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RESEARCH ARTICLE :

Yield gap analysis in Cassava and strategies to improve the production in Tamil Nadu, India

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SUMMARY : Cassava is an industrial cum commercial crop of Tamil Nadu, India mainly processed for starch and sago. Among 32 districts of Tamil Nadu, Salem district stands first in area, production and productivity. In recent years, the area under Cassava is under threat and the production is not sufficient to meet the industrial demands. Keeping this in view, the study focuses on the various factors responsible for the area shrinkage and yield gap prevailing for major Cassava varieties and intended to develop strategies. The results revealed that majority of the farmers (63.33%) facing a yield gap of 16 to 30 per cent. For different varieties of Cassava the average yield gap is 5.86 t/ac. Introduction of short duration crops like sunflower and maize, Mosaic virus and tuber rot, unavailability of quality planting materials, lack of awareness on improved technologies were the major factors for yield loss. In order to increase the yield/ac awareness has to be given to adopt the recommended technologies and popularization through various extension methods is the need of the hour.

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KEY WORDS :
Cassava, Yield gap, Production technologies, Constraints, Strategies

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BACKGROUND AND OBJECTIVES

Cassava (*Manihot esculenta* Crantz) is grown in over 90 countries and is the third most important source of calories in the tropics, after rice and maize. It is a staple food for half a billion people in Africa, Asia, and Latin America. Cassava is an important tuber crop in India which is grown in 2.7 lakh hectares area and the production is 71 lakh tonnes. The average yield of cassava is 22 tonnes per hectare. It is a richest source of starch (25 to 35%) mainly processed for starch and sago. In India the major cassava growing states are Kerala and Tamil Nadu.

Tamil Nadu occupies 22,082 ha of area with a production of 37,97,910 tons. The major traditional cassava growing districts are Salem, Namakkal, Erode, Cuddalore, Dharmapuri and Kaniyakumari mostly as rainfed. Among the districts Salem district stands first in area (27,007 ha), production (10.475 lakh mt) and productivity (38.78 kg/ha) (Horticulture Statistics, 2013). There are about 650 starch and sago industries are functioning in and around Salem district. More than two lakh labourers from rural sector are employed in these factories. It is estimated that 60 per cent of the starch produced in India is from Salem district.

Even though the area is more in Salem

district the production is not sufficient to meet the demand of the food and textile industries. Even though the farmers are cultivating cassava in larger area, the scientific method of cultivation is poor. Scientists are developing lot of varieties, new improved technologies etc., while seeing the knowledge and adoption of recommended practices were found to be least. It has been well demonstrated by the research system through its outreach programmes that yield of cassava could be boosted to a level of 35 tonnes per hectare in farmer's field if farmers adopt the recommended practices. But in practical farmers are getting 20-25 t/ha (Edison *et al.*, 2006).

In addition, for the past three years, particularly in Salem district, the cassava area and production has been reduced. In 2005-2006 the area was about 27,000 ha but this had comedown drastically to 10,564 ha in 2007-2008. It slightly increased to 15,728 ha in 2008-2009. Now the area is about 11000 ha with the production of 4.333 lakh mt and 26.31 kg/ha of productivity (Horticulture Statistics, 2014).

This had created a shortage in the supply of tubers to starch mills and affected the production. Shortage in the supply of cassava tubers is posing a serious threat to the survey of cassava starch manufacturing units in Salem district. Due to the low production about 300 factories have already been closed. If the remaining starch manufacturing units are closed because of shortage of tubers, the livelihood of a large number of people employed in these units will be affected.

Hence, there is an urgent need to channelize our efforts to increase the cassava yield in farmer's field to achieve the targeted yield. In view of these a study to assess the yield gaps and factors responsible for the low production in cassava and to design promotional strategies was undertaken.

RESOURCES AND METHODS

The study area is Salem district of Tamil Nadu. Salem district consists of 9 Taluks and 20 Blocks. From each block of Salem district one village having maximum area under cassava was selected purposively for conducting the survey. From each village 15 cassava growers were selected randomly. Overall 300 cassava growers were selected as respondents for this study. To fulfill the entire objectives data collection tool interview schedule was constructed. The interview schedule was pre-tested in non-sample area in Annur block of Coimbatore district. Accordingly, it was modified and used for the study.

The potential yields of cassava were obtained from Tapioca and Castor Research Station, Yethapur, Salem. The potential farm yield with respect to cassava was collected from the farmer's field. For this study, major cassava varieties were considered and comparative study was undertaken for the varieties Kungumarose and H-226 as these varieties were extensively cultivated in the study villages.

Yield gap I :

Data were collected to identify the yield gap I using the following formula. It is the difference between the potential yield (Y_p) and the potential farm yield (Y_d).

$$\text{Yield gap I (\%)} = (Y_p - Y_d)/Y_p \times 100$$

where, potential yield is the yield that is claimed in the research station and potential farm yield is the highest farm yield.

Yield gap II :

Data were collected to identify the yield gap II using the following formula. It is the difference between the potential farm yield (Y_d) and actual farm yield (Y_a).

$$\text{Yield gap II (\%)} = (Y_d - Y_a)/Y_d \times 100$$

where, potential farm yield is the highest yield and the actual yield is the yield obtained by the farmers in their field.

Index of realized potential yield (IRPY) :

It is the ratio of the actual yield (Y_a) to the potential yield (Y_p) expressed in percentage terms.

$$\text{IRPY} = (Y_a/Y_p) \times 100$$

Index of realized potential farm yield (IRPFY) :

It is the ratio of the actual yield (Ya) to the potential farm yield (Yd) expressed in percentage terms

$$\text{IRPFY} = (Ya/Yd) \times 100$$

OBSERVATIONS AND ANALYSIS

The data collected regarding yield gap I, II and realised potential yield for different cassava varieties were analyzed and presented in Table 1.

Cassava is an 8-10 months old crop. However, the yield variability is there for each variety as it depends upon its genetic characters and environmental factors. So different varieties of cassava were collected and the yield gap was measured. For example, the study reported that more than 80 per cent of the sample farmers planted H-226 and Kungumarose varieties under irrigated condition in the study villages.

The potential yield (research station) for Kungumarose variety is 12.00 t/ac while at the demonstration site; the potential farm yield was reported to be 10.30 tonnes. It is estimated that there was an extent of 14.16per cent of yield gap between potential and demonstration yield (Table 1). This gap is technically called as 'Yield gap I'.

The 'Yield gap I' is calculated to understand to what extent the potential yield of research station is possibly achieved at the field demonstration. Similarly, the yield gap II, between demonstration and actual yield realized by the farmers, helps to know to what extent the farmers by all categories, on an average, could have achieved by their field conditions was observed to be 12.62 per cent. In quantity terms, the sample farmers produced on an average about 10.30 tonnes/ac/year as against 9.00 tonnes/ac under demonstration plot yield. The total yield gap was estimated at 26.78 per cent. This finding is supported by the study of Arunkumar (2002).

Another popular cassava variety, H-226 is a hybrid and is found to be a superior cassava variety as compared to the other existing varieties with respect to quality and quantity characteristics under irrigated conditions. The potential yield at research station is estimated to be 14.50 t/ac/year under irrigated condition. The study revealed that the gap I for H-226 variety was to the extent of 31.03 per cent while at gap II level, it was 10.00 per cent. The total yield gap was observed to be around 41.03 per cent.

While comparing the magnitude of yield gaps at farmers' level, the yield gap with Kuguma rose was narrow than that of H226 variety, since Kuguma rose variety was in existence since many decades in the study villages and it reached close to the potential farm yield, whereas, H-226 is of a new high-yielding variety and it is planted with limited scale which is expected to take some more years to reach the potential farm yield. The index of potential yield realization was to the extent of 75.00 per cent for Kuguma rose and 62.06 per cent for H-226 variety by sample farmers. The yield gap I exists as a result of differential environmental factors prevailing in the research station that could not be replicated at demonstration field under farmers' condition (Lakshmanan, 2007).

However, the yield gap II could be narrowed down as the farmers move from traditional practices to adoption of new technologies (Vijaya Prakash and Dandin, 2005). The field findings amply show that efforts should be made to popularize H-226 variety in the field to increase the yield. In the same way the other newly released varieties like Co2, Co3 and Yethapur 1 have a wider yield gap which needs attention.

For different varieties of cassava the average potential yield is 15.43 t/ac and actual yield was 9.57 t/ac, respectively. The average yield gap is 5.86 t/ac. Index of realized potential yield and potential farm yield showing 18.27 per cent difference. This can be achieved through creating awareness to adopt the recommended technologies and popularization of high yielding varieties through various extension methods.

Table 1 : Yield gap for different cassava varieties

Yield particulars	Varieties of cassava								
	Kunguma rose	Burma	M4	Muluvadi	H-226	Co2	Co3	Yethapur 1	Average yield data
Potential yield (t/ac/year)	12.00	9.20	16.00	12.80	14.50	14.00	16.00	29.00	15.43
Potential farm yield (t/ac/year)	10.30	7.00	14.00	10.50	10.00	10.00	12.00	19.00	11.60
Average farm yield (t/ac/year)	9.00	6.40	11.46	8.50	9.00	8.50	9.50	14.25	9.57
Yield Gap I (%)	14.16	23.91	12.50	17.96	31.03	28.57	25.00	34.48	23.44
Yield Gap II (%)	12.62	8.57	18.14	19.04	10.00	15.00	20.83	25.00	16.15
Total yield gap (%)	26.78	32.48	30.64	37.00	41.03	43.57	45.83	59.48	39.59
Index of potential yield realization	75.00	69.56	71.62	66.40	62.06	60.71	59.37	49.13	64.23
Index of realized potential farm yield	87.37	91.42	81.86	80.95	90.00	85.00	79.16	75.00	82.50

Apart from the above varietal analysis, the yield gaps prevailing among the farmers in general were worked out and presented in Table 2.

From the Table 2 it is seen that regarding the yield gap in cassava cultivation most of the farmers (63.33%) faced a yield gap of 16 to 30 per cent followed by 18.33 per cent of the farmers with 5-15 percentage range yield gap. The study concludes that still there are lots of chances to minimize the yield gap through interventions.

Factors responsible for the area shrinkage and yield gap :

Various factors responsible for the yield gap were expressed by the cassava growers were presented in the following Table 3.

It could be observed from Table 3 that in cassava cultivation, mosaic virus and tuber rot are the important diseases in reducing the yield upto 40 per cent. This was expressed by majority of the farmers (83.33 %). Nowadays, cassava area is reducing due to the introduction of short duration crops like maize, sunflower etc. Farmers felt that they have to wait one year for harvest of cassava and also it does not fetch good rate in the industries. But the above crops had three months of duration and cultivation of these crops increase the income within three months was expressed by 80.00 per cent of the farmers. This might be the possible reason for the area shrinkage.

Unavailability of quality planting materials on high yielding varieties was expressed by 73.33 per cent of the farmers. Top dressing on 90th day with urea and potash is essential for the development of tubers. Due to lack of awareness it was adopted by the farmers on the 5^{th,} 6th ,7th ,8th and even before harvesting was the reason for yield gap was expressed by 73.33per cent of the farmers. Cassava is an eight to ten months old crop. They were in need of short duration varities so; lack of short duration varieties with high starch content to meet the industrial demand is one of the major constraints expressed by 68.33 per cent of the farmers.

Table 2 : Distribution of cassava growers based on their yield gap

Sr. No.	Range (Average yield gap in %)	No. of respondents	Percentage
1.	5-15	55	18.33
2.	16-30	190	63.33
3.	31-45	35	11.67
4.	46-60	20	6.67
	Total	300	100.00

Table 3 : Factors responsible for the yield gap expressed by the cassava growers **(n=300)**

Sr. No.	Factors	No.	Percentage
1.	Mosaic virus and tuber rot	250	83.33
2.	Decline in area due to the introduction of short duration crops like maize, sunflower	240	80.00
3.	Unavailability of quality planting materials	220	73.33
4.	Not aware of top dressing on 3rd month	220	73.33
5.	Lack of short duration varieties with high starch	205	68.33
6.	Labours scarcity	195	65.00
7.	Not aware of High yielding varieties	195	65.00
8.	Not aware of Sett treatment methods	190	63.33
9.	Lack of awareness on raising nursery	170	56.66
10.	Not aware of Micro nutrient application	170	56.66
11.	Lack of training programmes	170	56.66
12.	Lack of High cost of inputs	165	55.00
13.	Assured irrigation	135	45.00
14.	Lack of credit facilities	125	41.66

Even though labour scarcity was the common problem everywhere it was another production constraint expressed by most of the respondents (65.00 %). Agricultural labourers are being seasonal there is always shortage of labour during peak season. The migration of the labour from agricultural to other occupations and to other sectors has also contributed to the labour problem. Most of the farmers in the study area cultivating only the local varieties like Kungumarose Rose, White Rose, Burma etc. They were not known much about high yielding Tamil Nadu Agricultural University varieties like CO2, CO3,CO(TP)4, CO(TP)CTCRI-5 and Yethapur 1 and their importance in increasing the yield and resistance to CMVD and it was expressed by 65.00 per cent of the farmers. Due to lack of awareness and knowledge farmers do not follow the sett treatment methods and it was spelt by majority of the farmers (63.33%). Micronutrient application and raising nursery were not known by 56.66 per cent of the farmers.

Only few training programmes were conducted by government and those are held at distant places. This was expressed by 56.66 per cent of the farmers. They also felt that the cost of inputs is high and expressed as a constraint by 55.00 per cent of the farmers. They expressed that subsidy can be provided to encourage the tapioca cultivation. Due to lack of water facilities cassava growers could not able to irrigate their lands. This was expressed by 45.00 per cent of the growers. Absence of adequate financial institutions like Agricultural Banks, Co-operative Society etc., and rigid rules and regulations to get credit was felt by 41.66 per cent of farmers.

Based on the yield gap analysis carried out the following strategies are needed to increase the area, production and productivity.

– Mosaic virus, mealy bug, white fly and tuber rot are the major pest and diseases reducing the yield of cassava. Development of cassava mosaic disease resistant variety and creating awareness about *Trichoderma viridi* application for tuber rot. Creating awareness about pest and disease management at appropriate time is essential.

– In order to meet the industrial demands development of high starch varieties for industrial utilization and short duration cassava varieties for rice fallow conditions.

– Large scale production and distribution of quality planting material of cassava.

– Popularization of TNAU varieties through various extension methods.

– Creation of awareness on recommended technologies like nursery techniques, sett treatment methods, top dressing on 90th day, micronutrient application, management of CMVD and tuber rot.

– Frequent training cum demonstration programmes on cassava cultivation and value addition.

– Development of information and communication materials on cassava.

Conclusion:

The field study amply shows that the potential yield realization was more for the newly released varieties. The most important reasons for not attaining potential yield were due to non-adoption of the recommended technologies and marketing problems. The study suggests measures to reduce yield gaps in the study regions. First, farmers should be educated regarding the technological interventions, inputs usage through trainings and demonstrations. Implementing suitable schemes to train the farmers to attain potential yield are necessary.

Secondly, the financial lending institutions should extend credit support to the needy farmers in time as that would help them to purchase crucial inputs to increase production. Thirdly, at present, cassava processing is taken up in a large scale in Attur taluk of Salem district. No one government processing factories are functioning in this district. All factories are run by private people. Here middlemen playing major role. No remunerative prices for their produce. Establishment of new government factories and remunerative prices will increase the production and meet out the demands in future. The measures suggested above if implemented properly, would ensure better quality and quantity of cassava production in the long run in the study regions in particular and Tamil Nadu in general.

REFERENCES

Arunkumar, A. (2002). Retrospects and prospects of commercial Cassava cultivation. M.Sc. (Ag) Thesis, Tamil Nadu Agricultural University, Coimbatore (T.N.) India.

Edison, S., Anand, M. and Srinivas, T. (2006). *Status of Cassava in India- An Overall View*. CTCRI Publications, Trivananthapuram.

Horticulture Statistical Report, Salem District 2014.

Lakshmanan, S. (2007). Yield gaps in mulberry sericulture in Karnataka: An Econometric Analysis. *Indian J. Agric. Econ.*, **62** (4) : 623-635.

Vijaya Prakash, N.B. and Dandin, S.B. (2005). Yield gaps and constraints in Biovoltine Cocoon Production in Mandya District of Karnataka- An Economic Analysis. *Indian J. Sericulture*, **44** (1) : 50-54.