogen:*** Place half of the dose of nitrogen on the 25th day of sowing along the furrows evenly and cover it with soil and place the remaining quarter of nitrogen on the 45th day of sowing. Demonstrations were conducted to convince them about potentialities of improved varieties of maize namely NK 6240 and 900m gold. All the participating farmers were trained on all aspects of maize production management. To study the impact of demonstrations, out of 150 participating farmers, a total of 44 farmers were selected as respondent through proportionate sampling. Production and economic data for improved production technologies adopted and local practices were collected and analyzed. The technology gap and technology index were calculated using the following formulas as given by Samui *et al*. (2000) [11]:

Technology gap = Potential yield – Demonstration yield
Technology index = (Potential yield – Demonstration yield) / Potential yield ×100

Knowledge level of the farmers about improved production practices of maize before demonstration implementation and after implementation was measured and compared by applying dependent't' test. Further, the satisfaction level of respondent farmers about extension services provided was also measured based on various dimensions like training of participating farmers, timeliness of services, supply of inputs, solving field problems and advisory services, fairness of scientists, performance of variety demonstrated and overall impact of demonstrations. The selected respondents were interviewed personally with the help of a pre-tested and well-structured interview schedule. Client Satisfaction Index was calculated as developed by Kumaran and Vijayaragavan (2005) [7].

The individual obtained score

$$\text{Client Satisfaction Index} = \frac{\text{The individual obtained score}}{\text{Maximum score possible}}$$

The data thus collected were tabulated and statistically analyzed to interpret the results.

Result and Discussion

Constraints in Maize Production

The constraints faced by Farmers' on maize production problems were documented in this study. Preferential ranking technique was utilized to identify the constraints faced by the respondent farmers in maize production. The ranking given by the different farmers are furnished in table 1. The major constraints faced by farmers is marketing of maize as grain which fetches lower price and recorded top raking by 15 respondent farmers. The rank based quotients were calculated and presented in table 2 by using the ranking of respondent farmers.

The analysis of data pertaining to rank based quotients revealed that the order of shoot fly infestation, lack of high yielding varieties, weed menace, water scarcity, poor soil fertility lack of knowledge and marketing facilities are the major constraints to maize production as reported by Joshi *et al.* 2005 [5].

Performance of FLD

The yield obtained in maize as green cob in both demonstrated technologies and local checks (Conventional method) is shown in table 3. The demonstrations results revealed that the improved production technologies along with high yielding maize variety recorded the higher green cob yield (49800 Nos. ha^{-1}) compared to local check (39500 Nos. ha $^{-1}$). The percentage in-crease in the yield over local check was 26.07. The similar findings were reported by Haque (2000) [2], Tiwari and Saxena (2001) [13], Tiwari *et al.* (2003) [14], Mishra *et al.* (2009) [8], Kumar *et al.* (2010) [6]. From these results it is evident that the performance of improved variety was found better than the local check under local conditions. Farmers were motivated by results of agro technologies applied in the demonstration trials and it is expected that they would adopt these technologies in the coming years.

Yield of demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology index. The technology gap shows the gap in the demonstration yield over potential yield and it was 5755 Nos. ha^{-1}. Hence, to narrow down the gap between the yields of different varieties, location specific recommendation appears to be necessary. Technology index shows the feasibility of the variety at the farmer's field. The lower the value of technology index more is the feasibility. Table 3 revealed that the technology index values was 10.36. The finding of the present study is coincided with the findings of Sawardekar *et al.* (2003) [12], Hiremath and Nagaraju (2009) [4].

Table 1: Ranks given by farmers for different constraints (n=44)

S. No.	Constraints	Ranks							
		I	II	III	IV	V	VI	VII	VIII
1.	Lack of suitable HYV	4	3	6	5	9	5	5	7
2.	Shoot fly	3	5	6	6	6	8	6	4
3.	Low soil fertility	3	2	3	5	4	8	7	12
4.	Low technical knowledge	7	0	1	4	6	8	7	11
5.	Weed menace	6	5	9	4	6	5	8	1
6.	Water scarcity	8	8	8	3	5	4	8	0
7.	Marketing (as grain)	4	15	6	5	4	6	3	1
8.	Marketing (as green cob)	9	6	5	12	4	0	0	8

Table 2: Frequency distribution of RBQ values given by farmers (n=44)

S. No.	Problems	R.B.Q	Overall rank
1.	Lack of suitable HYV	36.93	II
2.	Shoot fly	39.20	I
3.	Low soil fertility	21.59	V
4.	Low technical knowledge	17.05	VI
5.	Weed menace	31.82	III
6.	Water scarcity	25.57	IV
7.	Marketing (as grain)	9.09	VII
8.	Marketing (as green cob)	8.52	VIII

Table 3: Yield (green cob), technology gap and technology index of demonstration

Variables	Yield (Nos.)	% increase over local check	Technology gap (kg ha^{-1})	Technology index (%)
Local check	39500	-		
Demonstration	49800	26.07	5755	10.36

The economics of maize production under demonstrations were estimated and the results have been presented in table 4. Economic analysis of the yield performance revealed that demonstrations recorded higher gross returns (Rs. 99600 ha^{-1}) and net return (Rs. 68433ha^{-1}) with higher benefit ratio (3.18) compared to local checks. These results are in line with the findings of Hiremath *et al*. (2007), Hiremath and Nagaraju (2009) [4]. Further, additional cost of Rs.2212 per hectare in demonstration has yielded additional net returns Rs. 18388 per hectare with incremental benefit cost ratio 9.31 suggesting its higher profitability and economic viability of the demonstration. Similar results were also reported by Hiremath and Nagaraju (2009) [4].

Table 4: Economics of frontline demonstrations

Variables	Cost of cultivation (kg ha^{-1})	Gross return (kg ha^{-1})	Net return (kg ha^{-1})	Benefit cost ratio
Local check	28950	79000	50050	2.72
Demonstration	31162	99600	68438	3.18
Additional income	2212	20600	18388	9.31*

* Incremental benefit cost ratio

Increase in Knowledge

Knowledge level of respondent farmers on various aspects of improved maize production technologies before conducting the demonstration and after implementation was measured. It could be seen from the table 5 that farmers mean knowledge score had increased by 19.09 after implementation of frontline demonstrations. The increase in mean knowledge score of farmers was observed significantly higher. The results are at par with Singh *et al*. (2007). It means there was significant increase in knowledge level of the farmers due to demonstration. This shows positive impact of demonstration on knowledge of the farmers that have resulted in higher adoption of improved farm practices. The results so arrived might be due to the concentrated educational efforts made by the scientists.

Table 5: Comparison between knowledge levels of the respondent farmers about Improved Farming Practices of maize (n=44)

Mean score		
Before demonstration	After demonstration implementation	Mean difference
42.15	61.24	19.09

Farmers' Satisfaction

The extent of satisfaction level of respondent farmers over extension services and performance of demonstrated variety was measured by Client Satisfaction Index (CSI) and results presented in table 6.

Table 6: Extent of farmers satisfaction of extension services rendered (n=44)

Satisfaction level	Number	Per cent
Low	10	22.73
Medium	12	27.27
High	22	50.00

It is observed from table 6 that majority of the respondent farmers expressed in terms of low (22.73), medium (27.27 %) and high (50.00 %) level of satisfaction for extension services and performance of technology under demonstrations. The similar findings were recorded by Narayanaswamy and Eshwarappa (1998) [9], Kumaran and Vijayaragavan (2005) [7].

Conclusion

The demonstration on Popularization of Improved Production Technology in Maize - as an alternate crop during *kharif* season under Cauvery delta zone of Tamil Nadu was concluded that adoption of high yielding variety along with improved production technologies recorded higher yield as well as higher economic return. Therefore, it is recommended that the farmers of Cauvery delta regions could be adopt the improved production technologies of maize along with high yielding variety to get higher profitability than rice.

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