Banana economics and contribution of production technologies

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ABSTRACT

Field experiment was conducted at Banana Research Station, Jalgaon, Maharashtra during 2014-2017 with the objective to identify efficient combination of inputs for improving growth and yield of banana under precision farming. The experiment was laid out in randomized block design (RBD) comprising five treatment combinations and four replications. The treatment T_6 [Drip irrigation- 80% ETc throughout the growth period; fertigation- 75% of worked out NPK based on STCR equation (120 tons/ha target) developed by MPKV, Rahuri, Maharashtra; micronutrient foliar spray (2% NRCB micronutrient mixture at 2, 3 and 4 MAP, 0.5% spray of EDTA-Zn and Fe each at 2 and 4 MAP; bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray); polyethylene mulching (30 micron)] was found superior for higher production and higher net income of banana followed by the treatment T_5 [Drip irrigation- 80% ETc throughout the growth period; fertigation- 75% of worked out NPK based on STCR equation (120 tons/ha target) developed by NRCB, Trichy, Tamil Nadu; micronutrient foliar spray (2% NRCB micronutrient mixture at 2, 3 and 4 MAP, 0.5% spray of EDTA-Zn and Fe each at 2 and 4 MAP; bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray); polyethylene mulching (30 micron)].

Keywords: Banana; economics; production technology; inputs; yield; growth

INTRODUCTION

Banana (*Musa* sp) is the leading fruit crop in tropical and subtropical regions of the world. Banana is grown in over 130 countries around the world and whilst primarily a tropical fruit, it is also grown in the subtropics and in greenhouses at latitudes outside of the subtropics (Bragard et al 2021).

Its year round availability, affordability, varietal range, taste, nutritive and medicinal value make it the favourite fruit among all classes of people. It also has good export potential.

Globally, India stands first both in area and production, but has a very meager share of less than 0.05 per cent of the international banana trade (Mustaffa and Kumar 2012). Bananas with year round availability provide a permanent source of income not only to the farmers and rural populations, but also to the traders and retailers, thus playing an important role in poverty alleviation. Now a days because of increasing input costs for banana production, the farmers are looking for new ways to increase efficiency and cut costs.

Standardization of production technology would be a viable alternative to improve productivity and profitability of the banana growers. Hence, the experiment was planned with the objectives to identify efficient input use technology for improving yield and quality of banana and find out the per cent contribution of technologies and economics of different treatment combinations.

MATERIAL and METHODS

Field experiment was conducted at Banana Research Station, Jalgaon, Maharashtra during 2014-2017 to identify efficient combination of inputs for improving growth and yield of banana under precision farming. The experiment was laid out in randomized block design (RBD) comprising seven treatment combinations and four replications. The treatment combinations were T_1: Control (soil application of RDF

+ surface irrigation), T_2: a + b + c, T_3: a + b + d, T_4: a + b + c + d, T_5: a + b + c + d + e, T_6: a + f + c + d + e (tissue culture plant) and T_7: a + f + c + d + e (rhizomes) [here a = Drip irrigation – 80% ETc throughout the growth period, b = Fertigation – 75% of worked out NPK based on STCR equation (120 tonnes/ha target) developed by NRCB, Trichy, Tamil Nadu, c = Micronutrient foliar spray {2% NRCB micronutrient mixture at 2, 3 and 4 MAP (T_2, T_4 and T_5), 0.5% spray of EDTA-Zn and Fe each at 2 and 4 MAP (T_6 and T_7)}, d = Bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray), e = Polyethylene mulching (30 micron), f = Fertigation – 75% of worked out NPK based on STCR equation (120 tonnes/ha target) developed by MPKV, Rahuri, Maharashtra].

Economics of treatments

The benefit-cost ratio for the different treatments was worked out based on the expenditure and return in order to study the economics of banana production under different treatments. In order to find out the accurate comparison of treatment combinations for yield and economics, the sustainability yield index and sustainability value index were also worked out as under index. The sustainability yield index was calculated by utilizing the mean, standard deviation for yield and maximum yield recorded by treatment combinations as suggested by Singh et al (1990) and further used by Badgujar and Deshmukh (2013) in banana crop:

$$\text{Sustainability yield index (SYI)} = \frac{Y - \sigma}{Y_{max}}$$

where Y = Average yield of treatment combinations over the year, σ = Standard deviation, Y_{max} = Observed maximum yield over the year

The sustainability value index was also calculated as per the method suggested by Singh et al (1990) and used by Badgujar et al (2018a, 2018b) in banana crop as under:

$$\text{Sustainability value index (SVI)} = \frac{V - SD\ (\sigma)}{V_{max}}$$

where V = Net income per hectare under each treatment, SD (σ) = Standard deviation, V_{max} = Maximum net income per hectare

RESULTS and DISCUSSION

The data in respect of yield per hectare, gross income, cost of treatments, net income, SVI, SYI and B-C ratio are depicted in Table 1. The highest yield of banana (123 tonnes/ha) was recorded under treatment T_6 [Drip irrigation – 80% ETc throughout the growth period; fertigation – 75% of worked out NPK based on STCR equation (120 tons/ha target) developed by MPKV, Rahuri, Maharashtra; micronutrient foliar spray (2% NRCB micronutrient mixture at 2, 3 and 4 MAP, 0.5% spray of EDTA-Zn and Fe each at 2 and 4 MAP; bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray); polyethylene mulching (30 micron)] and T_5 [Drip irrigation – 80% ETc throughout the growth period; fertigation – 75% of worked out NPK based on STCR equation (120 tonnes/ha target) developed by NRCB, Trichy, Tamil Nadu; micronutrient foliar spray (2% NRCB micronutrient mixture at 2, 3 and 4 MAP, 0.5% spray of EDTA-Zn and Fe each at 2 and 4 MAP; bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray); polyethylene mulching (30 micron)] (121 tonnes/ha) was found second best for this trait. The highest gross income was recorded in treatment T_6 (Rs 9,84,000) followed by T_5 (Rs 9,68,000).

Net income was received from the treatment combinations viz T_6 (Rs 6,73,256) and T_4 [Drip irrigation- 80% ETc throughout the growth period; fertigation- 75% of worked out NPK based on STCR equation (120 tons/ha target) developed by NRCB, Trichy, Tamil Nadu; micronutrient foliar spray (2% NRCB micronutrient mixture at 2, 3 and 4 MAP, 0.5% spray of EDTA-Zn and Fe each at 2 and 4 MAP; bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray)] (Rs 6,42,482). T_6 and T_4 also recorded highest SYI of 0.92 and 0.90 and SVI of 0.90 and 0.85 respectively. With regard to B-C ratio, the highest value (3.19) was recorded in T_4 followed by T_6 (3.17). The results recorded in the present investigations are in line with those recorded by Badgujar and Deshmukh (2013) and Badgujar et al (2018a, 2018b).

The data on the effect of treatments on the increase in yield of banana and increase in terms of money are depicted in Table 2. The use of drip irrigation + fertigation over RDF by conventional + surface irrigation (18% of water saving in drip) was found

Table 1. Economics of Grand Naine banana under different treatment combinations of production technologies

Treatment	Yield (tonnes/ha)	Gross income (Rs/ha)	Total cost (Rs/ha)	Net income (Rs/ha)	SYI	SVI	B-C ratio
T_1	94	7,52,000	2,82,112	4,69,888	0.69	0.60	2.67
T_2	114	9,12,000	2,92,966	6,19,034	0.85	0.82	3.11
T_3	113	9,04,000	2,89,380	6,14,620	0.84	0.81	3.12
T_4	117	9,36,000	2,93,518	6,42,482	0.87	0.84	3.19
T_5	121	9,68,000	3,26,624	6,41,376	0.90	0.85	2.96
T_6	123	9,84,000	3,10,744	6,73,256	0.92	0.90	3.17
T_7	107	8,56,000	2,88,613	5,67,387	0.79	0.47	2.97
SD	9.81	67,503	-	-	-	-	-

T_1: Control (soil application of RDF + surface irrigation), T_2: a + b + c, T_3: a + b + d, T_4: a + b + c + d, T_5: a + b + c + d + e, T_6: a + f + c + d + e (tissue culture plant), T_7: a + f + c + d + e (rhizomes); a= Drip irrigation- 80% ETc throughout the growth period, b= Fertigation- 75% of worked out NPK based on STCR equation (120 tons/ha target) developed by NRCB, Trichy, Tamil Nadu, c= Micronutrient foliar spray [2% NRCB micronutrient mixture at 2, 3 & 4 MAP (T_2, T_4 & T_5), 0.5% spray of EDTA-Zn and Fe each at 2 & 4 MAP (T_6 & T_7)], d= Bunch spray of SOP (2%) (I spray after male bud removal and II spray at 30 days after I spray), e= Polyethylene mulching (30 micron), f= Fertigation- 75% of worked out NPK based on STCR equation (120 tons/ha target) developed by MPKV, Rahuri, Maharashtra

Table 2. Contribution of production technologies in banana yield

Production technologies	Increase in banana yield (%)	Increase in terms of money (Rs/ha)
Drip irrigation + fertigation over RDF by conventional + surface irrigation (18% water saving in drip)	23.40	1,87,000
Use of tissue culture banana plants over rhizomes	14.95	1,27,075
Polyethelene mulching	5.13	51,000
Micronutrient foliar sprays	3.54	34,000
SOP bunch spray	2.56	25,500
MPKV's STCR equation over NRCB's STCR equation	1.65	17,000

superior and receded 23.40 per cent increase in yield and in terms of money it accounted for Rs 1,87,000 per hectare. Use of tissue culture seedlings over rhizome planting recorded 14.95 per cent increase and in terms of money it was Rs 1,27,075 per hectare. In rest of the treatments increase was in the range of 1.65 to 5.13 per cent and in terms of money from Rs 17,000 to 51,000 per hectare.

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