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## Integrated crop management for viable production of banana cv. Tella chakkerakeli (AAA) under Godavari alluvial soils of Andhra Pradesh

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### Abstract

Tella chakkerakeli (AAA) is high priced commercial banana cultivar grown in Andhra Pradesh owing to its characteristic taste, aroma and quality. Demand for this banana could not met due to its low productivity. Timely and precise application of inputs like water, fertilizer, to the crop optimizes its productivity. The integrated approach is to adopt practices like drip irrigation, fertigation, mulching, foliar sprays, bunch sprays and bunch sleeves etc. to enhance the productivity. Hence, the present study was conducted to increase the yield of Tella Chakkerakeli banana in sustainable manner. Thirteen treatments with different combinations of micro nutrient foliar sprays, bunch sprays with various sources of potassium, with or without polyethylene bunch sleeves along with control were carried out in Randomised Block Design, replicated twice at Dr. YSRHU-Horticultural Research Station, Kovvur, Andhra Pradesh. Among all the treatments, by adopting drip irrigation, fertigation with 75% of recommended dose of fertiliser based on soil test, 100 micron polyethylene mulching, foliar sprays with IIHR Arka Banana Special @ 0.5% at 5, 6, 7 months after planting and bunch spray with KNO<sub>3</sub> @ 0.5% on de-navelled bunches at 5 and 30 days after last hand opening without bunch sleeves enhanced the yield (45.16 t ha<sup>-1</sup>) and benefit cost ratio (1.51) of Tella chakkerakeli banana over traditional practices like flood irrigation, 100% recommended dose of fertiliser through pocketing, without mulching, foliar, bunch sprays and bunch covers (32.76 t ha<sup>-1</sup>, 1.23 respectively).

**Keywords:** Tella chakkerakeli, integrated crop management, bunch spray, Arka banana special

### Introduction

Banana is the most preferred, very popular, fresh fruit consumed all over the world due to its low price and high nutritive value. It is an excellent source of carbohydrates, edible fibre, minerals (P, K, Ca), vitamins (A, B<sub>6</sub>, C, D) with minimum fat and is easily digestible than many fruits. India is one of the largest banana producing countries contributing about 25% to the global production with a production of 34.53 million tonnes. Among the banana producing states in India, Andhra Pradesh produces 18% of banana. A wide array of traditional cultivars viz., Amritpani, Karpura chakkerakeli, Tella chakkerakeli, Nellore amritpani etc. are grown along with commercial cultivar Grand Naine. Tella chakkerakeli (AAA) cultivation is mostly confined to Krishna and Godavari alluviums which are highly fertile soils. It is the premier variety with soft, sweet pulp and good aroma. However, the productivity of Tella chakkerakeli is very less (15 t ha<sup>-1</sup>), compared to the commercial cultivar Grand Naine (65-75 t ha<sup>-1</sup>). Though the productivity is less, it fetches premium price in the market. In order to enhance the productivity and profitability of Tella chakkerakeli, the integrated use of available latest production technologies like drip irrigation, fertigation, plastic mulching, bunch covers, foliar and bunch sprays etc. is need of the hour. Hence, an experiment was conducted at Dr. YSRHU-HRS, Kovvur to improve fruit grade in addition to productivity, which are mostly determined by pre-harvest bunch management practices.

### Materials and Methods

Planting material used in this experiment was tissue culture plants of Tella chakkerakeli which were procured from Tissue culture laboratory of Dr. YSRHU-Horticultural Research Station, Kovvur. Tella chakkerakeli (AAA), produces small bunches and weighs 7-8 kg with 5-6 hands and 70-80 fruits. Fruits are short, stout, slightly curved and glistening green. Fruit rind is thick, pulp is soft with high TSS and characteristic pleasant aroma. The trial was conducted in randomised block design with thirteen treatments comprising various combinations of different sources of micronutrients as foliar sprays, different sources of

potassium as bunch sprays, with and without bunch sleeves along with control (100% recommended dose of fertilisers (RDF), flood irrigation, without polyethylene mulching, foliar, bunch sprays and bunch cover) and replicated twice. Except in control, all the other treatments were supplied uniformly with 75% of recommended dose of fertilisers (Nitrogen and potassium) based on soil test through fertigation for 24 weeks at pre shooting and 4 weeks at post shooting and 100 microns polyethylene mulching was used. Entire phosphorus was applied as basal at the time of planting. Transparent, 2% ventilated, 25 microns polyethylene bunch covers were used for treatments involving bunch covers. The treatment details are as follows.

- Drip irrigation + 75% RDF based on soil test + Polyethylene mulching (100 micron thickness)
- Micro nutrient spray- IHR Arka Banana Special @ 0.5% at 5, 6, 7 months after planting (MAP)
- Micro nutrient spray- FeSO<sub>4</sub>, ZnSO<sub>4</sub>, MgSO<sub>4</sub> and Boron (each @ 0.2% at 3, 5, 6 MAP)
- Bunch spray -K<sub>2</sub>SO<sub>4</sub> @ 0.5% (Two times on de-navelled bunches at 5 and 30 days after last hand opening)
- Bunch spray -KH<sub>2</sub>PO<sub>4</sub> @ 0.5% (Two times on de-navelled bunches at 5 and 30 days after last hand opening)
- Bunch spray -KNO<sub>3</sub> @ 0.5% (Two times on de-navelled bunches at 5 and 30 days after last hand opening)
- Bunch cover

#### Treatment combinations

- T<sub>1</sub>: a+b+d+g  
 T<sub>2</sub>: a+b+e+g  
 T<sub>3</sub>: a+b+f+g  
 T<sub>4</sub>: a+c+d+g  
 T<sub>5</sub>: a+c+e+g  
 T<sub>6</sub>: a+c+f+g  
 T<sub>7</sub>: a+b+d  
 T<sub>8</sub>: a+b+e  
 T<sub>9</sub>: a+b+f  
 T<sub>10</sub>: a+c+d  
 T<sub>11</sub>: a+c+e

T<sub>12</sub>: a+c+f

T<sub>13</sub>: Control (Conventional flooding, 100% RDF, without polyethylene mulching, foliar & bunch sprays and bunch covers)

The data were subjected to statistical analysis by the method of analysis of variance outlined by Panse and Sukhatme (1989) [5].

## Results and Discussions

### Growth parameters at shooting

Among the growth parameters at shooting, except leaf area, all other growth parameters like plant height, plant girth, number of leaves and days to shooting were not significantly influenced by various treatments under study (Table 1). Significantly maximum leaf area was observed in all the treatments with (a+b) i.e., drip irrigation, fertigation with 75% RDF based on soil test, 100 micron polyethylene mulching and foliar spraying of Arka Banana Special @ 0.5% at 5, 6, 7 MAP (Months After Planting) over all the treatments containing (a+c) i.e., drip irrigation, fertigation with 75% RDF based on soil test, 100 micron polyethylene mulching and foliar spraying of FeSO<sub>4</sub>, ZnSO<sub>4</sub>, MgSO<sub>4</sub> and Boron each @ 0.2% at 3, 5, 6 MAP and control. Significantly largest leaf area was observed in T<sub>2</sub> (15.26 m<sup>2</sup>) which was on par with T<sub>3</sub> (14.52 m<sup>2</sup>), T<sub>1</sub> (14.48 m<sup>2</sup>), T<sub>7</sub> (14.39 m<sup>2</sup>), T<sub>9</sub> (13.86 m<sup>2</sup>) and T<sub>8</sub> (13.28 m<sup>2</sup>). Enhanced leaf area with micro nutrient sprays was also found by Bashma *et al.* (2018) [1] in banana cv. Nendran, Hazarika *et al.* (2018) [2] in banana cv. Grand Naine, Nisarga *et al.* (2022) [4] in banana cv. Rajapuri. Arka banana special supplies six micro nutrients viz., zinc, iron, boron, copper, manganese, molybdenum and three secondary nutrients viz., calcium, magnesium and sulphur which plays a greater role in the synthesis of critical auxins, protein and also enhances the photosynthetic activity that increased the cell division and chlorophyll content in leaf which in turn increased the leaf area as explained by Shetty *et al.* (2022) [8]. However, copper, manganese, molybdenum and calcium which are also essential for banana are lacking in the other micronutrient foliar spray.

**Table 1:** Effect of different treatments under integrated crop management on growth of banana cv. Tella chakkera keli at shooting

Treatment	Plant height (cm)	Plant Girth (cm)	Leaf area (m <sup>2</sup> )	No. of leaves	No. of days to shooting
T <sub>1</sub> : a+b+d+g	310.63	64.00	14.48	10.50	265.50
T <sub>2</sub> : a+b+e+g	308.34	65.34	15.26	11.84	259.00
T <sub>3</sub> : a+b+f+g	293.13	63.00	14.52	10.75	260.13
T <sub>4</sub> : a+c+d+g	288.34	65.17	10.34	9.50	250.83
T <sub>5</sub> : a+c+e+g	271.63	62.38	12.66	9.96	241.46
T <sub>6</sub> : a+c+f+g	276.42	62.46	12.19	10.29	260.17
T <sub>7</sub> : a+b+d	295.25	59.38	14.39	10.13	245.38
T <sub>8</sub> : a+b+e	300.00	62.50	13.28	10.13	247.38
T <sub>9</sub> : a+b+f	295.00	62.75	13.86	10.75	265.63
T <sub>10</sub> : a+c+d	291.67	64.25	9.49	9.59	262.67
T <sub>11</sub> : a+c+e	271.88	58.50	11.72	9.25	249.25
T <sub>12</sub> : a+c+f	273.75	60.63	10.22	8.75	260.25
T <sub>13</sub> : Control	292.50	61.67	10.46	9.59	226.55
SEm±	18.57	2.50	0.95	0.66	12.58
C.D. (0.05)	NS	NS	2.95	NS	NS

### Yield and yield attributing characters

Among yield and yield attributing characters, hands bunch<sup>-1</sup>, number of fingers in 2<sup>nd</sup> hand and fingers bunch<sup>-1</sup> were not significantly influenced by the treatments (Table 2). However, individual finger weight, bunch weight and yield ha<sup>-1</sup> were significantly influenced by the treatments (Table 2).

Significantly highest finger weight of 151.83 g was observed in T<sub>2</sub> which was on par with T<sub>11</sub>, T<sub>10</sub> and T<sub>4</sub>. Whereas, maximum bunch weight (15.21 kg) and yield (45.16 t ha<sup>-1</sup>) was observed in T<sub>9</sub> which was on par with T<sub>7</sub>, T<sub>1</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>12</sub> and T<sub>2</sub>, T<sub>5</sub>. All the treatments with bunch covers enhanced bunch weight except T<sub>6</sub>. The enhanced finger weight and

bunch weight due to bunch cover might be due to the enhanced temperature and altered microclimate around bunch cover, which provides a congenial environment for better fruit growth and development as elucidated by Singh *et al.* (2023)<sup>[9]</sup>. The results are in conformity with the findings of Rubel *et al.* (2019)<sup>[7]</sup> in banana cv. Mehersagar. Moreover, the same treatments without bunch covers and treatments with (a+c) management practices did not enhance bunch weight significantly except bunch spray with KNO<sub>3</sub>. When compared to control, in all the treatments bunch weight and yield

increased significantly. Similar results were observed in banana by Paul *et al.* (2008)<sup>[6]</sup> with drip irrigation, mulch and Jyothi *et al.* (2020)<sup>[3]</sup> in Grand Naine with the application of banana special and bunch cover which enhanced bunch weight by 6.0%. The micronutrients help in the metabolism and in the translocation of major nutrients to the source and produced photosynthates from the source to sink. Additional secondary nutrients like Ca, Mg, and S which are present in the banana special would be the one of the additional benefits for the yield enhancement.

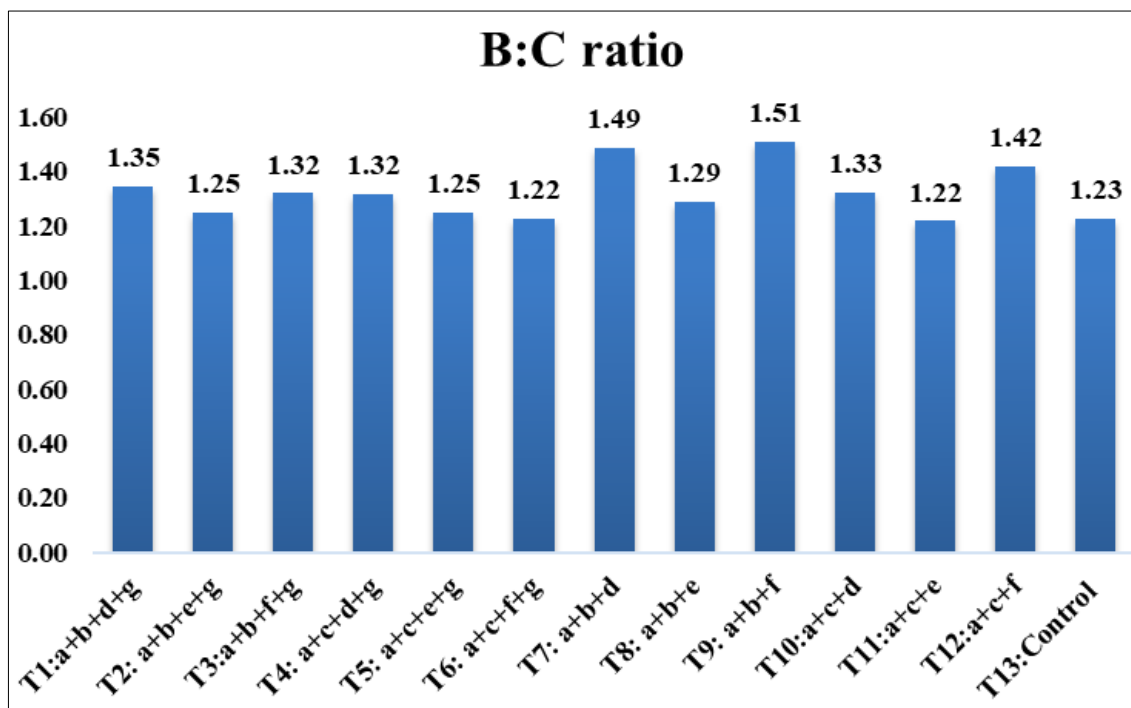
**Table 2:** Effect of different treatments under integrated crop management on yield and yield attributing characters of banana cv. Tella chakkera keli

Treatment	Hands bunch <sup>-1</sup>	No. of fingers in 2 <sup>nd</sup> hand	Fingers bunch <sup>-1</sup>	Finger weight (g)	Bunch weight (kg)	Yield (t ha <sup>-1</sup> )
T <sub>1</sub> : a+b+d+g	5.38	14.00	71.00	135.07	15.00	44.54
T <sub>2</sub> : a+b+e+g	4.75	13.00	63.50	151.83	14.00	41.57
T <sub>3</sub> : a+b+f+g	5.13	13.29	65.25	130.26	14.67	43.54
T <sub>4</sub> : a+c+d+g	5.17	14.33	70.50	146.11	14.67	43.56
T <sub>5</sub> : a+c+e+g	4.63	14.13	64.13	138.79	14.00	41.57
T <sub>6</sub> : a+c+f+g	5.00	14.17	63.17	136.83	13.59	40.33
T <sub>7</sub> : a+b+d	5.38	14.63	70.50	130.70	15.00	44.54
T <sub>8</sub> : a+b+e	5.25	14.63	68.88	138.05	13.13	38.97
T <sub>9</sub> : a+b+f	5.25	15.75	66.13	115.91	15.21	45.16
T <sub>10</sub> : a+c+d	5.00	16.00	65.34	148.97	13.34	39.59
T <sub>11</sub> : a+c+e	5.25	14.25	71.00	149.28	12.38	36.74
T <sub>12</sub> : a+c+f	5.38	14.75	69.88	130.01	14.25	42.31
T <sub>13</sub> : Control	5.00	14.34	67.17	133.87	12.34	32.76
SEm±	0.28	0.74	4.50	4.04	0.51	1.51
CD (0.05)	NS	NS	NS	12.59	1.59	4.72

**Economics**

Among the treatments, highest BC ratio was recorded in T<sub>9</sub> (1.51) over control T<sub>13</sub> (1.23) (Figure 1). Paul *et al.* (2008)<sup>[6]</sup>

also reported that an increase of 49% in net seasonal income and highest benefit-cost ratio by adopting drip irrigation with mulch as compared to conventional irrigation in banana.



**Fig 1:** Effect of different treatments under integrated crop management on economics of banana cv. Tella chakkera keli

**Conclusion**

Integrating crop management practices like drip irrigation, fertigation with 75% RDF based on soil test, use of 100 micron polyethylene mulching, foliar spray with IHR Arka Banana Special @ 0.5% at 5, 6, 7 MAP and bunch spray with

KNO<sub>3</sub> @ 0.5% on de-navelled bunches at 5 and 30 days after last hand opening enhanced the yield and profitability of banana cultivar Tell Chakkera keli under Godavari alluviums over traditional practices like flood irrigation, 100% RDF through pocketing, without mulching, foliar and bunch sprays.

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