A field experiment was conducted at the Main Maize Research Station, Anand Agricultural University, and Godhra to study the “Effect of Biofertilizers, Organic manures and Chemical fertilizers on Microbial population, Yield attributes and Quality of Sweetcorn (Zea mays L., saccharata) cv. Madhuri”. The experiment was laid out in randomized block design with four replication and fifteen treatments. The results of study revealed that an increase in dehusked cob's length and girth, number of cobs and average weight of cobs were recorded highest in the treatment (T8) where seed inoculation with biofertilizers (Azotobacter-1 + PSB1-16) + Vermicompost @ 2.5 t ha\(^{-1}\) + 100% RDF was given which was at par with T10 and T2. Treatment T8 produced significantly higher green cobs and fodder yield followed by T2 and thereby obtained higher harvest index in treatment T8 followed by T10, T2, T1 and T3. With respects to quality parameters, the total sugar content and TSS were significantly higher under treatment T8 followed by T10 and T2 while, ascorbic acid was registered significantly higher under T13 than rest of the treatments. Moisture content was found non-significant in all the treatments. Looking to the results of microbial population, the bacterial, fungal and actinomycetes population were significantly higher in those treatments receiving Biofertilizers, FYM and vermicompost except treatment T15 (100% RDF alone) had the lowest microbial population where only application of chemical fertilizers. The maximum microbial load was recorded in the treatment (T8) followed by (T13) and (T10) over rest of the treatments.
2004). This is of special importance for vegetables, which are consumed either raw or mildly cooked. The poor soil health has reflected conspicuous decline the yield and quality of the fresh horticultural produce. This is a matter of major concern. The nutritive value and quality of vegetables depend upon genetic, climatic, biotic, edaphic, chemical and other factors as well as combinations of these factors. Some ecological, cultural and physical factors including fertilizer management have significant influence on the chemical and nutritional composition of plants as well as their anatomical and morphological structure (Salunkhe and Kadan, 2005). This is possible only when chemical based inputs supplemented with biologically derived inputs/bio-resources and biofertilizers to supply nutrients. Therefore, biofertilizers are used as a partial substitute for chemical fertilizers. As sweet corn fits well in semi-urban agriculture and it needs to be consumed in a short time after harvest, contributes to diet diversification and improve nutrition, therefore this investigation was needed to find out integrated nutrients effects on yield, microbial load and quality of sweet corn.

Materials and Methods

A field experiment was conducted at the Main Maize Research Station, Anand Agricultural University, Godhra during the rabi season of year 2005-06 and 2006-07 to study the "Influence of bioorganics and levels of chemical fertilizers on the growth, yield and post-harvest quality of sweet corn (Zea mays L., saccharata) cv. Madhuri.” The soil of experimental plot was sandy loam in texture. The soil was low in organic carbon and nitrogen, medium in available phosphorous and high in potassium, during both the years. The experiment was laid out in randomized block design with four replication and fifteen treatments. The fifteen treatments comprised of two organic manure i.e. FYM, VC, two level i.e. (ABA-1 + PSB-16) and no biofertilizers and three levels of chemical fertilizers (50% RDF, 75% RDF and 100% RDF) with additional treatments T13 (application of 10 t ha⁻¹ FYM + 2.5 t ha⁻¹ VC and seed inoculated with biofertilizers), T14 (application of 100% RDF and seed inoculated with biofertilizers) and treatment T15 as control (application of 100% RDF (120:40:0 kg NPK ha⁻¹) through chemical fertilizers).

The seeds of sweet corn variety Madhuri were dilled manually in previously opened furrows at a distance of 45 cm between rows and 20 cm within the row @ 20 kg ha⁻¹ according to inoculated and un uninoculated treatments. Two seeds per hill were sown at 3-4 cm depth. The furrows were slightly covered with soil. The full dose of phosphate and one third quantity of nitrogen in the form of DAP and urea were applied as a basal dose and remaining two third quantity of nitrogen was applied as top dressing in equal two splits at knee high stage and silking stage. The Azotobacter-1 and PSB-16 were used 25 g inoculated kg seed⁻¹ containing 10⁸ CFU g⁻¹ carrier for treating seed with water slurry a day prior to sowing.

Yield attributes

The biometric observations for all the yield attributing characters, except (number of cobs plant⁻¹ and mean weight of cob) were recorded from five randomly selected tagged plants within each net plot.

Harvest index is the ratio of economic yield to the biological yield plot⁻¹. It was calculated by using the formula (Donald and Hamblin (1976)) as given below.

\[
\text{Economic yield, kg ha}^{-1} = \frac{\text{Above ground biological yield, kg ha}^{-1} \times (\text{Green cobs yield} + \text{Green Stover yield})}{\text{Harvest index} \times \text{Green cobs yield} + \text{Green Stover yield}}
\]
Quality parameters

Sugar content, moisture, total soluble solids and ascorbic acid (mg100g\(^{-1}\)) the individual treatment were determined as per procedure described below.

Total soluble sugar content of grains of green cobs of sweet corn was determined by anthrone reagent method described by Franscistt et al., (1971).

Total soluble solids (TSS) was recorded by using ERMA hand refractometer with a range of 0 to 32° Brix and a resolution of 0.2° Brix by placing 1 to 2 drop of clear juice on the prism (Rangamma, 1987).

Spectrophotometric method for determination of ascorbic acid with 2, 4-DNPH was used to determine ascorbic acid content of green cobs of sweet corn.

The moisture content of kernels at harvest was determined using the hot air oven during method.

\[
\text{Moisture} \% = \frac{100 \times (W_1 - W_2)}{W}
\]

Where,

- \(W_1\) = Weight in grams of the dish with the material before drying
- \(W_2\) = Weight in grams of the dish with the material after drying

Microbial population

The composite soil sample collected from plot before sowing was taken for determination of initial status of soil microbial count. For individual treatment the soil sample was collected from the root-zone periphery of five plants from central rows of each net plot of the treatment of respective replication at 60 DAS crop stage were taken for soil microbial count determination during the year 2006-07.

To estimate the number of soil micro flora, count were calculated on the basis of serial dilution technique, using pour plate method and replicated 10 g soil and appropriate dilution as described by Johnson and Curl, (1972).

Statistical analysis

Both the year data were analyzed and presented here only pooled value for better explanation. Data on different aspects of sweet corn crop were subjected to statistical analysis as per the procedure of Randomized Block Design described by Cochran and Cox (1957) at the Computer Center, Department of Agricultural Statistics, BACA, AAU, Anand. Comparisons of the treatment means were done by using Duncan's Multiple Ranking Test (Duncan, 1955).

Results and Discussion

Effect of treatments on yield attributes and yield

Observation on yield attributing characters of sweetcorn presented in Table 1, revealed that the maximum number of cob plant\(^{-1}\) (1.45 cob/plant) and average weight of cob (178.53 g/plant) were obtained with application of vermicompost @ 2.5 tha\(^{-1}\) + 100 % RDF + seed inoculation with biofertilizers in treatment T\(_8\) followed by T\(_{10}\) and T\(_2\) than rest of treatments. With respect to dehusked green cob length and girth, treatment T\(_8\) recorded highest i.e 16.71cm and 14.69 cm respectively followed by T\(_{10}\) and T\(_2\). This increased in yield attributes was due to the growth pattern at different intervals of crop growth phase. It might be the reflection of source of nutrient
available in the root zone which stimulate the physiological processes in plant, ultimately results into increased in girth and length of cob and the integrated effect of inorganic fertilizer, organic manures and biofertilizers. These results are in accordance with Kar et al., (2006) on N in sweet corn, Sahoo and Mahapatra (2004) on N in sweet corn and Zende (2007) on INM in sweet corn.

Among the treatments, T8 resulted significant increase in green cob and fodder yield. The green cobs yield and green fodder yield were registered significantly the higher in treatment T8 i.e. 15705 kg/ha and 21917 kg/ha respectively followed by T2 than rest of the treatments. The harvest index was observed significantly higher in treatment T8 (42.55%) followed by T1, T2, T10, T7, T3, and T9. This might be due to the pronounced effect of integrated nutrient management on green cobs yield reflects the increased in growth and yield attributes of sweet corn, resulted in green higher cobs yield and fodder yield which ultimately noted the higher harvest index. Further vermicompost application increased green cobs yield over FYM application. These might be due to vermicompost which improved the soil fertility where all the appropriate nutrients are in readily available forms to the plants and have narrow C: N ratio (below 20:1) than FYM. These results are in accordance with the findings by Sambhavi and Sharma (2008) in potato. Organic manures along with inorganic fertilizer and seed inoculated with azotobacter and phosphate-solubilizing bacteria had beneficial effect on green cob yield and green fodder yield. These might be due to fixation of atmospheric N and secretion of growth promoting substances of azotobacter and increased bacterial efficiency by phosphobacteria combined together might have increased the growth and yield parameters as reported by Somani et al., (2005). Similar effect was also observed by Thavanprakash et al., (2005) in baby corn, Patil et al., (2001) and Mishra et al., (1998) in Maize, Geleta (2004) on sweet corn and Zende (2007) on INM in sweet corn.

Effect of treatments on quality parameters

Data pertaining to quality parameters presented in Table 2 revealed that the total sugar content and TSS were significantly observed higher under treatment T8 (21.05% and 17.38°brix respectively) followed by T10 and T2 than rest of the treatments. The rise in total soluble sugar content of sweet corn might be due to starch protein hydrolysis to soluble sugar and carbon skeleton has been used for amino acid synthesis and subsequently protein biosynthesis via TCA intermediate and increase in photosynthesis rate and chlorophyll content which enhanced total soluble sugar of sweet corn (Duffs and Duffs, 1984). Arbad et al., (2008) found impact of inorganic fertilizers along with vermicompost and seed inoculation with biofertilizers on total sugar in sweet sorghum due to balance C: N ratio, which improved soil physical, chemical and microbial properties and thereby increased availability of N, P & K and micronutrients. These results were in accordance with Zende N. (2007) in sweetcorn, Gutte et al., (2008) in sorghum, Arunkumar et al., (2007b) in sweet corn, Khadtare et al., (2006b) in sweet corn and Hailu et al., (2008) in carrot. The highest ascorbic acid content (7.660 mg/100g) was recorded in T13 than rest of the treatments.

This might be due to available Zn in organic manures, which ultimately stimulate the higher ascorbic acid. Zn act as a potential inhibitor of Cu uptake which forms parts of the enzyme ascorbic acid oxidase. These results were in agreement with Sambhavi and Sharma (2008) in potato, Bahadur et al., (2006) in garden pea. The moisture content in the kernel of cobs of sweet corn exerted no differences among different treatments.
**Table 1** Effect of biofertilizers, organic manures and chemical fertilizers on yield attributes and yield of sweetcorn (*Zea mays* L., saccharata) cv. Madhuri

| Treatments                      | Green cob length (cm) | Green cob girth (cm) | Number of cobs plant$^{-1}$ | Average weight of cob (g) | Green cobs (kg ha$^{-1}$) | Green fodder (kg ha$^{-1}$) | Harvest index (%) |
|--------------------------------|-----------------------|----------------------|-----------------------------|---------------------------|---------------------------|-----------------------------|------------------|
| T1 F$_{10}$ + 100% RDF + B$_0$ | 15.18 bcd             | 13.41 bcd            | 1.30 cde                    | 156.69 cde                | 12996 cde                 | 17824 c                   | 42.21 ab         |
| T2 F$_{10}$ + 100% RDF + B$_1$ | 15.62 abc             | 13.62 abc            | 1.36 abc                    | 165.79 bc                 | 14098 bc                  | 19565 bc                   | 41.91 abc        |
| T3 F$_{10}$ + 75% RDF + B$_0$  | 14.74 def             | 13.13 bdef           | 1.24 ef                     | 146.30 efg                | 12425 de                  | 17640 c                   | 41.13 abde        |
| T4 F$_{10}$ + 75% RDF + B$_1$  | 15.30 bcd             | 13.35 bcd            | 1.33 bcd                    | 157.63 cde                | 13370 cd                  | 19462 bc                   | 40.70 bcdef       |
| T5 F$_{10}$ + 50% RDF + B$_0$  | 14.05 f               | 12.05 g              | 1.07 g                      | 130.44 h                  | 8844 f                    | 13554 d                   | 39.39 f          |
| T6 F$_{10}$ + 50% RDF + B$_1$  | 14.50 ef              | 12.29 fg             | 1.12 g                      | 136.30 gh                 | 9345 f                    | 14460 d                   | 39.22 f          |
| T7 V$_{2.5}$ + 100% RDF + B$_0$| 15.51 abcd            | 13.70 bc             | 1.30 cde                    | 159.40 bcd                | 13449 cd                  | 18843 bc                   | 41.70 abcdef      |
| T8 V$_{2.5}$ + 100% RDF + B$_1$| 16.71 a               | 14.69 a              | 1.45 a                      | 178.53 a                  | 15705 a                   | 21917 a                   | 42.55 a          |
| T9 V$_{2.5}$ + 75% RDF + B$_0$ | 15.15 bcd             | 13.03 cdef           | 1.28 cde                    | 150.68 def                | 13168 cde                 | 18587 c                   | 41.36 abcdef      |
| T10 V$_{2.5}$ + 75% RDF + B$_1$| 16.13 ab              | 14.11 ab             | 1.39 ab                     | 171.63 ab                 | 15084 ab                  | 21006 ab                   | 41.83 abc         |
| T11 V$_{2.5}$ + 50% RDF + B$_0$| 14.31 g               | 12.52 efg            | 1.10 g                      | 133.53 h                  | 9229 f                    | 13726 d                   | 40.20 def         |
| T12 V$_{2.5}$ + 50% RDF + B$_1$| 14.46 ef              | 12.66 defg           | 1.15 fg                     | 138.55 gh                 | 9618 f                    | 14705 d                   | 39.62 ef          |
| T13 F$_{10}$ + V$_{2.5}$ + B$_1$| 14.63 def             | 12.81 defg           | 1.09 g                      | 139.68 fgh                | 9933 f                    | 14991 d                   | 39.73 ef          |
| T14 F$_0$ + 100% RDF + B$_1$   | 15.01 cde             | 13.41 bcd            | 1.25 b                      | 146.94 efg                | 12127 de                  | 17935 c                   | 40.36 cdef        |
| T15 F$_0$ + 100% RDF + B$_0$   | 14.83 def             | 13.62 abc            | 1.23 ef                     | 143.89 h                  | 11805 e                   | 17311 c                   | 40.52 cdef        |

S. Em ±: 0.29 0.26 0.03 3.63 497.46 687.85 0.48
C.D. (5 %) : 0.818 0.726 0.075 10.189 1398.2 1933.4 1.336
C.V. % : 5.85 5.93 6.15 7.31 12.55 11.93 3.31

**Note**: Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Range Test at 5% level of significance.
Table 2: Effect of Biofertilizers, Organic manures and Chemical fertilizers on Quality of Sweetcorn (Zea mays L., saccharata) cv. Madhuri

| Treatments          | Moisture (%) | Total Soluble solids (°Brix) | Total soluble sugar (%) | Ascorbic acid (mg/100g) |
|---------------------|--------------|------------------------------|-------------------------|--------------------------|
| T<sub>1</sub>       | 74.37        | 16.68                        | 19.74                   | 7.350                    |
| T<sub>2</sub>       | 75.30        | 17.10                        | 20.15                   | 7.510                    |
| T<sub>3</sub>       | 74.16        | 15.90                        | 19.06                   | 7.280                    |
| T<sub>4</sub>       | 74.16        | 16.55                        | 19.39                   | 7.325                    |
| T<sub>5</sub>       | 74.16        | 14.98                        | 17.63                   | 6.950                    |
| T<sub>6</sub>       | 74.53        | 15.50                        | 17.96                   | 7.235                    |
| T<sub>7</sub>       | 75.08        | 16.75                        | 19.95                   | 7.360                    |
| T<sub>8</sub>       | 75.35        | 17.38                        | 21.05                   | 7.540                    |
| T<sub>9</sub>       | 74.96        | 15.98                        | 19.53                   | 7.340                    |
| T<sub>10</sub>      | 75.42        | 17.35                        | 20.68                   | 7.575                    |
| T<sub>11</sub>      | 74.75        | 15.53                        | 17.93                   | 7.170                    |
| T<sub>12</sub>      | 74.69        | 15.85                        | 18.43                   | 7.240                    |
| T<sub>13</sub>      | 75.47        | 17.65                        | 19.35                   | 7.660                    |
| T<sub>14</sub>      | 75.37        | 16.23                        | 19.28                   | 7.260                    |
| T<sub>15</sub>      | 74.68        | 16.23                        | 18.89                   | 6.650                    |

S. Em ±: 0.45 0.15 0.22 0.060
C.D. (5 %): NS 0.42 0.64 0.168
C.V. %: 1.090 2.010 2.350 0.660

NS = Non significant
Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Range Test at 5% level of significance

Table 3: Effect of Biofertilizers, Organic manures and Chemical fertilizers on Microbial population of Sweetcorn at 60 DAS (Zea mays L., saccharata) cv. Madhuri

| Treatments          | Bacteria Cfg<sup>1</sup>x 10<sup>6</sup> of soil | Fungi Cfg<sup>1</sup>x 10<sup>4</sup> of soil | Actinomycetes Cfg<sup>1</sup>x 10<sup>7</sup> of soil |
|---------------------|-----------------------------------------------|------------------------------------------|-----------------------------------------------|
| Initial             |                                               |                                          |                                               |
| T<sub>1</sub>       |                                               |                                          |                                               |
| T<sub>2</sub>       |                                               |                                          |                                               |
| T<sub>3</sub>       |                                               |                                          |                                               |
| T<sub>4</sub>       |                                               |                                          |                                               |
| T<sub>5</sub>       |                                               |                                          |                                               |
| T<sub>6</sub>       |                                               |                                          |                                               |
| T<sub>7</sub>       |                                               |                                          |                                               |
| T<sub>8</sub>       |                                               |                                          |                                               |
| T<sub>9</sub>       |                                               |                                          |                                               |
| T<sub>10</sub>      |                                               |                                          |                                               |
| T<sub>11</sub>      |                                               |                                          |                                               |
| T<sub>12</sub>      |                                               |                                          |                                               |
| T<sub>13</sub>      |                                               |                                          |                                               |
| T<sub>14</sub>      |                                               |                                          |                                               |
| T<sub>15</sub>      |                                               |                                          |                                               |
| S. Em ±             | 8.52                                         | 2.05                                     | 2.27                                          |
| CD                  | 25.68                                        | 6.17                                     | 6.84                                          |
| CV %                | 8.49                                         | 15.50                                    | 16.41                                         |
Effect of treatments on microbial population

Result presented in (Table 3) showed significant differences in microbial population in soil as influenced by different treatments in their microbial build of soil. Results revealed that the highest bacterial load 19.6 x 10^6 cfu g^-1 was observed in treatment T_13 (F_10 + V_2.5 + B_1) which was at par with T_8 (18.60 x 10^6 cfug^-1) and T_10 (18.00 x 10^6 cfug^-1).

The lowest bacterial load was recorded in T_15 (10.20 x 10^6 cfug^-1). The highest fungal population was recorded in T_8 (25.0 x 10^4 cfug^-1) followed by treatments T_10, T_13, T_7, T_3, T_4, T_14, T_11 and T_12. The lowest fungal was recorded in T_15 (14.00 x 10^4 cfug^-1). Actinomycetes load was recorded highest in T_13 (32.0 x 10^4 cfug^-1) and was at par with T_8, T_10 and T_2 whereas the lowest actinomycetes load was recorded in T_15 (15.5 x 10^4).

Looking to the results, the bacterial, fungal and actinomycetes population were significantly higher in those treatments receiving FYM and VC except treatment T_15 (100%RDF alone) had the lowest microbial population where only application of chemical fertilizers. The maximum microbial counts were found in the treatment T_8 (V_2.5+100% RDF + B1) followed by T_13 and T_8 over rest of the treatments.

In-conclusion, the results discussed in the present study revealed that treatment T_8 found to be superior with respect to increase microbial load in soil, yield attributing characters and yield as well as for improving quality of sweetcorn followed by treatment T_10.

Therefore it is concluded that sustainable higher yield and better quality can be obtained with an application of vermicompost @ 2.5 t ha^-1 along with 100% RDF and seed inoculation with biofertilizers (Azotobacter-1 + PSB1-16) (T_8) or an application of vermicompost @ 2.5 t ha^-1 along with 75% RDF and seed inoculation with biofertilizers (Azotobacter-1 + PSB1-16) (T_10) in rabi sweet corn crop cv Madhuri.

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