INFLUENCE OF IRRIGATION AT CRITICAL STAGES ON YIELD AND QUALITY OF SUNFLOWER

A.NANDHAGOPAL, K.S. SUBRAMANIAN, A.GOPALAN AND A.BALASUBRAMANIAN
Agricultural Research Station
Tamil Nadu Agricultural University
Bhavanisagar 638 451

ABSTRACT

Field experiments were conducted in summer and kharif seasons during 1991-92 at the Agricultural Research Station, Bhavanisagar to study the critical stages of irrigation requirement for sunflower. Results revealed that skipping irrigations at button initiation, flowering and seed filling stages significantly reduced the seed yield of sunflower by 19.5, 31.2 and 9.4 per cent in summer and 11.9, 10.2 and 11.5 per cent in kharif respectively over the optimal level of irrigations scheduled. Response to irrigations was more pronounced in summer than kharif.

KEY WORDS : Sunflower, Stages, Irrigation, Yield

Sunflower is a recent entrant into India’s vegetable oil scenario accounting for four per cent of the current indigenous production of oil seeds. To step up the production and realise maximum benefit in a short period, it is imperative to schedule irrigations need based. Proper use of irrigation water demands its application at the proper dryness at which maximum net profit is obtained. Ideal irrigation frequency varies with climatic conditions, soil type, stage of growth, tolerance to soil dryness and consumptive use rate. Depth of water applied per irrigation should be equal to the soil moisture deficit created in the root zone. Lindstrom et al. (1982) found that flowering stage in sunflower is more sensitive to moisture stress. Rawson and Turner (1983) reported that crop has the capacity to recoup the loss in reduction in earlier leaf area due to moisture stress once it is alleviated. With this in view, an experiment was initiated to define the criteria or irrigation scheduling for sunflower growing tracts of Tamil Nadu.

MATERIALS AND METHODS

Field experiments were conducted in both summer and kharif seasons of 1991-92 at the Agricultural Research Station, Bhavanisagar, to assess the stage wise irrigation requirement in sunflower by adopting a spacing of 60 x 30 cm. Fertilizers were applied at the rate of 60:90:60 kg NPK ha⁻¹. Half of the N and full P and K were applied basally and remaining N top dresssed at button initiation and flowering stages on equal basis. Standard
Table 1. Effect of stages of irrigation on flowering and days to maturity in sunflower

<table>
<thead>
<tr>
<th>Investigation at (Phase)</th>
<th>1991 Days to 50% flowering</th>
<th>1992 Mean</th>
<th>1991 Days to maturity</th>
<th>1992 Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>基发</td>
<td>52.3</td>
<td>54.7</td>
<td>53.7</td>
<td>53.7</td>
</tr>
<tr>
<td>Vegetative</td>
<td>52.3</td>
<td>54.0</td>
<td>52.3</td>
<td>53.7</td>
</tr>
<tr>
<td>Button initiation</td>
<td>51.3</td>
<td>53.3</td>
<td>51.0</td>
<td>53.0</td>
</tr>
<tr>
<td>Flowering</td>
<td>53.3</td>
<td>54.3</td>
<td>53.3</td>
<td>54.0</td>
</tr>
<tr>
<td>Seed filling</td>
<td>53.0</td>
<td>54.3</td>
<td>53.7</td>
<td>54.0</td>
</tr>
<tr>
<td>Seed Maturity</td>
<td>53.3</td>
<td>54.7</td>
<td>53.7</td>
<td>54.0</td>
</tr>
<tr>
<td>Need based</td>
<td>52.7</td>
<td>55.0</td>
<td>53.7</td>
<td>54.7</td>
</tr>
<tr>
<td>CD (P=0.05)</td>
<td>1.01</td>
<td>0.89</td>
<td>0.91</td>
<td>NS</td>
</tr>
</tbody>
</table>

S: Summer; K: Kharif; NS: Not significant

agronomic practices were followed. During the course of study, observations on days to 50 per cent flowering, Maturity, seed filling and seed yield were recorded. Seed samples drawn treatmentwise were estimated for oil content using Nuclear Magnetic Resonance.

RESULTS AND DISCUSSION

Days to 50 per cent flowering

The data on days to 50 per cent flowering (Table 1) clearly indicated that moisture stress at various growth stages significantly altered the flowering behaviour. It varied from 51- 54 and 53-55 days to attain 50 per cent flowering in summer and kharif seasons, respectively. Moisture stress imposed at button initiation stage reduced the time taken by 3 and 2 days in summer and kharif seasons respectively over optimal moisture regime. But initiation being critical stage of moisture requirement, it might have altered the normal course of flowering behaviour (Sindagi and Virupakshappa, 1987).

Days to maturity

Consequent to the alteration in flowering behaviour, days to maturity also fluctuated correspondingly. It varied from 91-95 and 92-95 days in summer and kharif seasons respectively. Stress experienced by sunflower at button initiations, lowered the number of days to attain 50 per cent flowering and later optimal moisture regimes helped in recouping and behaved normally as that of optimal need based irrigation treatment. However, skipping irrigation at critical stages of crop growth especially flowering, seed filling and seed maturity could not be recovered and registering lower values under these treatments over optimal moisture regimes which again signifies the need of irrigation at these stages. The results are in accordance with the findings of Hegde (1988).

Plant height

Plant height measured at harvest stage showed significant variations among the treatments in both the seasons. Highest values were recorded under

Table 2. Effect of stages of irrigation on plant height and seed filling in sunflower

<table>
<thead>
<tr>
<th>Investigation at (Phase)</th>
<th>1991 Plant height (cm)</th>
<th>1992 Mean</th>
<th>1991 Seed Filling (%)</th>
<th>1992 Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>基发</td>
<td>163.2</td>
<td>142.3</td>
<td>160.3</td>
<td>148.1</td>
</tr>
<tr>
<td>Vegetative</td>
<td>162.1</td>
<td>141.0</td>
<td>159.0</td>
<td>140.6</td>
</tr>
<tr>
<td>Button initiation</td>
<td>160.1</td>
<td>136.9</td>
<td>158.8</td>
<td>141.6</td>
</tr>
<tr>
<td>Flowering</td>
<td>152.1</td>
<td>130.9</td>
<td>152.7</td>
<td>138.3</td>
</tr>
<tr>
<td>Seed filling</td>
<td>160.2</td>
<td>141.1</td>
<td>128.1</td>
<td>142.3</td>
</tr>
<tr>
<td>Seed Maturity</td>
<td>166.4</td>
<td>140.2</td>
<td>159.2</td>
<td>141.9</td>
</tr>
<tr>
<td>Need based</td>
<td>165.4</td>
<td>141.7</td>
<td>162.1</td>
<td>148.4</td>
</tr>
<tr>
<td>CD (P=0.05)</td>
<td>3.94</td>
<td>5.27</td>
<td>4.38</td>
<td>4.84</td>
</tr>
</tbody>
</table>
Table 3. Effect of stages of irrigation on seed yield and oil content in sunflower

<table>
<thead>
<tr>
<th>Investigation at (Phase)</th>
<th>1991</th>
<th>1992</th>
<th>Mean</th>
<th>1991</th>
<th>1992</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S</td>
<td>K</td>
<td>S</td>
<td>K</td>
<td>S</td>
<td>K</td>
</tr>
<tr>
<td>Germination</td>
<td>1358</td>
<td>1339</td>
<td>1359</td>
<td>1274</td>
<td>1359</td>
<td>1357</td>
</tr>
<tr>
<td>Vegetative</td>
<td>122</td>
<td>1194</td>
<td>1146</td>
<td>1231</td>
<td>1188</td>
<td>1213</td>
</tr>
<tr>
<td>Button initiation</td>
<td>1124</td>
<td>1174</td>
<td>1061</td>
<td>1221</td>
<td>1093</td>
<td>1198</td>
</tr>
<tr>
<td>Flowering</td>
<td>959</td>
<td>1258</td>
<td>910</td>
<td>1178</td>
<td>935</td>
<td>1218</td>
</tr>
<tr>
<td>Seed filling</td>
<td>1215</td>
<td>1132</td>
<td>1247</td>
<td>1270</td>
<td>1231</td>
<td>1201</td>
</tr>
<tr>
<td>Seed Maturity</td>
<td>1262</td>
<td>1288</td>
<td>1216</td>
<td>1349</td>
<td>1239</td>
<td>1319</td>
</tr>
<tr>
<td>Seed based</td>
<td>1297</td>
<td>1333</td>
<td>1339</td>
<td>1364</td>
<td>1318</td>
<td>1349</td>
</tr>
<tr>
<td>CD (P=0.05)</td>
<td>87.68</td>
<td>124.39</td>
<td>87.19</td>
<td>NS</td>
<td>2.06</td>
<td>6.82</td>
</tr>
</tbody>
</table>

S: Summer; K: Kharif; NS: Not significant.

optical moisture regimes and reduced significantly under treatments receiving moisture stress at irrespective of stages. However, the reduction in plant height was well pronounced in the treatment experiencing moisture stress at flowering.

Head diameter

There was no significant differences among the treatments experiencing moisture stress at various growth stages on the head diameter.

Seed filling

Seed filling showed significant differences among the treatments. Lower values were registered under treatment receiving moisture stress at seed filling and flowering stages in kharif and summer seasons respectively (Table 2).

Seed yield

Data on seed yield (Table 3) revealed that moisture stress at various growth stages reduced the seed yield significantly in both the seasons. Highest seed yields were recorded under treatment scheduled at optimal seed based irrigation. Yield reduction was more pronounced in summer than kharif due to moisture stress experienced by the crop irrespective of crop growth stages. It is obvious that alleviation of moisture, purfroth ramification of secondary and tertiary roots thereby the reduction in seeds yields was more under treatments receiving stress at button initiation, flowering and seed filling stages exhibiting the necessity for irrigation at these critical stages.

Oil content

Oil content estimated showed a significant variation among treatments. Higher oil build up was registered in summer than kharif. Moisture stress at all growth stages significantly reduced the oil content over normal irrigation.

REFERENCES


(Received: December 1994. Revised: June 1995)