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# Impact of Front Line Demonstrations on the Yield and Economics of Colocasia (*Colocasia esculenta* L. Schott) in Kanker District of Chhattisgarh

**Suresh Kumar Markam[1*], Birbal Sahu[2], Chandu Lal Thakur[2] and Alakh Ram Gour[3]**

*[1]Department of Horticulture, [2]Department of Agronomy, [3]Department of Soil Sceince and Agricultural Chemistry, Krishi Vigyan Kendra, Kanker and Krishi Vigyan Kendra, Balod, IGKV, Raipur (CG), India*

**Corresponding author*

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## A B S T R A C T

Colocasia (*Colocasia esculenta* L. Schott) is one of the important tuber crops grown for fresh and processing purpose all over the India due to its wider adaptability under various agro- climatic conditions, which plays a major role in supplementing the income of small and marginal farmer of the Kanker district of Chhattisgarh state. The present study was carried out at Kanker district during *kharif* 2015-16 and 2016-17. Front line demonstrations were conducted on colocasia by the active participation of the farmers with the objective of improved technologies of colocasia production potential. The improved technologies consist improved variety (Indira Arvi-1), balanced fertilizers (Soil test based) application and integrated pest and disease management, *etc*. The development of the agriculture is primarily depends on the application of the scientific technologies by making the best use of available resources. One of the major constraints of traditional colocasia farming is low productivity because of non-adoption of advanced technologies like improved varieties. To increase the production, productivity and quality of agricultural produce, front line demonstrations are being conducted at various farmer's field. All the recommended practices were provided to the selected farmers. The data related to the cost of cultivation, production, productivity, gross return and net return were collected as per schedule and analyzed. Result of the present study revealed that higher average yield in the demonstrations was recorded (205.5 q $ha^{-1}$) as compared to farmers practice (159 q $ha^{-1}$) traditionally adopted by the farmers. The percentage increase in the yield over farmer's practice 29.24 was recorded. The technology gap and extension gap were computed 14.5 and 46.5 q $ha^{-1}$ respectively, along with 6.59 per cent of technology index. The demonstrated field gave higher average net return Rs. 89500 and B:C ratio is 1: 2.19. The result of the study indicated the gap existed in the potential yield and demonstration yield is due to soil fertility and weather conditions. Present results clearly show that the yield and economics of tomato can be boost up by adopting recommended technologies.

## Introduction

Colocasia (*Colocasia esculenta* L. Schott) is a traditional crop with a long history of cultivation in Asia and the Pacific. It is widely used as a tuber vegetable in India, whereas, it is very closely associated with culture in many of the South Pacific Islands. It ranks third after cassava and yam, in terms of total production, area and consumption (Poonia and Pithia 2011). Colocasia also known as *'eddoe'* or '*arvi'* is a tropical tuber crop belongs to the monocotyledonous family "Araceae" of the order "Arales" whose members are known as "aroids" (Henry, 2001 and Van Wyk, 2005). Colocasia is believed to have originated in South Central Asia, perhaps in Eastern India or Malaysia (Sturlevant, 1919). All parts of the plant including corm, cormels, rhizome, stalk, leaves and flowers are edible and contain abundant starch (Bose *et al.,* 2003). Corms are consumed roasted, boiled, or fried and are also used to produce flour or industrial starch, which is generally processed into various food products (Balai *et al.,* 2012). Colocasia is a rich source of starch and reasonably good source of major components of the diet *viz.* proteins, minerals and vitamins. The nutritional value of a food depends upon its nutritional contents, digestibility and the presence or absence of anti-nutrients or toxic factors. Several authors have evaluated the chemical composition of whole corms and cormels of taro (Surjit and Tarafdar, 2015.). It has been observed that in spite of the fact that colocasia are neglected crops, their nutritional value is high. Apart from the low fat content, the crop is nutritionally superior to other root and tuber crops in protein, mineral and vitamin contents (Onwueme, 1978). Investigations have shown that colocasia contain digestible starch, protein of good quality, vitamin C, thiamine, riboflavin, niacin and high scores of proteins and essential amino acids. The crop is also very rich in dietary fibre, thus, it could be employed in the treatment of diseases such as obesity, diabetes, cancer and gastrointestinal disorders (Mukherjee *et al.,* 2016). Taro is cultivated in an area of around 1.30 m ha with an annual production of 9.98 mt and average yield of 7.68 t/ha (FAOSTAT, 2016) and the major colocasia growing states are Assam, Nagaland, Manipur, Orissa, Maharashtra, Kerala, Andhra Pradesh, Meghalaya, West Bengal, Uttar Pradesh Gujarat, Tamil Nadu and Bihar. In Chhattisgarh state total area under colocasia is 7815 ha with a production of 110260 metric tonnes (Anonymous, 2018-19). Colocasia is mainly grown as a major tuber crop in tribal areas like Kanker, Bastar, Dantewada, Kawardha, Surguja and Raigarh districts in Chhattisgarh. Despite of the importance of this crop, its cultivation anywhere in India is generally a subsistent to semi-commercial crop due to low productivity because of non-adoption of advanced technologies like improved varieties. To increase the production, productivity and quality of agricultural produce, front line demonstrations are being conducted at various farmers' field.

## Materials and Methods

The front line demonstration (FLD) is an applied approach to accelerate the dissemination of proven technologies at farmers fields in a participatory mode 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 (Chaudhary *et al.,* 2018) To overcome the problems faced by the farmers in cultivation of colocasia, integrated crop management in colocasia was conducted by Krishi Vigyan Kendra, Kanker during *kharif* 2015-16 and 2016-17 in ten farmer's of Kanker district. In the demonstration, improved variety Indira Arvi-1 was grown in 0.5 ha area with integrated crop management practices and the farmers

practice traditionally in 0.5 ha area for comparison. The integrated crop management practices consisting the conjoint use 10 t FYM $ha^{-1}$ with a balanced fertilization of 100:60:80 NPK kg $ha^{-1}$.

Improved variety of colocasia *i.e.* Indira Arvi -1 introduced under demonstration was released from IGKV, Raipur (CG) treated with fungicide namely, diathan M-45 and integrated pest management strategies were demonstrated as per need.

The Indira Arvi -1 was a clonal selection. Salient features of technology are plant height upto 75-100 cm, growth habit is erected, sucker type stem, 5-6 tillers $plant^{-1}$, leaf margin pigmented in early stage petiole type medium leaf sheath pattern open cormel shape clubbed shape with blunt end, 9-10 main cormels $plant^{-1}$, cormels weight is 600-700 gm $plant^{-1}$, corm shape: round corm, size :medium (100-110 gm), suitable for culinary purpose due softness and non-acrid which make it easy to cook.

Responsive to recommended dose of fertilizer at both rainfed and irrigated conditions situation in *kharif* and *spring–summer* season and field tolerant to pest and leaf blight disease with average yield of 22 t $ha^{-1}$ (Hort portal, 2019) colocasia (Indira Arvi-1) may progressively commercialized in Chhattisgarh as well as in Madhya Pradesh.

The technological interventions followed in farmers practice and demonstration is given in table 1. Before initiating the demonstration, the beneficiary farmers were given with skill training on various technological interventions to be followed in colocasia cultivation. The performance of crop was periodically observed by the scientists of Krishi Vigyan Kendra and advisory recommendations were followed. During harvest, yield data was collected from both the demonstration and farmers practice. At the end, cost of cultivation, net income and cost benefit ratio were worked out. An average of cost of cultivation, yield, and net returns of different farmers was analyzed by the formula:

$$\text{Average} = \frac{(F_1 + F_2 + F_3 \ldots\ldots\ldots\ldots\ldots\ldots + F_n)}{N}$$

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 front line demonstrations in tomato. To estimate the technology gap, extension gap and technology index following formula used as given by Samui *et al.*, 2000.

Technology Gap

= $P_i$ (Potential yield)- $D_i$ (Demonstration yield)

Extension Gap

= $D_i$ (Demonstration yield)- $F_i$ (Farmers yield)

Technology index

$$= \frac{\text{Potential yield- Demonstration yield}}{\text{Potential yield}} \times 100$$

B: C ratio

$$= \frac{\text{Net income (Rs ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs ha}^{-1}\text{)}}$$

Percent increased over farmers practices

$$= \frac{\text{Improved practices- Farmers practices}}{\text{Farmers practices}} \times 100$$

## Results and Discussion

The economic indices depicted in table 2 showed that the average yield of colocasia variety (Indira Arvi - 1) were 204 and 207 q $ha^{-1}$ during *kharif* 2015-16 and 2016-2017, respectively under demonstrated technology however, under farmer's practices the average yield were found to be 160 and 158 q $ha^{-1}$ during respective years. 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.

The result is in conformity with the finding of Tiwari and Saxena (2001) and Tiwari *et al.*, (2003). Yield of the front line demonstration and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gap. The data of table 3 depicted the technology gap in the demonstration yield against potential yield which is 14.5 q $ha^{-1}$ during both the year and reflects the farmer's cooperation in carrying out such demonstrations with encouraging results in subsequent years. The technology gap observed may be attributing to the dissimilarity in soil fertility status, timely sowing and weather conditions. Similar finding were recorded by Mitra and Samajdar (2010). Further, the higher extension gap was observed. The extension gap ranged from 46.5 q $ha^{-1}$ during the period of study that emphasizes the need to educate the farmers through various means for adoption of improved production technologies to mitigate the extension gap. The data of table 2 reveals that as far as average economics of colocasia is concerned; gross cost, net income and benefit cost ratio were Rs. 73800 $ha^{-1}$, Rs. 163200 $ha^{-1}$ and 1:2.21, respectively during 2015-16 and Rs. 165600 $ha^{-1}$, Rs. 89600 $ha^{-1}$ and 2.17, respectively during 2016-17 under demonstration plot. However, Rs. 128000 $ha^{-1}$ gross cost, Rs. 54667 $ha^{-1}$ net return with 1:1.74 benefit cost ratio during 2015-16 and Rs. 126400 $ha^{-1}$ gross cost, Rs. 51800 $ha^{-1}$ net return with 1:1.69 benefit cost ratio observed during 2016-17 under farmer's practices.

The superiority of recommended package of practices under frontline demonstration over farmer's practice was also reported by Mitra and Samajdar (2010) and Balai *et al.*, (2012). From the findings of present study, it can be concluded that use of above prescribed technologies of colocasia cultivation can reduce the technology gap to a considerable extent resulting in to increased productivity as well as quality in Chhattisgarh. It requires collaborative extension efforts to enhance adoption level of location and crop specific technologies among of the farmers for bridging these gaps. Therefore, extension agencies in the district need to provide proper technical support to the farmers through various educational and extension methods for better colocasia production in tribal districts of Chhattisgarh.

**Table.1** Level of use and gap in adoption extent of colocasia technologies in study area

| S.N | Package of practices (Technology intervention) | Frontline demonstration (Recommended package of practices) | Farmers practice (Local/Check) | Gap |
|---|---|---|---|---|
| 1 | Selection of variety | Improved vareity (Indira Arvi -1) | Age old variety | Partial gap |
| 2 | Soil testing | Have been done in all the location | Not in practice | Full gap |
| 3 | Seed rate | 10 t $ha^{-1}$ | 10 t $ha^{-1}$ | Partial gap |
| 4 | Seed treatment | Seed treated with fungicide Dithan M-45 | Not done | Full gap |
| 5 | Spacing | 60 cm x 20 cm | 40 cm x 20 cm | Partial gap |
| 6 | Application of recommended dose of fertilizer | 100 kg N + 60 kg $P_2O_5$+ 80 kg $K_2O$ per ha (50 % N + 100 % P K at the time of planting and remaining 50 % N applied at 35 days and 70 days after planting. | Imbalance and inadequate | Partial gap |
| 7 | Application of vegetable special (micro-nutrients) | Foliar spray of vegetable special (micro-nutrients) 75 g + 15 lit water + 1 lemon +1 shampoo (Rs.1). | Not applied any micro-nutrient | Full gap |
| 8 | Irrigation | Drip or furrow method of irrigation at once in a 4-7 days interval depend upon soil condition. | Once/twice in a week | Partial gap |
| 9 | Weed management | Pre-emergence herbicide pendimethalin @ 1.5 kg *a.i.* $ha^{-1}$, followed by hand weeding depend upon weed intensity. | Weeding is not common | Partial gap |
| 10 | Plant protection measures for control of insect pest and diseases | Need based application for control: Aphid and sucking pest-spraying with diamethoate (30 EC) 1.5 ml $L^{-1}$. of water. Leaf eating catter piller: Spay NPV (250 LE/ha). Colocasia blight, pyithium rot & leaf blight – Spraying of (COC) blitox 50 3g $L^{-1}$ of water. | Plant protection is not common | Partial gap |
| 11 | Harvesting | Manual | Manual | No gap |

**Table.2** Economics of front line demonstrations of year 2015-16 and 2016-17

| Variables | Yield (q ha$^{-1}$) | | | Cost of Cultivation (Rs ha$^{-1}$) | | | Gross return (Rs ha$^{-1}$) | | | Net return (Rs ha$^{-1}$) | | | Benefit : Cost ratio | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **2015-16** | **2016-17** | **Average** | **2015-16** | **2016-17** | **Average** | **2015-16** | **2016-17** | **Average** | **2015-16** | **2016-17** | **Average** | **2015-16** | **2016-17** | **Average** |
| **Farmers practice** | 160 | 158 | 159 | 73333 | 74600 | 73966 | 128000 | 126400 | 127200 | 54667 | 51800 | 53233 | 1:1.74 | **1:1.69** | 1.71 |
| **Recommended practices (Indira Arvi-1)** | 204 | 207 | 205 | 73800 | 76000 | 74900 | 163200 | 165600 | 164400 | 89400 | 89600 | 89500 | 1:2.21 | **1:2.17** | 2.19 |

**Table.3** Yield, technology gap and technology index of demonstration

| Variables | Yield (q ha$^{-1}$) | Increase (%) over farmers practice | Technology gap (q ha$^{-1}$) | Extension gap (q ha$^{-1}$) | Technology Index (%) |
|---|---|---|---|---|---|
| **Farmers Practice** | 159 | - | - | - | - |
| **Recommended practices ( Indira Arvi-1)** | 205.5 | 29.24 | 14.5 | 46.5 | 6.59 |

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