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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ABSTRACT

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.

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

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 Aroidae. 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 tetro
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
cocoayam 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.


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

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Length of main sucker (cm)</th>
<th>Girth of main sucker (cm)</th>
<th>No. of side suckers Plant⁻¹</th>
<th>No. of petioles Clump⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C - 189</td>
<td>57.72</td>
<td>11.35</td>
<td>3.14</td>
<td>7.05</td>
</tr>
<tr>
<td>NDC 1</td>
<td>30.53</td>
<td>6.55</td>
<td>2.03</td>
<td>4.73</td>
</tr>
<tr>
<td>Jhankri</td>
<td>71.48</td>
<td>18.51</td>
<td>7.76</td>
<td>36.05</td>
</tr>
<tr>
<td>Kadma Local</td>
<td>79.31</td>
<td>15.57</td>
<td>7.21</td>
<td>27.87</td>
</tr>
<tr>
<td>Topi</td>
<td>81.59</td>
<td>16.49</td>
<td>7.15</td>
<td>26.33</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>7.67</td>
<td>3.15</td>
<td>2.13</td>
<td>3.21</td>
</tr>
</tbody>
</table>

| 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

<table>
<thead>
<tr>
<th>Treatments</th>
<th>No. of cormels Plant⁻¹</th>
<th>Corm weight (g)</th>
<th>Weight of cormels Plant⁻¹ (g)</th>
<th>Average weight of cormel (g)</th>
<th>Cormel yield (t ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C - 189</td>
<td>7.78</td>
<td>94.77</td>
<td>109.76</td>
<td>17.06</td>
<td>4.59</td>
</tr>
<tr>
<td>NDC 1</td>
<td>17.27</td>
<td>56.33</td>
<td>193.86</td>
<td>13.64</td>
<td>8.11</td>
</tr>
<tr>
<td>Jhankri</td>
<td>23.03</td>
<td>196.83</td>
<td>381.34</td>
<td>16.50</td>
<td>14.73</td>
</tr>
<tr>
<td>Kadma Local</td>
<td>21.89</td>
<td>151.23</td>
<td>385.70</td>
<td>16.36</td>
<td>11.79</td>
</tr>
<tr>
<td>Topi</td>
<td>21.63</td>
<td>74.00</td>
<td>373.47</td>
<td>17.68</td>
<td>14.70</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>6.02</td>
<td>7.31</td>
<td>11.56</td>
<td>3.03</td>
<td>5.24</td>
</tr>
</tbody>
</table>

| 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                  |
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 Shiyan 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 researeve (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 deposits 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 [\textit{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.

References


Of Florida State Horticultural Society, 85:85-94.


