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Yield Gap Analysis and Impact Assessment of Colocasia in Arunachal Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was carried out at Tirap district of Arunachal Pradesh, India during *kharif* 2015-16 and 2016-17 respectively. Before conducting the trials; a field survey was also carried out about farmer's practices of colocassia. As per the survey's result Lack of knowledge about improved variety, scientific cultivation practices, nutrient management was the major issues among farmers. As per the result of the study, OFT results were better (356 & 372 q/ha) as compared farmer's practices (243 & 268 q/ha), B:C ratio was also better (4.83 & 4.81) as compared farmer's practice (2.28 & 3.15). The current results are proving that the yield and economics of colocassia can be boost up by adopting recommended technologies.

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1. INTRODUCTION

Asia and the Pacific region have long been home to the traditional crop colocasia (Colocasia esculenta L. Schott). In contrast to its widespread usage as a tuber vegetable in India, it is deeply ingrained in the cultures of many South Pacific Islands. In terms of total output, area, and consumption, it comes in third place, behind yam and cassava [1]. This is a tropical crop belongs to the monocotyledonous family "Araceae" of the order "Arales" whose members are known as "aroids" [2] and (Van Wyk, 2005). “It is believed that this crop originated in South Central Asia, perhaps in Eastern India or Malaysia” [3]. “Every part of this crop viz. corm, cormels, rhizome, stalk, leaves and flowers are edible and have sufficient amount of starch” [4]. Colocasia is a reasonably good provider of the main dietary components—proteins, minerals, and vitamins and a significant source of carbohydrate. A food's nutritional worth is determined by its digestibility, amount of nutrients it contains and whether or not it contains [5] as harmful or anti-nutrients. The chemical makeup of taro corms and cormels has been assessed by a number of writers [6]. It has been noted that colocasia have a significant nutritional value despite being neglected crops. This crop has comparatively lower amount of fat content than other root and tuber crops and has higher protein, mineral, and vitamin contents [7]. Studies have revealed that colocasia contain high levels of vital amino acids, digestible starch, high-quality protein, vitamin C, thiamine, riboflavin, and niacin. Due to the crop's high dietary fiber content, it may also be used to treat conditions like cancer, diabetes, obesity, and gastrointestinal issues [8]. In India, prominent Colocasia frowing states are - Assam, Nagaland, Manipur, Orissa, Maharashtra, Kerala, Andhra Pradesh, Meghalaya, West Bengal, Uttar Pradesh Gujarat, Tamil Nadu and Bihar. Colocasia is mainly grown as a major tuber crop in Arunachal Pradesh as well as in entire north-eastern region. Despite the crop's significance, it is often grown as a subsistence to semi-commercial crop throughout India due to low productivity brought on by the lack of adoption of better varieties and other new technology. The On-farm testings were held at various farmers' fields with the aim of increasing agricultural produce's production, productivity and quality.

Table 1. Nutritional values in Colocassia

Nutrients	Availability/100 g	Nutrients	Availability/100 g
Moisture	70.3 %	Phosphorous	68 mg
Fat	0.1 %	Magnesium	106 mg
Protein	3.2 %	Sodium	1.6 mg
Starch	21.2 %	Potassium	356 mg
Energy	97 Kcal	Sulphur	7.4 mg
Vitamin B1	0.09 mg	Iron	0.63 mg
Vitamin B2	0.03 mg	Copper	0.20 mg
Vitamin C	Nil	Zinc	3.6 mg
Calcium	31 mg	Manganese	0.34 mg
Beta carotene	34 µg	Boron	0.09 mg

(Balagopalan et al., 1999)

2. MATERIALS AND METHODS

The On Farm Testing (OFT) is method which applied to assessment of feasibility of any technology at farmers field with an objective to explore the maximum available resources of crop production and also to bridge the productivity gaps by enhancing the production in national basket [9]. By seeking the low productivity of existing varieties of colocassia, Krishi Vigyan Kendra, Tirap, Arunachal Pradesh, India conducted OFT on Yield gap analysis and impact assessment of Colocasia in Arunachal Pradesh during kharif 2015-16 and 2016-17 respectively. Under the OFT, improved variety ML-1 was grown with full scientific package of practices. The total 04 farmers were selected for OFT during both year’s study; having 0.10 ha area of each farmer.

The interventions followed and farmers practice which demonstrated are given in Table 2. Before conducting OFT, farmers were trained in details about scientific cultivation practices of Colocassia.

The performance of crop was monitored as per the schedule by the experts of Krishi Vigyan Kendra and time to time advisories, field visits were also done. During the time of harvesting, yield data was recorded from both the plots- FLD and farmer's practice. After harvesting; economics part were also calculated and the gross income, net income and cost benefit ratio were also worked out. The average of cost of cultivation, yield and net returns of different farmers was analyzed by the following formulas:

$$Average = \frac{(F1 + F2 + F3 \ldots\ldots\ldots\ldots\ldots\ldots + Fn)}{N}$$

Where,

F= Farmer (s)
N= No. of farmers

In the present study, technology index was operationally defined as the technical feasibility obtained due to implementation of OFT at farmer's field. To estimate the technology gap, extension gap and technology index following formula used as given by Samui *et al.,* [10].

$$Technology\ Gap = Pi\ (Potential\ yield) - Di\ (Demonstration\ yield)$$

$$Extension\ Gap = Di\ (Demonstration\ yield) - Fi\ (Farmers\ yield)$$

$$Technology\ index = \frac{Potential\ Yield - Demonstration\ yield}{Potential\ yield}\ x\ 100$$

$$Benefit\ Cost\ ratio\ (B{:}C\ ratio) = \frac{Net\ income\ (Rs\ ha^{-1})}{Cost\ of\ cultivation\ (Rs\ ha^{-1})}$$

$$Percent\ increase\ of\ over\ farmer's\ practices = \frac{Improved\ practices - Farmers\ practice}{Farmers\ practices}\ x\ 100$$

Table 2. Improved and farmer's practices of colocassia in details

Particular	Technological intervention	Existing practices	Gap
Variety	ML-1	Local or unknown variety	Full gap
Seed rate	800 kg/ha	1200 kg /ha	Full gap
Seed treatment	Seed was treated	Not treated	Full gap
Sowing method	Line sowing	Line sowing	Partial gap
Spacing	45 x 20 cm	60 x 30 cm	Partial gap
Application of recommended dose of manure	5 kg/ meter^2	Nil/without recommendation	Partial gap
Application of Bio fertilizer	Soil application of Azospirillum & PSB @ 2 kg/ha mix with FYM	No application	Full gap
Weed management	Done at 30 and 45 days after planting	Not common	Full gap
Harvesting	Manual	Manual	No Gap

3. RESULTS AND DISCUSSION

The yield data from Table 3 proving that FLD yielded much more (356 q/ha and 372 q/ha) as compared farmer's practice (243 q/ha and 268 q/ha) during the both years of study. This finding proving that improved technologies with improved variety can increase the yield of Colocasia.

Table 3. Yield and economics of colocassia

Year	Yield (q/ha)		Cost of Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		Benefit Cost ratio B:C Ratio	
	D	F	D	F	D	F	D	F	D	F
2015	356	243	122000	148000	712000	446000	590000	338000	4.83	2.28
2016	372	268	128000	129000	744000	536000	616000	407000	4.81	3.15

Where D denotes Demonstration plot, F denotes Farmers practices

Table 4. Technology gap analysis

Year	Potential yield (kg/ha)	OFT Yield (kg/ha)	Farmer's practice yield (kg/ha)	% increased	Extension gap (kg/ha)	Technological gap (kg/ha)	Technology Index
2015-16	410	356	243	46	113	54	13
2016-17	410	372	268	38	104	38	9

After executing of scientific approaches under OFT, the gross cost of cultivation was less (Rs. 122000 and Rs. 128000) than farmer's practice (Rs. 148000 and Rs. 129000), Table 3. The cost of cultivation was higher in farmer's practices because they applied higher doses of planting materials as compared recommended dose. The net return was also higher in result of OFT (Rs. 590000 and Rs. 616000) as compared farmer's practice (Rs. 338000 and Rs. 407000). Similarly, the B:C ratio was also calculated better in OFT (4.83 and 4.81) as compared farmer's practice (2.28 and 3.15). The result is in conformity with the finding of Tiwari and Saxena [11] and Tiwari *et al.,* (2003). They elaborated that scientific package of practices resulted better yield on ground. Thus, this is encouraging to scientific community for further improvement in their action at farmer's field.

The Table 4 is clearly showing that extension gap was 113 and 104 q/ha, technological gap was 54 and 38 q/ha while the technology index was 13 and 9 respectively; during the both years of study. "The technology gap observed may be attributing to the dissimilarity in soil fertility status, timely sowing and weather conditions. Similar finding was recorded by Mitra and Samajdar" [12]. The extension gap during the both years of result is showing that dissemination of different technologies at farmers field can boost the farmer's productivity.

"The average percent increases over local yield were 29.24. The results clearly indicated the positive effect of FLDs over the existing practices toward enhancing the yield of colocasia in the study area due to use of high yielding variety, timely sowing, balance does of fertilizers, proper and timely irrigation, need based plant protection etc" [13-15].

4. CONCLUSION

The superior result of recommended package of practices under on farm testing's over farmer's practice was also reported by Mitra and Samajdar [12] and Balai et al*.,* [16]. From these findings of present study, this may be concluded that use of scientific technologies of colocasia cultivation can minimize the technology gap upto a considerable extent. By which productivity as well as quality of colocassia can be improved in Arunachal Pradesh. It requires collaborative extension efforts between all factions of agriculture viz. farming community, department of Agriculture, department of Horticulture and Krishi Vigyan Kendra.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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