under different alkalinity level, it was evident that the variety TMV 3 has the ability to withstand higher ESP (>30%) and recorded highest yield (16.63 g/pot). Varietal variations in oil content due to alkalinity were also found to be significant. However, in contrast to the seed yield, the highest oil content (42.1%) was recorded in TMV 4 in ESP > 30%.

It was revealed from the present study that soil alkalinity reduced the plant height yield and yield components. The chlorophyll content was not significantly affected by the salinity. The alkalinity was much more pronounced in ESP > 30% than the ESP 15-30%. Among the varieties, TMV 3 was able to withstand higher sodicity and recorded minimum reduction in seed yield (16.62 g/pot) even at ESP > 30% as compared to 12.9 g/pot in TMV 4, 10.00 g/pot in TMV 6 and 10.77 g/pot in Co 1. Sodicity also affected the oil content however, the magnitude of reduction was lesser than that of seed yield.

References


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Research Notes

**Effect of bio-fertilizer in seed yield and seed quality in sunflower**

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Bio-fertilizers are new generation cost effective and renewable sources of plant nutrients to supplement chemical fertilizers. The role of bio-fertilizers in agricultural production assumes greater importance, particularly in the present context of very high cost of chemical fertilizers. Though bio-fertilizers cannot totally replace the conventional chemical fertilizers, upto 20-25 per cent of nitrogen requirement can be met through bio-fertilizers. This situation coupled with cost advantage provides vast scope for promotion of alternative source of nitrogen particularly bio-fertilizer in seed production of different crops. In this context, the present study was undertaken to assess the influence of bio-fertilizers like *Azospirillum* sp. and Phosphobacterium along with and without recommended dose of fertilizers in sunflower. Nirmala Devi, et al. 1995 reported that application of *Azospirillum* sp. as a seed treatment significantly increase the seedling vigour in chilli. In baya also, soil application of *Azospirillum* sp. + Phosphobacterium as bio-fertilizer mixture (2000 g ha⁻¹) along with 75 per cent of recommended dose of N and P fertilizers recorded more number of tillers and economically higher green and dry fodder yield (Chellamuthu, 2000).

A field study was conducted during summer 1998 season in Agricultural Research Station, Bhavanisagar to assess the influence of biofertilizers like *Azospirillum* sp. and Phosphobacterium both as seed treatment 3 g/kg and soil application (600 g ha⁻¹). Recommended dose of NPK (60:90:60 kg ha⁻¹) application was considered as control for comparison.

*Azospirillum* application both as seed treatment and soil application were given along with different levels of N, (0, 50%, 70% and 100%) and complete dose of P and K (90:60 kg ha⁻¹).
Table 1. Influence of bio-fertilizers on yield attributes and seed quality attributes

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>Head diameter (cm)</th>
<th>Seed yield per plant (g)</th>
<th>Seed yield per ha (kg)</th>
<th>Oil content (%)</th>
<th>Seed germination (%)</th>
<th>Root length (cm)</th>
<th>Shoot length (cm)</th>
<th>Vigour index</th>
<th>Seed filling (%)</th>
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</thead>
<tbody>
<tr>
<td>T₁</td>
<td>96.7</td>
<td>16.6</td>
<td>50.0</td>
<td>926</td>
<td>31.98</td>
<td>69.0</td>
<td>12.1</td>
<td>14.3</td>
<td>1905</td>
<td>83.4</td>
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<tr>
<td>T₂</td>
<td>92.1</td>
<td>15.8</td>
<td>41.0</td>
<td>800</td>
<td>31.43</td>
<td>73.0</td>
<td>12.3</td>
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<td>1973</td>
<td>85.4</td>
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<tr>
<td>T₃</td>
<td>95.6</td>
<td>15.3</td>
<td>46.0</td>
<td>950</td>
<td>32.87</td>
<td>75.0</td>
<td>11.8</td>
<td>15.1</td>
<td>2009</td>
<td>81.2</td>
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<tr>
<td>T₄</td>
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<td>16.0</td>
<td>46.0</td>
<td>900</td>
<td>31.14</td>
<td>74.0</td>
<td>12.3</td>
<td>14.0</td>
<td>1944</td>
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(P=0.05)

Similarly Phosphobacterium was applied with different levels of P (0, 50%, 70% and 100%) along with complete dose of N and K (60:60 kg ha⁻¹). The *Azospirillum* and Phosphobacterium application along with different levels of N and P were compared with control (Recommended dose of fertilizer NPK 60:90:60 kg ha⁻¹ only).

T₁ : Recommended dose of fertilizer (60:90:60 NPK/ha)
T₂ : Azospirillum + 0:90:60 NPK kg ha⁻¹
T₃ : Azospirillum + 45:90:60 NPK kg ha⁻¹ (75% N)
T₄ : Azospirillum + 30:90:60 NPK kg ha⁻¹ (50% N)
T₅ : Azospirillum + 60:90:60 NPK kg ha⁻¹ (100% N)
T₆ : Phosphobacterium + 60:0:60 NPK kg ha⁻¹
T₇ : Phosphobacterium + 60:67.5:60 NPK kg ha⁻¹ (75% P)
T₈ : Phosphobacterium + 60:45:60 NPK kg ha⁻¹ (50% P)
T₉ : Phosphobacterium + 60:90:60 NPK kg ha⁻¹ (100% P)
T₁₀ : Azospirillum + Phosphobacterium + 60:90:60 NPK kg ha⁻¹

T₁₁ : Azospirillum + Phosphobacterium + 45:67.5:60 NPK kg ha⁻¹ (75% N + 75% P)
T₁₂ : Azospirillum + Phosphobacterium + 30:45:60 NPK kg ha⁻¹ (50% + 50% P)
T₁₃ : Azospirillum + Phosphobacterium + 0:0:60 NPK kg ha⁻¹

Each treatment was replicated thrice and the experiment was conducted in randomised block design in plots of 5 x 4 m. Seeds were sown at 30 x 10 cm spacing. During the crop growing period, the days to first flowering, 50 per cent flowering, plant height, head diameter, were recorded. At the time of harvest, the seed filling per cent, seed yield per plant, seed yield per plot and 100 seed weight were recorded. From the resultant seeds the seed quality evaluations on germination (Anon, 1985) seedling length and seedling vigour (Abdul-Baki and Anderson, 1972) were assessed. The data gathered were scrutinized as per Panse and Sukhatme (1995) to trace the level of significance.

The results revealed that the days to first flowering ranged between 41 and 43 days and
days to 50 per cent flowering ranged between 46 and 48 days and there was no specific variation in flowering behaviour between the treated and control plants. Among the treatments, T_{10} (Azospirillum sp. + Phosphobacterium with a fertilizer does of 60:90:60 NPK kg ha\(^{-1}\)) recorded the maximum head diameter (170 cm) seed yield per plant (51 g) and seed yield per ha (1183 kg) followed by T_{11}. The oil content of the seeds obtained from different treatments varied between 30.30 to 32.87 per cent. When compared with control, the percentage of seed yield increase was 27, due to T_{10} treatment. Yield reduction of 15 per cent was observed by without application of N and application of Azospirillum with 0:90:60 NPK kg ha\(^{-1}\) (T_{2}). With the application of 75 per cent N and 90, 60 kgs of P and K along with Azospirillum (T_{6}) the yield increase of 2.5 per cent, and with 100 per cent N application (T_{6}) the yield increase was 13 per cent. Without the application of phosphorus and application Phosphobacterium with 60:0:60 NPK (T_{4}) increased the seed yield to 4 per cent, and with 100 per cent phosphorus along with Phosphobacterium and complete dose of NPK (T_{8}) increased the seed yield to 12 per cent. Application of Azospirillum and Phosphobacterium with out N P and K alone (T_{11}) reduced the seed yield to 50 per cent. So bio-fertilizer application alone can not substitute the N and P application. But along with chemical fertilizer the bio-fertilizer application improved the seed yield. Similar trend was noticed for seed quality characters also. The observation on seed quality parameters revealed that the maximum seed germination (83%), root length (13.9 cm), shoot length (15.5 cm) and vigour index (2431) were recorded by T_{10} treatment.

In general application of bio-fertilizer both as seed treatment and soil application along with recommended dose of chemical fertilizer (60:90:60 NPK kg ha\(^{-1}\)) increase the seed quality and yield in sunflower.

**Reference**


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