Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 600-606

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 Special Issue-7 pp. 600-606
Journal homepage: http://www.ijcmas.com

Original Research Article

Interactive Effects of Cultivars and NPK Fertilizer on the Growth and Yield of Taro [*Colocasia esculenta* (L.) Schott] under Agro-Climatic Condition of Zone IV Prevailing In Palamu District of Jharkhand, India

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Keywords

Growth and Yield of Taro [*Colocasia esculenta* (L.) Schott], NPK fertilizer

A B S T R A C T

A trial was conducted to study the interactive effects of cultivars and NPK fertilizer on growth and yield of taro [*Colocasia esculenta* (L.) Schott] during summer planting seasons of 2016 and repeated in 2017 at the Krishi Vigyan Kendra, Palamu. The results based on two years mean revealed that out of eight different treatments, the plant of Topi attended the maximum length of main suckers of 81.59 cm. The genotype Jhankri showed the maximum girth of main suckers of 18.51 cm, number of side suckers plant^{-1} (7.76) and number of petioles clump^{-1} (36.05). Jhankri also produced maximum number of cormels of 31.73 plant^{-1} and biggest corm in size of 196.83 g. Kadma Local produced maximum weight of cormels plant^{-1} of 385.70 g. The plant of Topi produced biggest cormel of 17.68 g followed by Jhankri (16.50 g) resulting almost same yield of 14.70 and 14.73 t ha^{-1}, respectively. Cultivation of taro at different rates of NPK fertilizer plays significant difference in case of growth parameters and plants fertilized with NPK @ 300 Kg ha^{-1} attended maximum growth. However, yield attributes and yield 10.73 t ha^{-1} was recorded maximum from plants fertilized with NPK @ 300 Kg ha^{-1}.

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). Taro is grown in the tropical and sub-tropical regions of the world, particularly Africa, Asia, Pacific and Oceania (Atiquzzaman *et al.*, 2008). 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). *Colocasia esculenta* (L.) Schott is the fourteenth most consumed vegetable worldwide and comprises the diet of 300 million people (Brown, 1998). The use of inorganic fertilizer in cocoyam production is not common among the rural farmers. They depend more on farm yard manure and farm yard wastes. The quantities of these materials available may not be enough for large scale production. There is then the need to adopt the use of inorganic fertilizer by these farmers. However, Bashir *et al.*, (1997) have noted that one of the problems facing rural farmers on the fertilizer usage is lack of information on what type of fertilizer and quantity that will suit their crops and soil types. Shabbier (2007) has noted that NPK fertilizers are an all in one source of plant nutrient for the individual crops and soils. The use of NPK fertilizer will provide balanced nutrient and enhance soil fertility, maximizes crop yield and ultimately will boost the agricultural economy (Shabbier, 2007). Onwueme (1978) reported that cocoyam requires a lot of potassium which in the additional farming system is formed in ash left after bush burning. The present study was undertaken to assess the interactive effects of cultivars and NPK fertilizer on the growth and yield of taro under agro-climatic condition of Zone IV prevailing in Palamu district of Jharkhand.

Materials and Methods

The present investigation was carried out as on-farm trial at the Krishi Vigyan Kendra, Palamu during summer planting seasons of 2016 and repeated in 2017 on taro [*Colocasia esculenta* (L.) Schott]. Five cultivars namely C-189, NDC 1, Jhankri, Kadma Local, and Topi were grown at a planting space of 60X45 cm^2 under three doses of NPK fertilizer (19:19:19) in the plot size of 3.6 X 4.5 m^2 consisting six rows with ten plants per row and laid out in 5 X 3 factorial in Randomized Complete Block Design (RCBD) replicated thrice. The three doses of NPK fertilizer were 100, 200 and 300 Kg ha^{-1}. Uniform cultural practices were followed for the experiment. The soil of the experimental field was sandy loam in texture with pH 6.7 and organic carbon 0.5 %. Observations on four plant characters viz. length and girth of main suckers $plant^{-1}$ (cm), number of side suckers $plant^{-1}$ and number of petioles $clump^{-1}$ 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 Topi attended the maximum length of main suckers of 81.59 cm followed by Kadma Local (79.31 cm) while NDC 1 (29.73 cm) was dwarf in nature. The different genotypes showed differences in girth of main sucker. The genotype Jhankri showed the maximum girth (18.51 cm) but Topi (16.49) and Kadma Local (15.57 cm) was the close second and third one with non-significant difference. Number of side suckers plant^{-1} was recorded maximum (7.76) in Jhankri closely followed by in Kadma Local (7.21) and Topi (7.15) with non – significant difference. This genotype Jhankri producing maximum number of petioles clump^{-1} (27.87) significantly suppressed all others with big margin. Genotype Kadma Local was the second best (27.87 petioles clump^{-1}) in this respect and Topi (26.33 petioles clump^{-1}), the third one with non – significant difference to each other. A perusal of data revealed that higher doses of NPK resulted in increased al vegetative growth parameters than lower level.

The effect of NPK @ 300 kg ha^{-1} on length and girth of main sucker, number of side suckers plant^{-1} and number of petioles clump^{-1} were recorded maximum (66.15 cm, 13.92 cm, 5.63 and 21.20, respectively) followed by that of recorded due the effect of NPK @ 200 kg ha^{-1}.

Significant variations in yield attributing characters were observed among taro collections (Table -2). Jhankri produced maximum number of cormels plant^{-1} (23.03). Entry Kadma Local, a entry from Jharkhand itself, and Topi were the second and third best (21.89 and 21.63, respectively) and were at par with the data of Jhankri in this respect.

Singh and Singh (1985), Barrooah *et al.*, (1985) and Dwivedi and Sen (1998) 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 application of NPK @ 300 kg ha^{-1} produced maximum number of cormels plant^{-1} (19.72) and was significantly better over the application only of NPK @ 300 kg ha^{-1}.

Corm weight was recorded maximum in Jhankri (196.83 g) and Kadma Local was the close second best (151.23 g) with significant differences. Average weight of cormel varied from 13.64 to 17.68 g. Topi produced biggest cormel (17.68 g) closely followed by C – 189 (17.06g), Jhankri (16.50 g) and Kadma Local (16.36 g) and all were at par to each other.

Kuruvilla and Singh (1981), Singh and Singh (1985), Jaiswal *et al.*, (1989) and Sibyala (2013) also obtained great variations in cormel size of taro.

Kadma Local, an entry from Jharkhand itself, produced maximum weight of cormel plant^{-1} (385.70 g) closely followed by Jhankri (381.34 g) with non-significant difference. Jaiswal *et al.*, (1989) and Dwivedi and Sen (2001) 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 whereas 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.

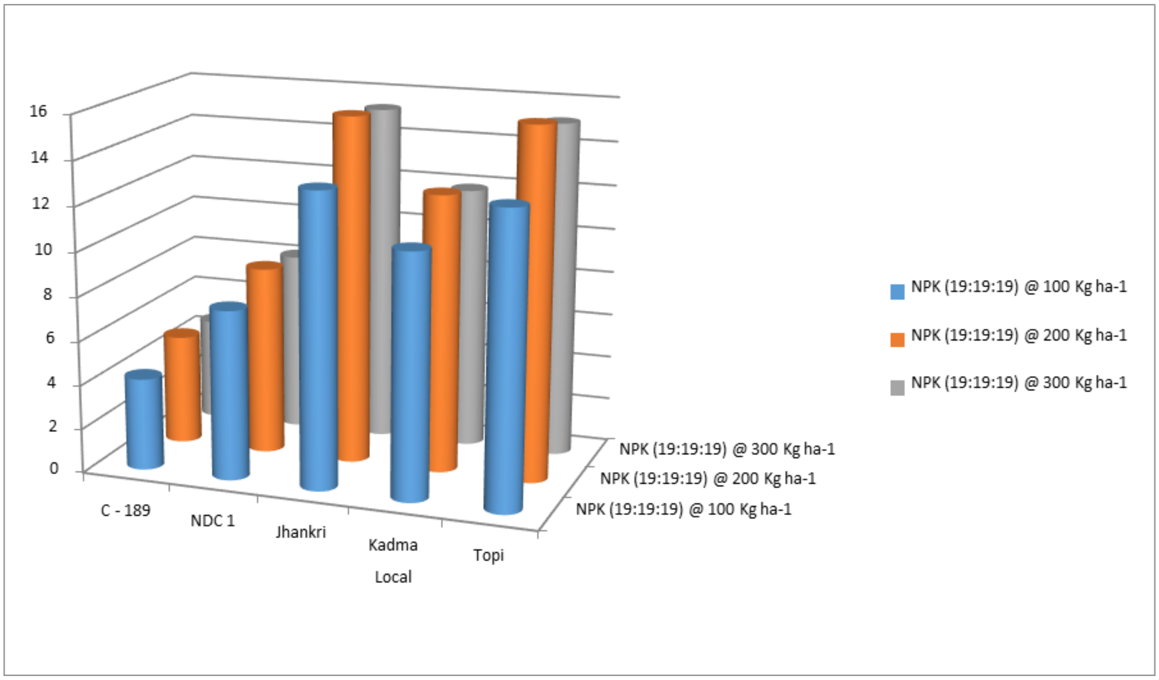
Table.1 Growth parameters of taro [*Colocasia esculenta* (L.) Schott] as influenced by cultivar and NPK fertilizer

Treatments	Length of main sucker (cm)	Girth of main sucker (cm)	No. of side suckers Plant^{-1}	No. of petioles Clump^{-1}
Cultivar				
C - 189	57.72	11.35	3.14	7.05
NDC 1	30.53	6.55	2.03	4.73
Jhankri	71.48	18.51	7.76	36.05
Kadma Local	79.31	15.57	7.21	27.87
Topi	81.59	16.49	7.15	26.33
LSD $_{0.05}$	7.67	3.15	2.13	3.21
NPK Fertilizer (19:19:19)				
100 Kg ha^{-1}	62.02	13.47	5.28	19.69
200 Kg ha^{-1}	64.20	13.70	5.47	20.34
300 Kg ha^{-1}	66.15	13.92	5.63	21.20
LSD $_{0.05}$	2.11	0.17	0.21	0.19

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

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 - 189	7.78	94.77	109.76	17.06	4.59
NDC 1	17.27	56.33	193.86	13.64	8.11
Jhankri	23.03	196.83	381.34	16.50	14.73
Kadma Local	21.89	151.23	385.70	16.36	11.79
Topi	21.63	74.00	373.47	17.68	14.70
LSD $_{0.05}$	6.02	7.31	11.56	3.03	5.24
NPK Fertilizer (19:19:19)					
100 Kg ha^{-1}	17.16	111.73	282.38	14.85	9.84
200 Kg ha^{-1}	19.72	118.58	296.53	17.66	11.50
300 Kg ha^{-1}	18.08	113.59	287.57	16.23	11.02
LSD $_{0.05}$	2.01	2.13	4.54	1.23	0.42

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



A significant yield variation was noticed among the genotypes. Though the highest cormel yield was obtained by the genotype Jhankri (14.73 t ha^{-1}), a genotype producing maximum number of cormel plant^{-1} to a tune of 23.03 and corm weight (196.83 g) and second best in case of production of cormels plant^{-1} with respect of weight (381.34 g) and approximately same yield was also obtained by Topi (14.70 t ha^{-1}) and significantly higher cormel yields were also obtained from other genotype - Kadma Local (11.79 t ha^{-1}). Poor yield (4.59 t ha^{-1}) of the entry C-189, a genotype having poor vegetative growth, might be due to lower number and weight of cormels plant^{-1}. Genotypes of C-series also showed poor yield performance under Dholi, Kalyani and Lohardaga conditions.

A significant variation in yield and yield attributes were also noticed due to cultivation of taro at different doses of NPK fertilizer. Application of NPK fertilizer @ 200 Kg ha^{-1} to taro plants performed best yield (11.50 t ha^{-1}) and significantly superior over performance due to other two doses of 300 and 100 Kg ha^{-1}. Application of NPK fertilizer to the soil was necessary due to its low fertility in order to increase the crop growth and productivity which was in agreement with the results obtained by Shiyam *et al.,* (2007) and Mare and Modi (2009). A crop response to fertilizer is higher in soil with low nutrient contents than soil with high nutrient researve (Tisdale and Nelson, 1975). 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 photosynthates deposited in the sink. This agreed with the result obtained by Ahmed and Badr (2009) and Orji *et al.,* (2016) and also is in agreement with the result of Ahmed (1981) found during experimentation with sweet pepper in the Sudan Gezira area.

It is evident from studied figure reveal that both cultivar and application of NPK fertilizer had an significant effect on the yield of cormel of taro. But cultivar was found to be more responsive to yield than that of application of NPK fertilizer (Fig. 1). However, with the interaction of cultivar – NPK fertilizer at increased rates significantly increased the studied parameter of yield at certain levels but beyond the further increment in the rate of NPK fertilizer, the upward trend sharply declined. The highest yield of taro cultivar Topi was obtained 15.81 t ha^{-1} closely followed by Jhankri from plants shown under application of NPK fertilizer @ 200 Kg ha^{-1} and significantly differed over other treatment combinations of cultivar and NPK fertilizer.

In last, it can be concluded that cultivation of Jhankri, Kadma Local and Topi planted under fertilizer application of NPK @ 200 Kg ha^{-1} will be attractive and beneficial for taro [*Colocasia esculenta* (L.) Schott] (locally called Kachu, arvi or pekchi) cultivation by the farmers of Palamu district and adjoining areas of agro-climatic condition of Zone IV of Jharkhand and uplift the socio-economic condition of them.

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