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Organic cultivation of Colocassia (*Colocassia esculenta* L.) at North Eastern Ghat Zone

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Abstract
The present investigation was carried during the *kharif* 2020-22 at – Regional Research and Technology Transfer Station, G. Udayagiri, Kandhamal (Odisha). The experiment was laid out for organic cultivation of Colocassia (*Colocassia esculenta* L.) at North Eastern Ghat Zone in a factorial randomized block design with ten treatment combinations consisted of RDF of fertilizer (N80P60K80)). The treatments taken *viz.* T_1- 1/3rd RDN each through FYM (5.3 tha^{-1}) + Turmeric manures (5.3 tha^{-1}) + Neem cake (o.5 tha^{-1}). T_2- 1/3rd RDN each through FYM (5.3 tha^{-1}) = Turmeric manure (5.3 tha^{-1}) +vermi compost (1.67t ha^{-1}). T_3-1/3rd RDN each through FYM (5.3t ha^{-1}) + turmeric manure (5.3 tha^{-1}) + sheep and goat manure (0.89t ha^{-1}). T_4-1/3rd RDN each through FYM (5.3t ha^{-1}) + Turmeric manures (5.3 tha^{-1}) + well decomposed poultry manure (1.78t ha^{-1}). T_5-1/3rd RDN each through FYM (5.3t ha^{-1}) + Turmeric manures (5.3 tha^{-1}) + stera mel (1t ha^{-1}). T_6-100% RDN through FYM (16 tha^{-1}). T_7-100% RDN through turmeric (16t ha^{-1}). T_8-RDF (80:60:80 kg ha^{-1}). T_9-Control (Nil). T_{10}- Bio- Fertiliser (bio -fertiliser soil application with 3kg each of *Azospirillum*, *Azotobacter* and PSB inoculated with 25 times of FYM for 7 days). The result revealed that revealed that maximum number of tubers per plant (12.80) was recorded in the T_10 as against in the control T_9 (9.40). The quality parameters like length of tubers(4.45cm), diameter (3.08 cm), weight of tubers (187.00 gm), yield of tuber per plot (18.70 kg) and yield of tuber /ha (13.85t ha^{-1}) were also found maximum with application of combination of bio-fertilizer (*Azospirillum*, *Azotobacter* and PSB 1:1:1 ratio). It also gives maximum cost: benefit ratio of 1:2.35.

Keywords: Colocasia, organic cultivation, RDF, *Azospirillum*, *Azotobacter*, PSB

Introduction
Roots and Tuber crops are the 2nd most principal food crops in the world after cereals, generally found in tropical and subtropical zone in the world, nearly 2.2 billion people depend upon roots and tuber crops in the world (FAO, 2018) [2]. Tuber crops have an immense potential as functional foods and nutritional ingredients to be explored in disease risk reduction and wellness (Chandrasekara *et al*., 2016) [1]. Taro (*Colocasia esculenta* L. Schott) is an important staple food crop grown throughout many Pacific island countries, parts of Africa, Asia and the Caribbean for its fleshy corms and nutritious leaves. The corm is an excellent source of carbohydrate, the majority being starch of which 17-28% is amylose, and the remainder isamylopectin. All parts of the Colocassia are consumed, *viz*. the leaves, petioles, corm and cormels for curry preparation, corms for snacks, baby feed and pig feed, etc. Taro is thought to haveoriginated in North Eastern India and Asia (Kuruvilla and Singh 1981; Ivancic 1992) [13, 5] and gradually spread worldwide by settlers. Bunda (*Colocasia esculenta* var. *esculenta*) is intensively produced in the Pacific Islands and forms a significant proportion of their diet; West Africa cultivates the largest area and is the leading producer of the crop in the world (FAOSTAT, 2010) [3]. Bunda is originated in Indo-Malaysian region of South East Asia and generally cultivated in most of the state of India and Malaysia. Bunda is widely grown in Caribbean and Pacific Island including Fiji, New Hebrides, New Caledonia, New guinea and Solomon Islands. It occupied 9th positions among the food crops in the world (Kumar *et al*., 2016) [12] It is widely grown as a rainfed crop in the valley and Jhum area in entire North Eastern States of India. The productivity of taro in the region is very low due tonon-availability of quality planting materials and no or limited uses of organic and inorganic fertilizers. Some work on nutrient management in different tuber crops have been carried out in India. Ramesan *et al*. (1996) [17] reported that the application of nitrogen and potassium significantly increase yield component of arrowroot. Maheswarappa *et al.* (2000) [15] and Veena (2000) [21] reported highest uptake of N and K at the highest level of fertilization in

arrowroot intercropped in coconut gardens. Suja *et al.* (2006) [19] reported that the application of NPK @ 50:25:75 kg ha-1 produce higher yield. Joshi *et al.* (2017) [8] reported that the application of NPK fertilizer @ 60:40:60 and vermicompost @ 20 tha-1 had significantly increased the tuber yield and growth parameters of tikhur (East Indian arrowroot). It is well known that addition of organic manures has shown considerable increase in crop yield, quality and significant influence on physical, chemical and biological properties of soil (Joshi *et al*. 2018) [9]. For sustainable crop production, integrated uses of inorganic and organic source of fertilizers are highly beneficial. The uptake of nutrients by plants and yield of crops is highly depends on soil nutrient supply system through different sources (Kannaiyan, 1999 and Joshi and Sharma, 2017) [11, 8] The information regarding nutritional requirement of this crop is very scanty. as well as yield and quality of produce. The integrated nutrient management (INM) approaches not only improve the quality of the produce but also help in improving the soil fertility including the biosphere. In addition, they are eco-friendly, easily available and cost-effective.

Organic farming is a crop production method respecting the rules of the nature with a target to produce nutritive, healthy and pollution free food by maximum use of on farm resources avoiding chemical fertilizer and pesticide and so to protect plant, animal, the soil, water and micro-organism in the entire farming system. The NEGZ (North Eastern Ghat Zone) is very much prone to cattle menance. So, to overcome this problem the present study was undertaken to assess the effect of different organic manures on yield and quality of *Colocassia var*. Muktakesi, a local promising cultivar identified by CTCRI, Bhubaneswar. The variety is free from irritation of throat and suitable vegetable for mixed curry items. organic manures having slow release of nitrogenous nutrient and rich source of phosphorus and potassium nutrients.

Materials and Methods

Experiment was conducted during 2022-22 kharif season, at Regional Research Station, G. Udayagiri of OUAT of North Eastern Ghat Zone, Odisha. The soil type is red laterite and acidic in reaction (pH 5.3). The experiment was carried out under rainfed condition using taro cultivar Mukta kesi of CTCRI, Bhubaneswar with ten treatments and three replications under Randomized Complete Block Design. The sprouted corbels were planted at 45x45 cm spacing. The treatments were

- T_1- 1/3rd RDN each through FYM (5.3 tha^{-1}) + Turmeric manures (5.3 tha^{-1}) + Neem cake (o.5 tha^{-1}).
- T_2- 1/3rd RDN each through FYM (5.3 tha^{-1}) = Turmeric manure (5.3 tha^{-1}) +vermi compost (1.67 tha^{-1}).
- T_3-1/3rd RDN each through FYM (5.3 tha^{-1}) + turmeric manure (5.3 tha^{-1}) + sheep and goat manure (0.89 tha^{-1}).
- T_4-1/3rd RDN each through FYM (5.3 tha^{-1}) + Turmeric manures (5.3 t) + well decomposed poultry manure (1.78t ha^{-1}).
- T_5-1/3rd RDN each through FYM (5.3 tha^{-1}) + Turmeric manures (5.3 tha^{-1})+ steramel (1 tha^{-1}).
- T_6-100% RDN through FYM (16t ha^{-1}).
- T_7-100% RDN through turmeric (16t ha^{-1}).
- T_8-RDF (80:60:80kg ha^{-1}).
- T_9-Control (Nil).
- T_{10}- Bio- Fertiliser (bio-fertiliser soil application with 3 kg each of *Azospirillum*, *Azotobacter* and PSB inoculated with 25 times of FYM for 7 days).

Plotsize-45x30 cm, seed rate -8 qha^{-1} Design-RBD, Replication-3, Treatments-10. Observations and analysis on data have been taken on yield and yield attributing parameters.

Results and Discussions

The data presented in Table 1. revealed that maximum number of tubers per plant (12.80) was recorded in the T_10 as against in the control T_9 (9.40). The quality parameters like length of tubers (4.45 cm), diameter (3.08 cm), weight of tubers (187.00 gm), yield of tuber per plot (18.70 kg) and yield of tuber /ha (13.85 t/ha) were also found maximum with application of combination of bio -fertiliser (*Azospirillum*, *Azotobacter* and PSB 1:1:1 ratio). It also gives maximum cost: benefit ratio of 1:2.35. The increasing trend of yield and quality parameters might be due to activate phosphorus and potassic nutrient available to root zone which are essential component of nucleic acids, phospholipids, phyteen and some aminoacids ant it help the formation of food resents due to higher photosynthetic activity. Kamal *et al.* (2012) [10] also reported the highest dry weight of root (7.32 g), dry weight of rhizome per plant (40.35 g) and total dry matter yield (6.85 t/ha) from neem cake applied @ 2.0 t/ha in turmeric. Sen *et al.* (2007) [18] also reported highest stolon yield in swamptaro with organic (25%) and inorganic (75%) source of nitrogen combination. Suthar (2009) [20] also observed the maximum range of some plant parameters i.e. root length, shoot length, leaf length, fresh weight, number of cloves in garlic were in the treatment using 15t/ha vermicompost + 50% NPK and Mondal *et al.* (1993) [6] observed better net production values in potato when 75% RDF was applied together with FYM @ 10 t per ha. The increased mean growth and yield attributing traits by the application of NPK with FYM and vermicompost was attributed to solubilization effect Ivancic A (1992) [5]. Breeding and genetics of taro (*Colocassia esculenta* (L.) Schott. Ministry of Agriculture and Lands, Solomon Islands UNDP, Food and Agriculture Organizations of the United Nations, pp 1-97 Mondal SS, Chettri M, Sarkar S, Mondal TK (1993) [6]. Integrated nutrient management with sulphur bearing fertilizer, FYM and crop residues in relation to growth and yield of potato

Iwuagwu *et al.* (2017) [9] reported that plant height was significantly enhanced by the application of cow dung at the rate of 30 t ha1. Mama *et al.* (2016) [14] studied those highest values for plant height was observed due to conjunctive application of farm yard manure and potassium. Najm *et al.* (2013) [16] found that application of cattle manure with potassium fertilizer have significant effect on plant heights at 60th, 75th, 90th and 105th days after planting.

Table 1: Effect of organic manures on growth, yield and quality of Colocassia (*Colocassia esculenta* L.) under North Eastern Ghat Zone.

Treatment	No of tuber/plant	Length of tuber (cm)	Diameter of tuber (cm)	Weight of tuber/plant	Yield per plot(kg)	Yield /ha (tones)	Benefit: Cost Ratio
T_1	10.60	4.12	2.96	117.30	11.73	8.68	1:1.10
T_2	9.45	3.60	2.66	124.60	12.46	9.23	1:1.23
T_3	11.26	4.11	2.80	124.00	12.40	9.18	1:1.22
T_4	12.40	4.35	2.90	140.00	14.00	10.37	1:1.51
T_5	9.75	4.37	3.06	167.70	16.77	12.41	1:2.00
T_6	10.93	4.36	2.93	113.70	11.37	8.41	1:1.04
T_7	11.70	4.07	3.05	133.70	13.37	9.90	1:1.40
T_8	12.00	4.05	2.95	179.00	17.90	13.25	1:2.20
T_9	9.40	4.10	3.08	127.70	12.77	9.45	1:1.28
T_{10}	12.80	4.45	3.08	187.00	18.70	13.85	1:2.35
SE(m)+ -	1.211	-	-	17.673	1.338	0.991	
C.D. (0.05)	NS	NS	NS	52.505	3.977	2.946	

Conclusion: Bio -fertilizer soil application with 3kg each of *Azospirillum*, *Azotobacter* and PSB inoculated with 25times of FYM for 7 days in Colocassia crop for higher yield and related attributes application has been found suitable.

Future study: integration of organic and inorganic fertilizer is to be taken for higher yield.

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