Influence of irrigation schedules and mulches on growth and quality of Sunflower (Helianthus annuus L.) in black soil of Northern Transitional Tract of Karnataka

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ABSTRACT
A field experiment was conducted to find the Influence of Irrigation Schedules and Mulches on Growth and Quality of Sunflower (Helianthus annuus L.) in medium deep black clayey soil of Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during rabi 2003-04. The experiment consisted of four main plot treatments (0.4, 0.6, 0.8 IW/CPE ratio and critical stages) and three sub plot treatments (control, maize straw mulch and polythene mulch) with three replications laid out in split plot design. The results indicated significantly higher head diameter, number of seeds per head and seed weight per head in 0.8 IW/CPE ratio irrigation schedules as compared to 0.4, 0.6 IW/CPE ratio and critical stages. The growth components like plant height, number of leaves per plant, leaf area index and total dry matter production per plant at harvest were also higher in 0.8 IW/CPE ratio. The significantly higher head diameter, number of seeds per head and seed weight per head was recorded in mulch with polythene over rest of the treatments. Similar trends were also observed in growth components. Higher seed oil content (41.07%) and oil yield (795 kg/ha) over 0.4, 0.6 IW/CPE ratio and critical stages.

Key words : Irrigation schedules, Mulches, Sunflower

INTRODUCTION
Sunflower (Helianthus annuus L.) is an important edible oilseed crop among the oilseed crops grown in India. In India, sunflower is being cultivated over an area of 1.34 million hectare with total production of 0.733 million tones with an average productivity of 549 kg per hectare (Anon. 2002). Which constitutes 6.17 per cent and 2.72 per cent of world’s area and production respectively. However, the present productivity of sunflower in India is much less compared to other countries. In Karnataka, sunflower occupies an area of 6.9 lakh hectare with production of 2.55 lakh tones of seed with an averages productivity of 370 kg for hectare (Anon., 2002). The low productivity of sunflower in India in general and Karnataka in particular, is due to its cultivation in unfavorable environmental conditions such rain feed condition in marginal and sub marginal lands with poor nutrient supply, improper irrigation scheduling and inadequate plant protection measures. Water being a natural resource input and now a scare and costly input in the production of agricultural crops, has direct influence on the availability of nutrients from the soil. Judicious irrigation management is crucial in sunflower production. In post–rainy /summer season sunflower responds better to man agement factors, especially irrigation. More than 62 per cent increase in seed yield has been observed due to irrigation compared to rainfed condition (Sunilkumar et al., 1992)

Among different conservation practices, mulching is an important practice for crop production. According to Jackes et al. (1955), the English word mulch probably was derived from the German word ‘Molsch’ meaning “soft to decay”, Mulch is any porous or non-porous material spread on soil surface in order to obtain beneficial effect on soil environment and crop productivity. The benefits from mulching are prevention and control of soil and runoff losses, check on evaporation of water, increase in moisture status of soil, controls fluctuation of soil temperature, improvement in physical, chemical and biological properties of soils, reduced weed, pest and disease infestation, building of soil fertility and ultimately influence on the yield of crop and profit. There fore, the present experiment was undertaken to find out the effect of irrigation schedules and mulches on growth, yield and quality of sunflower in rabi season on medium deep black clayey soil of Northern Transitional Tract of Karnataka.

MATERIALS AND METHODS
A field experiment was conducted during Rabi 2003-04 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka). The experiment was laid out in split plot design with three replications. There were 12 treatment combinations consisting of four irrigation schedules (0.4, 0.6, 0.8 IW/CPE and critical stages) assigned to main plots and three mulches (no mulch, mulch, maize straw and polythene...
mulch) to sub plots. The soil was medium deep black clayey with pH 7.53, available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was 18.25:373 kg/ha and had field capacity of 33.97 per cent, wilting coefficient 16.92 per cent and bulk density of 1.29 Mg/m<sup>3</sup>. Sunflower hybrid (RSFH-1) was used for experimentation. This hybrid is derived from a cross between CMS-103 x RHA-64 NB. It is higher yielder than MSFH-17 and also have 23 per cent higher in oil content. A uniform fertilizer dose of 60:90:60 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O per hectare was applied. Scheduling of irrigation was done based on IW/CPE ratio with 60 mm depth of water in each irrigation. Maize straw @ 6 tonne per ha and transparent polythene sheet of 7 micron thickness were mulched at 25 days after sowing as per the sub plot treatment. These were spread uniformly between the sunflower crop rows without giving any gap in the plots after weeding. Five plants from each plot were selected at random and tagged for recording various growth, yield and yield attributes. Oil content was determined by Nuclear Magnetic Resonance (NMR) spectrophotometer against a standard reference sample according to A.O.A.C (1975). The oil yield (kg/ha) was computed using the following formula:

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\text{Oil yield (kg/ha)} = \frac{\text{Oil content (%)} \times \text{seed yield (kg/ha)}}{100}
\]

**RESULTS AND DISCUSSION**

Results of the experiment revealed that the significantly higher plant height (137.7 cm), number of leaves per plant (5.51), leaf area index (0.357) and total dry matter production per plant (159.8 g) were recorded in 0.8 IW/CPE ratio (Table 1) over rest of the irrigation schedules (0.4, 0.6 IW/CPE ratio and critical stages). This was mainly due to optimum moisture in root zone which favoured uptake of nutrients, resulting in better growth of the crop. These results were in accordance with results of Singh and Gupta (2002). The significantly higher plant height (131 cm) number of leaves (4.87), leaf area index (0.340) and total dry matter production per plant (156.2 g) were recorded in mulch with polythene treatment over rest of mulch treatments (no mulch and maize straw mulch). This could be attributed to higher availability of soil moisture in the root zone as the mulches are known to conserve the moisture, reduced weed and check the evaporation losses. Similar results were also reported by Shinde et al. (2001).

The significantly higher head diameter (14.34), number of seeds per head (662) and seed weight per head (25.61 g) (Table 2) were recorded in 0.8 IW/CPE ratio over rest of irrigation schedules (0.4, 0.6 IW/CPE ratio and critical stages). Increase in these yield components is mainly attributed to better performance of plants with respect to growth parameters like plant height, number of leaves, leaf area index and total dry matter production. This is mainly due to optimum moisture available in the root zone which favoured plant growth throughout growing period reflecting better growth attributes. These results are in accordance with results of Tomar et al. (2003).

Significantly higher head diameter (13.99 cm), number of seeds per head (634) and seed weight per

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**Table 1 : Growth parameters of sunflower at harvest as influenced by irrigation schedules and mulches**

<table>
<thead>
<tr>
<th>Irrigation schedules(I)</th>
<th>Plant height at harvest (cm)</th>
<th>Number of leaves per plant</th>
<th>Leaf area index</th>
<th>Total dry matter production per plant (g/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M&lt;sub&gt;1&lt;/sub&gt;</td>
<td>M&lt;sub&gt;2&lt;/sub&gt;</td>
<td>M&lt;sub&gt;3&lt;/sub&gt;</td>
<td>Mean</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------</td>
<td>------</td>
</tr>
<tr>
<td>I&lt;sub&gt;1&lt;/sub&gt;</td>
<td>119.6</td>
<td>118.6</td>
<td>127.5</td>
<td>121.9</td>
</tr>
<tr>
<td>I&lt;sub&gt;2&lt;/sub&gt;</td>
<td>126.1</td>
<td>126.3</td>
<td>133.7</td>
<td>128.7</td>
</tr>
<tr>
<td>I&lt;sub&gt;3&lt;/sub&gt;</td>
<td>133.8</td>
<td>136.3</td>
<td>142.8</td>
<td>137.7</td>
</tr>
<tr>
<td>I&lt;sub&gt;4&lt;/sub&gt;</td>
<td>114.2</td>
<td>116.6</td>
<td>120.1</td>
<td>117.0</td>
</tr>
<tr>
<td>Mean</td>
<td>123.4</td>
<td>124.4</td>
<td>131.0</td>
<td></td>
</tr>
<tr>
<td>For comparison</td>
<td>S.E±</td>
<td>C.D. (P=0.05)</td>
<td>S.E±</td>
<td>C.D. (P=0.05)</td>
</tr>
<tr>
<td>Irrigation schedules(I)</td>
<td>2.04</td>
<td>7.09</td>
<td>0.28</td>
<td>0.99</td>
</tr>
<tr>
<td>Mulches(M)</td>
<td>1.26</td>
<td>3.80</td>
<td>0.12</td>
<td>0.37</td>
</tr>
<tr>
<td>I x M</td>
<td>2.91</td>
<td>NS</td>
<td>0.35</td>
<td>NS</td>
</tr>
</tbody>
</table>

**Note:**
- I<sub>1</sub> : 0.4 IW / CPE
- I<sub>2</sub> : 0.6 IW / CPE
- I<sub>3</sub> : 0.8 IW / CPE
- I<sub>4</sub> : Critical stages
- M<sub>1</sub> : No mulch
- M<sub>2</sub> : Mulch with maize straw
- M<sub>3</sub> : Mulch with polythene
- NS-Non significant
head (23.73 g) were recorded in mulch with polythene over no mulch and maize straw mulch. This is attributed to higher plant height, number of leaves, leaf area index and total dry matter production in this treatment. Moody (1963) who reported increased availability of moisture in the root zone because of conservation of the soil moisture and reduced evaporation losses with application of mulches.

Interaction effects between irrigation schedules and mulches were not significant with respect to plant growth and yield components.

The significantly higher seed oil content (41.07%) and seed oil yield (795 kg/ha) were recorded in 0.8 IW/CPE ratio irrigation schedule over 0.4, 0.6 IW/CPE ratio and critical stages. The higher oil yield with more frequent irrigation could be attributed to higher growth and yield parameters. Similar observations were also made by Singh and Gupta (2002). Oil content (%) of sunflower not significantly influenced by mulches, but oil yield (kg/ha) was significantly higher in polythene mulch (761 kg/ha) over no mulch (654 kg/ha) and maize straw mulch (693 kg/ha) respectively. The higher oil yield in polythene mulch is due to higher growth and yield parameters in this treatment. Such difference in oil yield due to mulches was noticed earlier by Khanvilkar et al. (1987). Thus scheduling of irrigation at 0.8 IW/CPE ratio and mulch with polythene was found better for maximum growth, seed yield and quality of sunflower on medium deep black clayey soils of Northern Transitional Tract of Karnataka.

**REFERENCES**


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