

Original Research Article

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## Economics of Integrated Nutrient Management in Sweet Corn (*Zea mays* L. *saccharata sturt.*)

Prashant N. Karanjikar\*, Bhairuba M. Wakchaure,  
Rohit Y. Karde and Shivaji R. Kadhavane

College of Agriculture, Vasantnaik Marathwada Krishi Vidyapeeth,  
Latur-413512, Maharashtra, India

\*Corresponding author

### ABSTRACT

A field experiment was conducted during *kharif* season of 2019 at the Experimental Farm, Department of Agronomy College of Agriculture, Latur to study the effect of integrated nutrient management in sweet corn (*Zea mays* L.var. *saccharata sturt.*). The objective of experiment was to study the effect of integrated nutrient management on sweet corn and to work out the economics of sweet corn. The experiment was laid out in a randomized block design with seven treatments and replicated thrice. The treatments were T<sub>1</sub>- 100% RDF, T<sub>2</sub> - 100% RDF + FYM @ 5 t ha<sup>-1</sup>, T<sub>3</sub> - 75% RDF + FYM @ 5 t ha<sup>-1</sup>, T<sub>4</sub> - 100% RDF + Vermicompost @ 2.5 t ha<sup>-1</sup>, T<sub>5</sub> - 75% RDF + Vermicompost @ 2.5 t ha<sup>-1</sup>, T<sub>6</sub> - 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum* and T<sub>7</sub>-75% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum*. The result revealed that green cob yield (10621 Kg ha<sup>-1</sup>) and green fodder yield (21824 Kg ha<sup>-1</sup>) of sweet corn were significantly highest with the application of 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum*. The protein content did not differ significantly among the treatments whereas the highest content was observed with application of 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum*. The highest net returns (₹90311 ha<sup>-1</sup>), gross returns (₹153062ha<sup>-1</sup>) and B:C ratio 2.44 highest was recorded in the application of 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum*.

### Keywords

Biofertilizers,  
Economics,  
Integrated nutrient  
management,  
Sweet corn,  
Vermicompost,  
*Zea mays*

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### Introduction

Maize (*Zea mays* L.) is one of the largest producing cereal crops in the world grown in more than 150 countries having 600 million ha area with 600 million tonnes of production. In India, it is cultivated on an area of 9.0 million ha with a production of 26.0 million tonnes of grain and productivity is 2710 kg

ha<sup>-1</sup> (Anonymous, 2017). Maize is considered as the “Queen of Cereal”. Being a C<sub>4</sub> plant, it is capable to utilize solar radiation more efficiently even at higher radiation intensity. Maize is a versatile product with uses ranging from industrial products to food preparations, as well as direct human consumption at the vegetative stage. The immature ears are used after roasting. For this, cultivars with

enhanced sugar content are most suitable and are preferred. Out of various specialty corns, sweet corn is a mutant type with one or more recessive alleles in homozygous condition that enable the endosperm to accumulate twice the sugar content as that of seed corn. These special corn with their high market value are perfectly suitable to *peri*-urban agriculture. Thus, they promise higher income to maize growers. Out of the various specialty corns, sweet corn (*Zea mays* L.var. *saccharata sturt*) has a big market potential. It is a hybridized variety of maize specially bred to increase the sugar content. In addition, fodders derived after harvest may be sold, which bring additional income to the farmers. The urban people have great interest in consuming green cobs.

In sweet corn best nutritional quality depends on moisture (72.7%) and total solids (22.3%) comprising of carbohydrate (81%), protein (13%) and lipids (3.5%). Approximately 40% of such corn is frozen and rest canned while processing. Sweet corn is a good source of energy. About 20% dry matter is sugar, compared with only 3 percent in dent maize at green stage. It is also good source of vitamins C and A. In addition to this, it is also used in the production of flavor, starch, carbohydrates, glucose, maltose, fructose and Ayurvedic medicines for making saups, vegetable and salad etc. Amongst various agricultural inputs, fertilizer is and will remain as a chief source in achieving the food production targets. For higher productivity, there is a need for the application of higher dose of fertilizers. But the increased application of high analysis fertilizers and use of high yielding cultivars demanding more secondary and micro nutrients for enhancing food grain production which resulted in their deficiencies and declined growth and productivity of crop due to continuous removal of nutrients from soil.

The mineral fertilizer has and will continue to play the key role in the augmentation of the food production in the entire world. Due to escalating cost of chemical fertilizers and objective of minimizing environmental pollution, the search of alternative source of plant nutrients is imperative. The integrated plant nutrient supply envisages conjunctive use of inorganic and organic sources of plant nutrients for crop productivity besides sustaining soil health. Application of organic materials along with inorganic fertilizers in the soil leads to sustained productivity and also vermicomposting technology involves the bio-conversion of organic waste into vermicasts and vermiwash utilizing earthworms. Vermicompost is a nutrient rich organic fertilizer and soil conditioner. By addition of vermicompost in soil it increases the soil physical, chemical as well as biological properties. Bio fertilizers play an important role in increasing the availability of nitrogen and phosphorus. Among several bio agent *Azospirillum* is known to fix atmospheric nitrogen and increases about 10-15 % grain yield in maize.

## **Materials and Methods**

### **Experimental site**

The field experiment was conducted during *kharif* season of 2019-20, at Agronomy Section Farm, College of Agriculture, Latur (Maharashtra).

### **Soil characteristics**

The soil of experimental plot was clay in texture color with good drainage. The topography of experimental field was uniform and fairly leveled. The representative soil samples from 0 to 30 cm depth were taken from randomly selected plots all over the experimental field before laying out the experiment. A composite soil sample of about

half kg was taken and analyzed for the determination of various physical and chemical properties of soil. The data showed that the soil of experimental plot was clayey in texture with chemical composition such as low in available nitrogen ( $125.3\text{kg ha}^{-1}$ ), medium in available phosphorous ( $18.20\text{kg ha}^{-1}$ ) and very high in available potassium ( $498.58\text{kg ha}^{-1}$ ). The soil was moderately alkaline in reaction having pH (7.7).

### Experimental details

The experiment was laid out in a randomized block design with seven treatments and replicated thrice. The treatments were T<sub>1</sub>- 100% RDF, T<sub>2</sub> - 100% RDF + FYM @  $5\text{ t ha}^{-1}$ , T<sub>3</sub> - 75% RDF + FYM @  $5\text{ t ha}^{-1}$ , T<sub>4</sub> - 100% RDF + Vermicompost @  $2.5\text{ t ha}^{-1}$ , T<sub>5</sub> - 75% RDF + Vermicompost @  $2.5\text{ t ha}^{-1}$ , T<sub>6</sub> - 100% RDF + FYM @  $5\text{ t ha}^{-1}$  + Vermicompost @  $1.25\text{ t ha}^{-1}$  + *Azospirillum* and T<sub>7</sub> - 75% RDF + FYM @  $5\text{ t ha}^{-1}$  + Vermicompost @  $1.25\text{ t ha}^{-1}$  + *Azospirillum*.

### Seed and seed treatment

A popular sweet corn hybrid in the region, Sugar-75, which is golden yellow in colour released by M/S Syngenta India Limited, Pune, Maharashtra, was used in the present study. It is a short duration hybrid matures in 80 to 90 days and suitable for both *kharif* and *rabi* cultivation in Maharashtra. The seed are treated with *Cyantraniliprole* + *Thiamethoxam* @  $5\text{ ml kg}^{-1}$  seeds and bio fertilizer *Azospirillum* treatment was given to seed as per treatments.

### Manures and fertilizers

Organic manures viz., FYM and vermicompost were applied to the respective plots ten days before sowing. The Biofertilizer *Azospirillum* obtained from the Biofertilizers Production Unit, VNMKV,

Parbhani was applied one day before sowing @  $10\text{ ml kg}^{-1}$ . The FYM and vermicompost was applied uniformly to all the plots as per treatments. As per treatments, half dose of nitrogenous fertilizers and full dose of phosphatic and potassic fertilizers were applied. The next half dose of nitrogen fertilizer was applied in bands as top dressing one month after sowing. The sources of nitrogen, phosphorus and potash were urea, single super phosphate (SSP) and muriate of potash (MOP), respectively.

### Yield and economics

The total weight of fresh green cobs from each net plot treatment wise was recorded after harvest and calculated as cob yield per hectare. The treatment wise weight of green plants after removal of green cobs from each net plot was recorded separately and converted into green fodder yield per hectare. The cost of cultivation for each treatment was worked out taking in prevailing market price of inputs. Similarly gross returns were calculated based on prevailing market price of the produce. The net returns  $\text{ha}^{-1}$  was calculated by deducting the cost of cultivation from the gross returns  $\text{ha}^{-1}$  basis.

### Results and Discussion

#### Green cob yield

The green cob yield of sweet corn (Table 1) was significantly influenced by different treatments at harvest. Significantly highest green cob yield ( $10621\text{ kg ha}^{-1}$ ) was produced by application of 100% RDF + FYM @  $5\text{ t ha}^{-1}$  + Vermicompost @  $1.25\text{ t ha}^{-1}$  + *Azospirillum* (T<sub>6</sub>) which was at par with 75% RDF + FYM @  $5\text{ t ha}^{-1}$  + Vermicompost @  $1.25\text{ t ha}^{-1}$  + *Azospirillum* (T<sub>7</sub>) and found to be significantly superior over rest of treatments.

Significantly lowest green cob yield 7846 kg ha<sup>-1</sup> of sweet corn was obtained from 75% RDF + FYM @ 5 t ha<sup>-1</sup> (T<sub>3</sub>). Similar results were reported by Sahoo and Mahapatra (2004), Massey and Gaur (2006) and Kurne *et al.*, (2012).

### Green fodder yield

The green fodder yield of sweet corn (Table 1) was significantly influenced by different treatments at harvest. Significantly highest green fodder yield (21482 kg ha<sup>-1</sup>) was produced by application of (T<sub>6</sub>) 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum* which was at par with (T<sub>7</sub>) 75% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum*

and found to be significantly superior over rest of treatments. Significantly lowest green fodder yield (16898 kg ha<sup>-1</sup>) of sweet corn was obtain from (T<sub>3</sub>) 75% RDF + FYM @ 5 t ha<sup>-1</sup>. Similar results were reported by Jadhav and Shelke (2012) and Thorat (2016).

### Harvest index

Numerically the highest harvest index (33.19%) was recorded with the application of 75% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + *Azospirillum* (T<sub>7</sub>). The treatment 75% RDF + FYM @ 5 t ha<sup>-1</sup> (T<sub>3</sub>) of sweet corn recorded lowest harvest index (31.47%) (Table 1). These findings are in agreement with the findings obtained by Grazia *et al.*, (2003) and Divya Sree (2012).

**Table.1** Green cob yield (kg ha<sup>-1</sup>), green fodder yield (kg ha<sup>-1</sup>) and harvest index (%) of sweet corn as influenced by different treatments at harvest

Treatments	Green cob yield (kg ha <sup>-1</sup> )	Green fodder yield (kg ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub> -100% RDF	7946	17300	31.47
T <sub>2</sub> -100% RDF + FYM @ 5 t ha <sup>-1</sup>	8570	18507	31.65
T <sub>3</sub> -75% RDF + FYM @ 5 t ha <sup>-1</sup>	7846	16898	31.71
T <sub>4</sub> -100% RDF + Vermicompost @ 2.5 t ha <sup>-1</sup>	8867	18771	32.08
T <sub>5</sub> -75% RDF + Vermicompost @ 2.5 t ha <sup>-1</sup>	7866	17099	31.51
T <sub>6</sub> -100% RDF + FYM @ 5 t ha <sup>-1</sup> + Vermicompost @ 1.25t ha <sup>-1</sup> + <i>Azospirillum</i>	10621	21482	33.08
T <sub>7</sub> -75% RDF + FYM @ 5 t ha <sup>-1</sup> + Vermicompost @ 1.25t ha <sup>-1</sup> + <i>Azospirillum</i>	9596	19312	31.47
SE±	568	868	-
CD at 5%	1751	2675	-
<b>General Mean</b>	<b>8759</b>	<b>18450</b>	<b>31.84</b>

**Table.2** Cost of cultivation (Rs ha<sup>-1</sup>), gross monetary returns (Rs ha<sup>-1</sup>), net monetary returns (Rs ha<sup>-1</sup>), and benefit cost ratio of sweet corn as influenced by different treatments at harvest

Treatments	GMR (Rs ha <sup>-1</sup> )	Cost cultivation (ha <sup>-1</sup> )	NMR (Rs ha <sup>-1</sup> )	B:C ratio
<b>T<sub>1</sub>-100% RDF</b>	115128	57651	57477	2.00
<b>T<sub>2</sub>-100% RDF + FYM @ 5 t ha<sup>-1</sup></b>	124088	58312	65776	2.13
<b>T<sub>3</sub>-75% RDF + FYM @ 5 t ha<sup>-1</sup></b>	113579	57102	56696	1.99
<b>T<sub>4</sub>-100% RDF + Vermicompost @ 2.5 t ha<sup>-1</sup></b>	128199	59262	68937	2.16
<b>T<sub>5</sub>-75% RDF + Vermicompost @ 2.5 t ha<sup>-1</sup></b>	113949	58263	55683	1.96
<b>T<sub>6</sub>-100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25t ha<sup>-1</sup> +Azospirillum</b>	153062	62751	90311	2.44
<b>T<sub>7</sub>-75% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25t ha<sup>-1</sup> + Azospirillum</b>	138238	60132	78106	2.30
<b>SE±</b>	7670	-	7670	-
<b>CD at 5%</b>	23631	-	23631	-
<b>General Mean</b>	<b>126606</b>	<b>59068</b>	<b>67538</b>	<b>2.0</b>

### Economics

#### Gross monetary returns

The gross monetary return (Table 2) was significantly influenced by different treatments. Significantly the highest gross monetary returns (Rs 153062 ha<sup>-1</sup>) was recorded by application of 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + Azospirillum (T<sub>6</sub>) which was at par with 75% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + Azospirillum (T<sub>7</sub>) and found superior over rest of treatments.

Significantly lowest gross monetary returns (Rs 113579 ha<sup>-1</sup>) of sweet corn was recorded from application 75% RDF + FYM @ 5 t ha<sup>-1</sup> (T<sub>3</sub>).

#### Net monetary returns

The highest net monetary returns (Rs 90311 ha<sup>-1</sup>) (Table 2) was recorded by application of 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + Azospirillum (T<sub>6</sub>). The lowest net monetary return (Rs

55683 ha<sup>-1</sup>) of sweet corn was recorded from 75% RDF + FYM @ 5 t ha<sup>-1</sup> (T<sub>3</sub>).

The economics results are in accordance with the findings Kumar and Thakur (2004), Jadhav and Shelke (2012).

Based on the result it can be concluded that significantly higher yield and net returns were produced by application of 100% RDF + FYM @ 5 t ha<sup>-1</sup> + Vermicompost @ 1.25 t ha<sup>-1</sup> + Azospirillum.

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