

Original Research Article

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## Conjunction of Inorganic and Organic Nutrients in Combination with Biofertilizers on Economic Analysis of Tissue Culture Banana cv. Grand Naine (AAA)

S. Firoz Hussain<sup>1\*</sup>, Lakshminarayana Reddy<sup>1</sup> and Venkata Ramudu<sup>2</sup>

<sup>1</sup>Dr YSRHU, Venkataramannagudem, Andhra Pradesh, India

<sup>2</sup>SKCHS, Anantapuramu, Andhra Pradesh, India

\*Corresponding author

### ABSTRACT

#### Keywords

Inorganic, Organic, Biofertilizers, Economic analysis, Banana and Grand Naine.

#### Article Info

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A field study was conducted at College of Horticulture, Anantharajupet to evaluate the yield and economics of banana cultivation during the years 2012 – 2013. More gross returns (3,74,110) were obtained with the application of 80 % RDF (inorganic) + 20 % RDF (FYM) along with *Azospirillum*, Phosphate solubilizing bacteria (PSB) and *Frateruria aurantia* (FA). Production of banana with the application of 80 % RDF (inorganic) + 20 % RDF (FYM) along with *Azospirillum*, Phosphate solubilizing bacteria and *Frateruria aurantia* and disposing the banana bunches has resulted in a higher benefit cost ratio (3.59). More gross returns were obtained due to higher bunch yield in the treatments containing inorganic fertilizers, organic sources of nutrients along with biofertilizers. However, application of recommended dose of fertilizers in the form of organic and inorganic sources of nutrients along with biofertilizers was found economical despite its higher cost of cultivation.

### Introduction

India leads the globe in acreage and production of banana. It is being grown in an area of 0.85 m.ha with an annual production of 30.27 million tonnes (Anon, 2017). Banana, popularly regarded as ‘‘Apple of Paradise’’ is a rich source of vitamins and minerals especially Potassium. Banana owing to its large size and rapid growth rate require relatively large amount of nutrients for higher yield and quality. Application of inorganic fertilizers though increases the yield substantially but could not able to sustain the fertility status of the soil (Somasundaram *et al.*, 2014). Integrated nutrient management (INM) found to be beneficial for maintenance

of soil fertility and plant nutrient supply to an optimum level, for sustaining desired crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner. The basic principle of INM is the maintenance of soil fertility, sustainable agricultural productivity and improving farmers’ profitability through judicious and efficient use of chemical fertilizers, organic manure, green manure and biofertilizers etc (Bhalerao *et al.*, 2009). Grand Naine is a popular variety grown mostly in all export oriented countries of Asia, South America and Africa. This is a superior selection of Giant Cavendish which

was introduced to India in 1990's. Due to many desirable traits like excellent fruit quality, immunity to fusarium wilt etc, it has proved better variety (Singh and Chundawat, 2002). Among all cultivars, Grand Naine is best preferred variety owing to its good shape, size and delicious state (Hazarika *et al.*, 2011).

## Materials and Methods

The present investigation was carried out during the years 2012 – 13 at College of Horticulture, Anantharajupet which is located at an altitude of 215 meters above mean sea level at 13. 98<sup>0</sup> North latitude and 79.40<sup>0</sup> East longitude, respectively. The maximum and minimum temperatures during the experiment were 39.03<sup>0</sup>C and 31.0<sup>0</sup>C and relative humidity during the period of crop growth ranged between 77.0 to 87.0 % respectively. The experiment consisted of eleven treatments which were replicated thrice and the statistical design used was Randomized Block Design (RBD). The treatments included were T<sub>1</sub> – 100 % Recommended dose of fertilizers (RDF) 300:50:300 g NPK plant<sup>-1</sup> crop cycle<sup>-1</sup>, T<sub>2</sub> – 80 % RDF 240:40:240 g NPK plant<sup>-1</sup> crop cycle<sup>-1</sup> through inorganic fertilizers + 20 % RDN through vermicompost (VC), T<sub>3</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN through VC + *Azospirillum*, T<sub>4</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN through VC + Phosphate solubilizing bacteria (PSB), T<sub>5</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN through VC + *Frateuria aurantia* (FA), T<sub>6</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN through VC + *Azospirillum* + PSB + FA, T<sub>7</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN (Farmyard manure (FYM), T<sub>8</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN (FYM) + *Azospirillum*, T<sub>9</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN (FYM) + PSB, T<sub>10</sub> – 80 % RDF through

inorganic fertilizers + 20 % RDN (FYM) + FA and T<sub>11</sub> – 80 % RDF through inorganic fertilizers + 20 % RDN (FYM) + *Azospirillum* + PSB + FA.

Calculated quantities of organic manures (Vermicompost @ 4.285 kg plant<sup>-1</sup> and Farmyard manure @ 5.309 kg plant<sup>-1</sup>) along with biofertilizers *viz.*, *Azospirillum* (50 g), Phosphate solubilizing bacteria (50 g) and *Frateuria aurantia* (25 g) were applied directly to the pits prior to planting. The data was analyzed as per the method of variance outlined by Panse and Sukhatme (1985). Statistical significance was tested by F value at 5% level of significance. Critical difference at 0.05 levels was worked out for the effects which were significant.

Matured bunches were harvested and data on weight of the bunch were estimated as per standard methods. The yield per hectare was calculated by multiplying the average bunch weight with total number of plants per hectare and expressed in tonnes per hectare. The economics of the individual treatment was calculated based on the total cost of cultivation and gross return and were expressed on per hectare basis. The expenditures both recurring and non – recurring required during the cropping period were computed based on the investment on preparatory cost including planting materials. Net return was calculated by subtracting gross expenditure from the gross return on per hectare basis. The cost benefit ratio was calculated from the value of total expenditure and gross return based on the benefit obtained on per rupee cost in different treatments separately.

## Results and Discussion

Economics of cultivation is the most important single factor which decides the adoption of any improved practices by the

grower. The cost – benefit ratio of treatments is another most important factor that determines its usefulness and acceptance by the grower. A treatment should not only be effective but also should be profitable proposition to be acceptance by a grower. In the present study, the different treatments showed clear impact on the comparative economics of the production of banana under the influence of inorganic, organic nutrients in combination with biofertilizers.

### Yield analysis

The yield data pertaining to the banana production under the influence of different combination of organic manures, inorganic nutrients and biofertilizers are given in Table 1. From the data, it is apparent that the treatment 80 % RDF (inorganic) + 20 % RDN (FYM) along with *Azospirillum*, PSB and *Frateuria aurantia* recorded significantly highest yield (68.02 t ha<sup>-1</sup>) compared to other treatments followed by 80 % RDF (inorganic) + 20 % RDN (vermicompost) along with *Azospirillum*, PSB and *Frateuria aurantia*

(66.31 t ha<sup>-1</sup>). Lowest yield (53.65 t ha<sup>-1</sup>) was recorded by 100 % RDF (inorganic).

### Total cost of cultivation

Among all the treatments, highest cost of cultivation 86, 280.13 Rs /- ha<sup>-1</sup> was incurred in 80 % RDF (inorganic) + 20 % RDN (vermicompost) along with *Azospirillum*, PSB and *Frateuria aurantia* followed by 84, 877.43 Rs /- ha<sup>-1</sup> in 80 % RDF (inorganic) + 20 % RDN (FYM) along with PSB and lowest of 78, 509.95 Rs /- ha<sup>-1</sup> in 100 % RDF (inorganic).

### Gross return

INM package with 80 % RDF (inorganic) + 20 % RDN (FYM) along with *Azospirillum*, PSB and *Frateuria aurantia* recorded highest gross returns in monetary terms (3,74,110 Rs /-) followed by 80 % RDF (inorganic) + 20 % RDN (vermicompost) along with *Azospirillum*, PSB and *Frateuria aurantia* (3, 64, 705 Rs /-) and the lowest (2, 95, 075 Rs) was in 100 % RDF (inorganic).

**Table.1** Economics of the banana cv. Grand Naine (AAA) cultivation as influenced by different INM treatments

| Treatments  | Yield (t ha <sup>-1</sup> ) | Total cost of cultivation | Gross returns | Net returns | Benefit : Cost ratio |
|---|-----------------------------|---------------------------|---------------|-------------|----------------------|
| T <sub>1</sub> : 100 % RDF  | 53.65                       | 78509.95                  | 295075        | 216565.05   | 2.76                 |
| T <sub>2</sub> : 80 % RDF + 20% RDN through VC                    | 54.89                       | 83895.33                  | 301895        | 217999.67   | 2.60                 |
| T <sub>3</sub> : T <sub>2</sub> + <i>Azospirillum</i>             | 57.97                       | 84877.43                  | 318835        | 233957.57   | 2.76                 |
| T <sub>4</sub> : T <sub>2</sub> + PSB                             | 60.99                       | 84877.43                  | 334950        | 250072.57   | 2.95                 |
| T <sub>5</sub> : T <sub>2</sub> + FA                              | 65.15                       | 84315.93                  | 358325        | 274009.07   | 3.25                 |
| T <sub>6</sub> : T <sub>2</sub> + <i>Azospirillum</i> + PSB + FA  | 66.31                       | 86280.13                  | 364705        | 278424.87   | 3.23                 |
| T <sub>7</sub> : 80 % RDF + 20% RDN through + FYM                 | 59.61                       | 79075.52                  | 327855        | 248779.48   | 3.15                 |
| T <sub>8</sub> : T <sub>7</sub> + <i>Azospirillum</i>             | 56.57                       | 80057.62                  | 311135        | 231077.38   | 2.89                 |
| T <sub>9</sub> : T <sub>7</sub> + PSB                             | 54.76                       | 80057.62                  | 301180        | 221122.38   | 2.76                 |
| T <sub>10</sub> : T <sub>7</sub> + FA                             | 59.36                       | 79496.12                  | 326480        | 246983.88   | 3.11                 |
| T <sub>11</sub> : T <sub>7</sub> + <i>Azospirillum</i> + PSB + FA | 68.02                       | 81460.32                  | 374110        | 292649.68   | 3.59                 |

RDF: Recommended dose of fertilizers, RDN: Recommended dose of nitrogen, PSB: Phosphate solubilizing bacteria, FA: *Frateuria aurantia*

**Table.2** Cost of cultivation of Tissue Culture banana cv. Grand Naine (AAA) per hectare

| S. No. | Particulars   | Cost ha <sup>-1</sup> (Rs/-) |
|--------|---|------------------------------|
| 1      | Land preparation (Deep ploughing and harrowing)                             | 10,000.00                    |
| 2      | Preparation of channels   | 2,210.00                     |
| 3      | Digging pits  | 6,500.00                     |
| 4      | Cost of fertilizer treatments wise per hectare                              |                              |
| 4.1    | 100% RDF  | 3,169.95                     |
| 4.2    | 80% RDF (Inorganic) + 20% RDF Vermicompost (VC)                             | 8,555.33                     |
| 4.3    | 80% RDF (Inorganic) + 20% RDF (VC) + <i>Azospirillum</i>                    | 9,537.43                     |
| 4.4    | 80% RDF (Inorganic) + 20% RDF (VC) + Phosphorus solubilizing bacteria (PSB) | 9,537.43                     |
| 4.5    | 80% RDF (Inorganic) + 20% RDF (VC) + <i>Frateuria aurantia</i> (FA)         | 8,975.93                     |
| 4.6    | 80% RDF (Inorganic) + 20% RDF (VC) + <i>Azospirillum</i> + PSB + FA         | 10,940.13                    |
| 4.7    | 80% RDF (Inorganic) + 20% RDF (FYM)   | 3,735.52                     |
| 4.8    | 80% RDF (Inorganic) + 20% RDF (FYM) + <i>Azospirillum</i>                   | 4,717.62                     |
| 4.9    | 80% RDF (Inorganic) + 20% RDF (FYM) + PSB                                   | 4,717.62                     |
| 4.10   | 80% RDF (Inorganic) + 20% RDF (FYM) + FA                                    | 4,156.12                     |
| 4.11   | 80% RDF (Inorganic) + 20% RDF (FYM) + <i>Azospirillum</i> + PSB + FA        | 6,120.32                     |
| 5      | Irrigation  | 7,540.00                     |
| 6      | Weeding   | 13,200.00                    |
| 7      | Fertilizer application  | 16,800.00                    |
| 8      | Planting material   | 5,280.00                     |
| 9      | Planting  | 2,040.00                     |
| 10     | Labour cost for spraying chemicals  | 3,770.00                     |
| 11     | Plant protection chemicals  | 3,000.00                     |
| 12     | Harvesting and loading  | 5,000.00                     |

### Net return

The net return is the main parameter for deciding the adoptability of a farming system. The highest net income of 2, 92, 649.68 Rs /- ha<sup>-1</sup> was obtained with 80 % RDF (inorganic) + 20 % RDN (FYM) along with *Azospirillum*, PSB and *Frateuria aurantia* followed by 2, 78, 424.87 Rs /- ha<sup>-1</sup> under 80 % RDF (inorganic) + 20 % RDN (vermicompost) along with *Azospirillum*, PSB and *Frateuria aurantia*. The lowest net income of 2, 16, 565.05 Rs /- ha<sup>-1</sup> was recorded in 100 % RDF (inorganic).

### Benefit – cost analysis

The evaluation of relative merit of integration of inorganic fertilizers and organic manures concomitant with biofertilizers in the present study in augmenting yield and thereby income. The data presented in Table 1 revealed that maximum cost benefit ratio of 3.59:1 was obtained in 80 % RDF (inorganic) + 20 % RDN (FYM) along with *Azospirillum*, PSB and *Frateuria aurantia*, followed by 3.25:1 in 80 % RDF (inorganic) + 20 % RDN (vermicompost) along with *Frateuria aurantia*. The highest ratio in 80 % RDF (inorganic) + 20 % RDN (FYM)

along with *Azospirillum*, PSB and *Frateriuria aurantia* might be due to the comparatively higher yield of 68.02 t ha<sup>-1</sup> which ultimately increases the cost benefit ratio. Among all the treatments, the lowest cost benefit ratio of 2.60:1 was obtained in 80 % RDF (inorganic) + 20 % RDF (vermicompost) which was mainly due to high gross expenditure with comparatively lower yield (54.89 t ha<sup>-1</sup>).

Economic benefit of any farming system is the major factor for its adoption by farmers. Different studies conducted in various parts of the globe proved that INM packages are superior to any other fertilizer management in respect of economics of cultivation in different crops. Marathe and Bharambe (2007) obtained complete supremacy in treatment using INM packages with 50 % RDF + 50 % FYM over the inorganic fertilizers with a highest cost benefit ratio of 4.59 in sweet orange cv. Mosambi. Our study is in the line of conformity with the findings of Chundawat *et al.*, (1983), Borges *et al.*, (1994), Kulkarni *et al.*, (1996), Duraiswami *et al.*, (1999) and El Naby (2000), who reported different INM packages including inorganic fertilizers, organic manures concomitant with biofertilizers in getting the maximum returns per unit as compared to the inorganic fertilizers alone.

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