Influence of Nitrogen and Phosphorus Levels on Yield Potential and Economics of sweet corn (Zea mays L. saccharata) varieties

Vipen Bhadu, KB Asodariya, Chouthu Ram Hakla and Kuldeep

Abstract
Sweet corn cultivation can contribute in diversifying cropping pattern. Performance of sweet corn varieties was evaluated under different fertility levels. Treatment consisted four sweet corn varieties viz., Bajaura sweet corn, Sugar 75, Win Orange and Priya and three levels of fertilizers (90-40, 120-50 and 130-60 kg N-P2O5 ha-1). Highest values of yield attributing parameters, green cob (9.00 t ha-1), green fodder yield (20.96 t ha-1), net return (68189 ` ha-1) and B C ratio (2.19) were obtained with Sugar 75. For sweet corn, application of 120 kg N + 50 kg P ha-1 significantly improved yield attributing parameters, green cob (4.17 t ha-1) and green fodder (6.25 t ha-1) yield and proved economically profitable dose with highest net returns (54212 ` ha-1) and BC ratio (2.05).

Keywords: Yield Potential, sweet corn, economically profitable

1. Introduction
Corn (Zea mays L.) is a versatile crop, which finds a place in the human food, animal feed, fodder and industrial raw material. Recently speciality corns such as baby corn and sweet corn have emerged as alternative food sources, especially for the affluent society. Sweet corn is used as a human food in the soft dough stage with succulent grain. The higher content of a water-soluble polysaccharide in the kernel adds texture and quality in addition to sweetness. Sweet corn is gaining popularity both in rural and urban areas because of its high sugar and low starch content. It has a great market potential and high market value in India [1]. Generally, maize farmers strive by improving yields and cutting costs of production, for instance, through shortening cultural risks by harvesting for either green corn or baby corn. Young cob corn has a short growth thus a farmer can grow four or more crop cycles per year. It has a wide range of adaptation and does not need intensive cultivation. Considering these factors, young cob corn has good potentials [2]. Sweet corn production, being a recent development has proved an enormously successful venture in India. Attention is now being paid to explore its potential in India, for earning foreign exchange besides higher economic returns to the farmers. The agronomic requirement of sweet corn is similar to grain maize except for the suitable variety, plant population density, higher doses of nitrogen and most importantly early harvesting. Yield and quality of sweet corn are affected by cultural management applied to the maize plants especially fertilizer application. The different levels of nutrition of maize plants greatly affected the yield and quality. Farmers are growing these varieties with existing fertilizer recommendations made for composite and hybrids maize. The needs of a sweet corn crop for supplemental nutrients can vary greatly among fields, seasons and crop growing conditions. Hence, there is need to evaluate sweet corn varieties under optimum combination of nitrogen and phosphorus fertilization under prevailing agroclimatic conditions [3].

2. Materials and methods
The present study was conducted throughout summer season of 2015 at the College Farm, College of Agriculture, Junagadh Agricultural University, Junagadh to study the Response of sweet corn (Zea mays L. saccharata) varieties to fertility levels under South Saurashtra region of Gujarat. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 7.9 and EC 0.38 dS m-1 and organic carbon 0.62%. The soil was low in available nitrogen (241.00 kg ha-1) and available phosphorus (31.60 kg ha-1) while medium in
available potash (245.36 kg ha⁻¹). The experiment was conducted in factorial randomized block design with total 12
treatment combination consisting of 4 varieties viz., Bajaura
sweet corn (V₁), Sugar 75 (V₂), Win Orange (V₃) and Priya (V₄)
and 3 levels of fertilizers (90-40, 120-50 and 130-60 kg
N-P₂O₅ ha⁻¹ as F₁, F₂ and F₃, respectively). These treatments
were replicated four times in a Randomized Block Design
with factorial concept.
The gross plot size was 5.0 m x 3.0 m and net plot sizes were
4.0 m x 1.8 m and 60 cm x 25 cm spacing was employed. The
total dose of phosphorus and half dose of nitrogen were
applied as basal application in form of urea and DAP at just
before sowing in the furrows. Remaining half dose of nitrogen
was top dressed as urea at knee height stage of the crop.
The statistical analysis of grain and stover yield was carried out
through the procedure appropriate to the Factorial
Randomized Block Design of the experiment as described by
Panse and Sukhatme, 1967 [4]. The significance of difference
was tested by ’F’ test. Five per cent level of significance
was used to test the significance of results. The critical differences
were calculated when the differences among treatments were
found significant in ’F’ test. The gross realization in term of
rupees per hectare was calculated on the basis of the yield of
chickpea for each treatment using the prevailing market prices
of produce. The cost of cultivation of the crop for each
treatment was worked out by taking into consideration the
cost of all the inputs used and operations followed starting
from the preparatory tillage to harvesting. The net realization
was worked out by deducting the total cost of cultivation from
gross realization per hectare for each treatment and recorded
accordingly. The benefit cost ratio (BCR) was calculated as follows

\[
BCR = \frac{\text{Gross realization}}{\text{Total cost of cultivation}}
\]

3. Result and discussion
Green cob yield, green fodder yield and economics
Effect of varieties
Data presented in Table 1 reveal that sweet corn variety
‘Sugar 75’ exhibited significant superiority in yield potential
(10.25 t ha⁻¹) over ‘Win Orange’ (8.21 t ha⁻¹), ‘Bajaura sweet
corn’ (8.02 t ha⁻¹) and ‘Priya’ (7.43 t ha⁻¹). The comparison of
later varieties indicated that ‘Win Orange’ was higher yielder
as it recorded higher green cob yield over ‘Bajaura sweet
corn’ and ‘Priya’, respectively. Further, ‘Bajaura sweet corn’
was also significantly higher over ‘Priya’. Data on green fodder yield of different varieties presented in
Table 4.13 explicit almost similar trend as observed in green
cob yield. Amongst varieties, ‘Sugar75’ (25.55 t ha⁻¹) was
significantly higher over ‘Win Orange’ (22.91 t ha⁻¹), ‘Bajaura sweet corn’ (16.96 t ha⁻¹) and ‘Priya’ (16.12 t ha⁻¹) in
producing green fodder yield. Further, ‘Win Orange’ produced significantly higher green fodder yield over
‘Bajaura sweet corn’ and ‘Priya’, respectively. At the same
time ‘Bajaura sweet corn’ recorded significantly higher green
cob yield over ‘Priya’. The data revealed that maximum gross realization of 123419
ha⁻¹ was realized with sweet corn variety ‘Sugar-75’ followed
by ‘Win orange’ 102032 ha⁻¹ and the lowest gross return
was obtained from ‘Priya’ with 86347 ha⁻¹. It is evident from the data that amongst varieties ‘Sugar-75’ was found
efficient in realizing highest net returns (67189 ha⁻¹) and B C
ratio (2.19) which was higher over rest of the varieties. Further amongst rest of varieties ‘Win orange’ registered
second highest net returns of 51469 with B C ratio of 2.03.
‘Bajaura sweet corn’ achieved lowest net returns (42068 ha⁻¹)
and B C ratio (1.90).
The significant increase in yield attributes in variety ‘Sugar 75’ over other varieties seems to be on account of overall
improvement in growth as evinced from higher production of
dry matter and greater availability of photosynthates as
evined from higher biomass accumulation along with
availability of nutrient particularly N and P in variety ‘Sugar 75’
might have resulted in enhancing cob and fodder yield. Similar results were also reported by Suthar et al. [3] and
Kumawat et al. [5].
Fertility levels
The data from Table 1 reveal that application of nitrogen and phosphorus in different proportions resulted in significant
variation in the green cob yield of the sweet corn varieties. An
application of 120 kg N + 50 kg P₂O₅ ha⁻¹ significantly
increase green cob yield over 90 kg N + 40 kg P₂O₅ ha⁻¹. Further increase in fertility levels could not produce
significant increase in green cob yield of the test crop. The
highest green cob yield (9.02 t ha⁻¹) was obtained under 130
kg N + 60 kg P₂O₅ ha⁻¹. From Table 1 it can be seen that an
application of 120 kg N + 50 kg P₂O₅ ha⁻¹ accounted for
significant increase in green fodder yield (20.96 t ha⁻¹) over
90 kg N + 40 kg P₂O₅ ha⁻¹ (19.99 t ha⁻¹). No significant
increase in green fodder yield was observed with further
enhancement of fertility level up to 130 kg N + 60 kg P₂O₅ ha⁻¹
(20.96 t ha⁻¹).
It is evident from data (Table 1) that the application of 130 kg
N + 60 kg P₂O₅ ha⁻¹ recorded highest gross returns of 106626 ha⁻¹. The lowest gross returns of 96389 ha⁻¹ was
obtained with 90 kg N + 40 kg P₂O₅ ha⁻¹. The crop fertilized
with fertility level 120 kg N + 50 kg P₂O₅ ha⁻¹ recorded significant increase in green fodder yield (20.96 t ha⁻¹) over
net returns and 1.91 B C ratio and succeeding level 130 kg N
+ 60 kg P₂O₅ ha⁻¹ with 53791 ha⁻¹ net returns and 2.00 B C
ratio, respectively (Table 1).
Significant increase in green cob yield due to application 120
kg N + 50 kg P₂O₅ ha⁻¹ could be ascribed to the fact that green
cob yield of crop is function of several yield components
further affirms the role of yield attributing and growth
parameters in improving green cob yield. This might also be
attributed to better availability of nutrients in the soil under
these treatments. The observed relationship corroborates with
findings of Nath et al. [6], Choudhary et al. [7], Dhaka et al. [8]
and Snehla et al. [9].
Interaction effects
A perusal of data (Table 2) indicated that highest BCR of 2.33 was obtained with treatment combination of V₂F₃ (Sugar
coupled with 120 kg N + 50 kg P₂O₅ kg N:P:K ha⁻¹). The
enhanced photosynthesis due to more N application might
have resulted in higher yields of sweet corn. Present study
clearly demonstrated that application of 120 kg N + 50 kg
P₂O₅ ha⁻¹ with variety ‘Sugar 75’ positively increased green
cob yield, green fodder yield, and economics of sweet corn.
Table 1: Effect of fertilizer levels on yield and economics of sweet corn varieties

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Green cob yield (t ha⁻¹)</th>
<th>Green fodder yield (t ha⁻¹)</th>
<th>Gross realization (₹ ha⁻¹)</th>
<th>Cost of production (₹ ha⁻¹)</th>
<th>Net profit (₹ ha⁻¹)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bajaura sweet corn</td>
<td>8.02</td>
<td>16.96</td>
<td>92625</td>
<td>50559</td>
<td>42068</td>
<td>1.90</td>
</tr>
<tr>
<td>Sugar 75</td>
<td>10.25</td>
<td>25.55</td>
<td>123419</td>
<td>56243</td>
<td>67189</td>
<td>2.19</td>
</tr>
<tr>
<td>Win Orange</td>
<td>8.21</td>
<td>22.91</td>
<td>102032</td>
<td>50559</td>
<td>51469</td>
<td>2.03</td>
</tr>
<tr>
<td>Priya</td>
<td>7.43</td>
<td>16.12</td>
<td>86347</td>
<td>50559</td>
<td>35785</td>
<td>1.76</td>
</tr>
<tr>
<td>S. Em. ±</td>
<td>0.14</td>
<td>0.19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C. D. (P = 0.05)</td>
<td>0.51</td>
<td>0.69</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Fertility levels (P) ha⁻¹:
- 90 kg N + 40 kg P₂O₅
- 120 kg N + 50 kg P₂O₅
- 130 kg N + 60 kg P₂O₅

Table 2: Economics of sweet corn varieties under various treatment combinations of levels of fertilizers

<table>
<thead>
<tr>
<th>Treatment combination</th>
<th>Yields (t ha⁻¹)</th>
<th>Gross realization (₹ ha⁻¹)</th>
<th>Cost of production (₹ ha⁻¹)</th>
<th>Net realization (₹ ha⁻¹)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green cob</td>
<td>Green fodder</td>
<td>Green cob</td>
<td>Green fodder</td>
<td>Fixed cost</td>
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<td>V₁:F₁</td>
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<td>16.10</td>
<td>68229</td>
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<td>16755</td>
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<td>V₂:F₂</td>
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<td>17.62</td>
<td>75563</td>
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<td>16755</td>
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<td>V₃:F₂</td>
<td>8.67</td>
<td>17.17</td>
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<td>16755</td>
</tr>
<tr>
<td>V₄:F₂</td>
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<td>24.74</td>
<td>75797</td>
<td>32158</td>
<td>16755</td>
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<tr>
<td>V₅:F₂</td>
<td>11.27</td>
<td>25.90</td>
<td>99176</td>
<td>33674</td>
<td>16755</td>
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<td>V₆:F₂</td>
<td>10.89</td>
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</tr>
<tr>
<td>V₇:F₂</td>
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<td>22.61</td>
<td>73568</td>
<td>29389</td>
<td>16755</td>
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<td>V₈:F₂</td>
<td>8.68</td>
<td>23.03</td>
<td>76355</td>
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<td>16755</td>
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<td>V₉:F₂</td>
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<td>77205</td>
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<td>16755</td>
</tr>
<tr>
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<td>20712</td>
<td>16755</td>
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<td>21160</td>
<td>16755</td>
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<tr>
<td>V₁₂:F₂</td>
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<td>16.58</td>
<td>68259</td>
<td>21554</td>
<td>16755</td>
</tr>
</tbody>
</table>

(B) Variable costs
- V₁: Bajaura sweet corn
- V₂: Sugar75
- V₃: Win Orange
- V₄: Priya

(A) Fixed cost (₹ ha⁻¹): 16755

4. References