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Interactive effects of cultivars and spacing on the growth and yield of taro [*Colocasia esculenta* (L.) schott] under acid soil conditions of Lohardaga district of Jharkhand

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Abstract
A trial was conducted to study the interactive effects of cultivars and spacing on growth and yield of taro [*Colocasia esculenta* (L.) Schott] during summer planting seasons of 2015 and repeated in 2016 at the Krishi Vigyan Kendra, Lohardaga. The results based on two years mean revealed that out of eight different treatments, the plant of Kadma Local attended the maximum length of main suckers of 79.31 cm, number of side suckers plant^{-1} (7.21) and number of petioles clump^{-1} (27.87). The genotype Muktakeshi showed the maximum girth of main suckers of 17.37 cm. Kovvur Local produced maximum number of cormels of 31.73 plant^{-1}. The plant of Kadma Local produced biggest corm and cormel of 151.23 and 16.36 g, respectively. Muktakeshi produced maximum weight of cormels plant^{-1} of 411.90 g resulting in maximum yield of cormels 15.11 t ha^{-1}. Planting of taro at different spaces plays significant difference in case of growth parameters and plants planted at 60X60 cm^2 attended maximum growth. However, yield attributes and yield 10.73 t ha^{-1} was recorded maximum from plants planted at 60X45 cm^2 space.

Keywords: *Colocasia esculenta* L., Krishi Vigyan Kendra, Lohardaga.

Introduction

A rhizomatous herb, cultivated throughout India for edible, starchy, tuberous rhizomes and young leaves used as vegetables named taro [*Colocasia esculenta* (L.) Schott] belongs to the family of *Araceae* and subfamily of *Aroideae*. The genus *Colocasia* includes the taro, dasheen, eddoes, and *curcal* or old cocoyams (Morton, 1972). Other genera that belong to the same family and subfamily are Xanthosoma and Alocasia. It originates from South East Asia (Uguru, 2011) [14]. Taro is grown in the tropical and sub-tropical regions of the world, particularly Africa, Asia, Pacific and Oceania (Atiquzzaman *et al*., 2008) [3]. There are more than 200 cultivars of taro, selected for their edible corms and cormels, or their tropical looking ornamental foliage. The taro plant has a triple value in that the stem may be used as salads, the tubers provide easily digested starch, with the leaves are used as a green vegetable. Taro root is often used in a similar fashion to a potato, but in fact has better nutritional qualities than a potato. It has almost three times the dietary fiber, which is important for proper digestive health and regularity. Fiber can also fill you up and make you feel less hungry with fewer calories. Taro root has a low Glycemic Index, as opposed to potato which has a high Glycemic Index. A low GI means that taro effects blood sugar levels slowly, without the peaks and crashes of a high GI, which lead to increased hunger later on. Eating a diet of low GI foods can also help prevent diabetes. Taro is nutritious, and is an excellent source of potassium, which is an essential mineral for many bodily functions. Taro also contains some calcium, vitamin C, vitamin E and B vitamins, as well as magnesium, manganese and copper. Taro leaves contain good amounts of vitamins A and C, fiber and a relatively high amount of protein. Eating taro can lead to kidney stones and gout as well as other health complications if it is not prepared properly by boiling for the recommended amount of time. It can also be steeped in water overnight before cooking to further reduce the amount of oxalates. To absolutely minimize risk, milk or other calcium rich foods should be eaten with taro in order to block oxalate absorption. However, taro is a staple food for many people around the world and should not be considered a high risk food after it is cooked (Plant Guide, 2014) [11]. *Colocasia esculenta* (L.) Schott is the fourteenth most consumed vegetable worldwide and comprises the diet of 300 million people (Brown, 1998) [5]. Makinde *et al*. (2011) reported that seasonal weather variability has a direct influence on the quality and quantity of agricultural production particularly in Nigeria. Prolong moisture stress during vegetative period could inhibit vegetative growth due to the retardation of phytochemical and biochemical activities (Jordan and Sullivan, 1982; Boyer, 1976). Contrarily, excessive moisture during vegetative growth might reduce the final plant yield considerably by leaching the plant nutrients (Jatzold, 1977). The present study was undertaken to assess the interactive effects of cultivars, NPK fertilizer and seasons on the growth and yield of taro on Plains of Nsukka.

Materials and Methods

The present investigation was carried out as on-farm trial at the Krishi Vigyan Kendra, Lohardaga during summer planting seasons of 2015 and repeated in 2016 on taro [*Colocasia esculenta* (L.) Schott]. Five cultivars namely C-266, NDC 2, Kadma Local, Kovvur Local and Muktakeshi were grown at three space dimensions of 60X30 cm^2, 60X45 cm^2 and 60X60 cm^2 in the plot consisting 6 rows laid out in Randomized Complete Block Design (RCBD) with three replications. Each plot measuring 3.6 X 9.0 m^2 consisted of six rows with 30, 20 and 15 plants per row, respectively and accordingly, 180, 120 and 90 plants were accommodated per plot, respectively. Uniform cultural practices were followed for the experiment. The soil of the experimental field was sandy loam in texture with pH 5.6. Observations on four plant characters viz. length and girth of main suckers $plant^{-1}$ (cm), number of side suckers $plant^{-1}$ and number of petiols $clump^{-1}$ and yield and yield attributes namely number of cormels $plant^{-1}$, corm weight (g), weight of cormels $plant^{-1}$, average weight of cormels (g) and cormel yield (t ha^{-1})were recorded. The data on growth parameters and yield attributes were pooled and analyzed statistically as per Gomez and Gomez, 1984 and presented in Table -1 and 2 and Figure 1.

Results and Discussion

Perusal of the data (Table -1) clearly indicated that the significant differences existed in all plant growth characters. Among the different genotypes studied, the plant of Kadma Local attended the maximum length of main suckers of 79.31 cm followed by Muktakeshi (70.77 cm) while Kovvur Local (29.73 cm) and NDC 2 (34.27 CM) was dwarf in nature. The different genotypes showed differences in girth of main sucker. The genotype Muktakeshi showed the maximum girth (17.37 cm) but Kadma Local (15.57 cm) was the close second with significant difference. Number of side suckers $plant^{-1}$ was recorded maximum (7.21) in Kadma Local closely followed by in Muktakeshi (6.62). This genotype Kadma Local producing maximum number of petioles $clump^{-1}$ (27.87) significantly suppressed all others with big margin. Genotype Muktakeshi was the second best (22.56 petioles $clump^{-1}$) in this respect. Planting of taro at different spaces plays significant difference in case of growth parameters and plants planted at 60X60 cm^2 attended maximum growth. This showed that minimum plant population per unit area used maximum nutrients and attended maximum vegetative growth.

Significant variations in yield attributing characters were observed among taro collections (Table -2). Kovvur Local, a collection from Andhra Pradesh and also performing best result in Dholi (Bihar) and Nadia (West Bengal) conditions, with 31.73 cormels $plant^{-1}$, significantly suppressed all others. Entry Muktakeshi was the second best (25.79 cormels $plant^{-1}$) in this respect. Singh and Singh (1985) [12], Barrooah *et al.*, (1985) and Dwivedi and Sen (1998) [6] observed 9.44 to 28.10, 2.05 to 16.18 and 7.13 to 31.37 cormels $plant^{-1}$, respectively in their collections.Perusal of data affected by spacing indicated that plants spaced at 60X45 cm^2 produced maximum number of cormels $plant^{-1}$ and was significantly better over two other planting space of 60X30 cm^2 and 60X60 cm^2.

Corm and average cormel weight were recorded maximum in Kadma Local (151.23 and 16.36 g, respectively) and Muktakeshi was the close second best (138.70 and 13.97 g, respectively) with significant differences. Kuruvilla and Singh (1981) [13], Singh and Singh (1985) [12], Jaiswal *et al.*, (1989) and Sibyala (2013) also obtained great variations in cormel size of taro.

Muktakeshi produced maximum weight of cormel $plant^{-1}$ (411.90 g) closely followed by Kadma Local (385.70 g) with significant difference. Jaiswal *et al.*, (1989) and Dwivedi and Sen (2001) [6] recorded 136 to 450 g and 137.7 to 472.3 g cormels $plant^{-1}$ in their local collections in Faizabad and Kalyani conditions, respectively where as Barrooah *et al.*, (1985) and Sibyala (2013) observed lesser variations (128.45 to 284.37 g $plant^{-1}$ and 450 to 660 g $plant^{-1}$, respectively) in this respect.

A significant yield variation was noticed among the genotypes. Though the highest cormel yield was obtained by the genotype Muktakeshi , a genotype producing maximum weight of cormel $plant^{-1}$ to a tune of 15.11 t ha^{-1}, but significantly higher cormel yields were also obtained from other genotypes like Kadma Local (11.79 t ha^{-1}) and Kovvur Local (11.12 t ha^{-1}). Poor yield (3.66 t ha^{-1}) of the entry C-266, a genotype having poor vegetative growth, might be due to lower number and weight of cormels $plant^{-1}$ and smallest corm and cormel (44.05 and 10.18 g, respectively). Genotypes of C- series also showed poor yield performance under Dholi and Kalyani conditions. Significant effect on the growth parameters and total yield of the cultivar (Table – 1 & 2) could be attributed to the maximum ecological factors which triggered high photosynthetic activities to produce enough photosynthetes deposited in the sink. This agreed with the result obtained by Ahmed and Badr (2009) [1] and Orji *et al.*, (2016) [10].

A significant variation in yield and yield attributes were also noticed due to sowing of taro at different spaces. Planting of taro at 60X45 cm^2 performed best yield (10.73 t ha^{-1}) and significantly superior over performance due to other two spaces of 60X30 cm^2 and 60X60 cm^2. The poor yield performance under the spacing of 60X30 cm^2 and 60X60 cm^2 might be due to poor corm and cormel production under these plant spacing as evident from the data presented in Table – 2. This result is in agreement with the result of Ahmed (1981) [2] find during experimentation with sweet pepper in the Sudan Gezira area.

It is evident from studied figure reveal that both cultivar and spacing had an significant effect on the yield of cormel of taro. But cultivar was found to be more responsive to yield than that of spacing (Fig. 1). However, with the interaction of cultivar – spacing at increased rates significantly increased the studied parameter of yield at certain levels but beyond the further increment in spacing, the upward trend sharply declined.The highest yield of taro cultivar Muktakeshi was obtained 16.03 t ha^{-1} from plants shown at a space of 60X45 cm^2 and significantly differed over other treatment combinations of cultivar and spacing.

In last, it can be concluded that cultivation of taro [*Colocasia esculenta* (L.) Schott] (locally called Kachu, arvi or pekchi) cultivation by the farmers of Lohardaga district and adjoining areas of Jharkhand and uplift the socio-economic condition of them.

Table 1: Growth parameters of taro [*Colocasia esculenta* (L.) Schott] as influenced by cultivar and spacing.

Treatments	Length of main sucker (cm)	Girth of main sucker (cm)	No. of side suckers Plant^{-1}	No. of petiols Plant^{-1}
Cultivar				
C - 266	42.57	6.55	1.76	4.94
NDC 2	34.27	6.79	1.74	4.26
Kadma Local	79.31	15.57	7.21	27.87
Kovvur Local	29.73	5.53	2.17	5.97
Muktakeshi	70.77	17.37	6.62	22.56
LSD $_{0.05}$	6.55	1.21	1.16	1.41
Spacing				
60 X 30 cm^2	49.08	10.06	3.79	12.49
60 X 45 cm^2	51.23	10.35	3.88	12.92
60 X 60 cm^2	53.67	10.68	4.04	13.95
LSD $_{0.05}$	2.11	0.13	0.11	0.14

Table 2: Yield and yield attributes of cormel of taro [*Colocasia esculenta* (L.) Schott] as influenced by cultivar and spacing

Treatments	No. of cormels Plant^{-1}	Corm weight (g)	Weight of cormels Plant^{-1} (g)	Average weight of cormel (g)	Cormel yield (t ha^{-1})
Cultivar					
C - 266	9.51	44.05	96.63	10.18	3.66
NDC 2	14.93	53.16	207.50	10.98	8.10
Kadma Local	21.89	151.23	385.70	16.36	11.79
Kovvur Local	31.73	81.18	288.93	9.88	11.12
Muktakeshi	25.79	138.70	411.90	13.97	15.11
LSD $_{0.05}$	4.12	4.42	10.50	0.95	2.33
Spacing					
60 X 30 cm^2	19.48	90.52	270.12	11.71	9.25
60 X 45 cm^2	22.24	97.71	286.62	13.13	10.73
60 X 60 cm^2	20.58	92.77	277.66	11.99	9.95
LSD $_{0.05}$	1.11	1.15	2.55	0.10	0.26

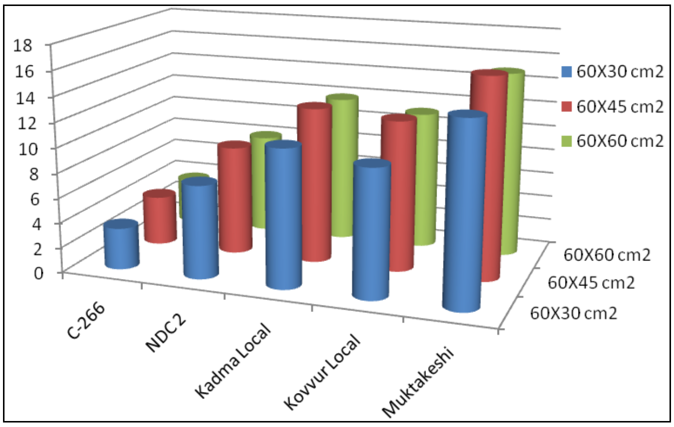

Fig 1: Interactive effect of cultivars and spacing on Yield of cormel (t ha^{-1}) of taro [*Colocasia esculenta* (L.) Schott]

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