OIL CROPS: SESAME AND SUNFLOWER SUBNETWORKS

PROCEEDINGS OF THE JOINT SECOND
WORKSHOP HELD IN CAIRO, EGYPT,
9–12 SEPTEMBER 1989
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This series includes meeting documents, internal reports, and preliminary technical documents that may later form the basis of a formal publication. A Manuscript Report is given a small distribution to a highly specialized audience.

La présente série est réservée aux documents issus de colloques, aux rapports internes et aux documents techniques susceptibles d’être publiés plus tard dans une série de publications plus soignées. D’un tirage restreint, le rapport manuscrit est destiné à un public très spécialisé.

Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.
OIL CROPS:
SESAME AND SUNFLOWER SUBNETWORKS

Proceedings of the Joint Second Workshop
held in Cairo, Egypt, 9–12 September 1989

Edited by
Abbas Omran
Technical Adviser, Oil Crops Network

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Food and Agriculture Organization, Industrial Crops and European Office, Rome
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International Development Research Centre, Canada

Scientific and Organizing Committee
Dr Abbas Omran
Dr Badr A. El-Ahmar
Dr Eglal Rashed
In September 1989, the Sunflower and Sesame subnetworks held their bi-annual meetings in Cairo, Egypt. The meetings were well attended and papers, presented in these proceedings, provide a very informative overview of some of the cropping systems, management practices, production constraints and research highlights for both crops in several countries.

Chronic edible oil deficit is a major problem facing many developing countries in Africa and Asia where most countries are forced to import large quantities to satisfy the requirements of their growing populations. With the present rates of population increase and the improvement of nutrition standards it is likely that the consumption of edible oil will rise over the years, increasingly drawing on scarce foreign exchange for the importation of this vital food staple. For this reason, several countries have opted to increase self-sufficiency in edible oil.

Production deficits are due to a number of factors, among which neglect in oilcrops research, in both developed and developing countries has been a major one. This is particularly true for minor crops such as sesame. In the context of the IDRC oilcrops network, initiated in 1981, the interchange of information and the sharing of results between scientists have proved to be very useful and beneficial for the generation of scientific knowledge and the stimulation of research in this important area. It is hoped that conclusions and recommendations of this meeting will stimulate further research and development in the future.

A second important reason for limited national production has been the exceptionally low levels of world prices for oils and fats in the 1980’s and the comparative advantage of importation over production for developing countries. The description of a case study using a systems’ approach to analysing the Vegetable Oil/Protein System of Kenya has stirred much interest during the Cairo meetings and it is hoped that similar work can be carried out in other countries in the future.

The Cairo meetings will also unfortunately be remembered as the one which has witnessed the diagnosis of the fatal disease of late Dr. Hiruy Belayneh, Chairman of the Brassica Subnetwork. We will all regret his absence.

On behalf of IDRC and of all participants, I would like to thank the Government of Egypt for its hospitality, the organizers for the excellent arrangements and all those who contributed to the success of these meetings by their presentations and discussions.

Eglal Nached,
Senior Program Officer,
IDRC, Cairo
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In Egypt, there is a severe shortage in vegetable edible oils. The majority of local oil production comes from cotton seed. However, there is no prospect to increase the area devoted to cotton cultivation. Therefore, increasing oil production depends on cultivation of the new oilcrops, such as sunflower.

Maximizing sunflower yield under Egyptian condition can be achieved by introduction of good varieties and/or application of suitable cultural treatments. Nitrogen fertilization and plant population density are the main factors affecting yield and its components in sunflower.

Materials and Methods

The experimental site of this study was at the Faculty of Agric., Cairo Univ., Agric. Research Centre (ARC) at Giza. The soil type is loamy clay; the pH 7.8-7.9, total N 0.11 - 0.12% and organic matter 1.17%. Three nitrogen levels, 30, 60 and 90 kg N/feddan (one feddan = 4200 m²), were applied in the form of ammonium nitrate (33% N), after thinning, just before the first irrigation. Also, three plant densities were used (17,000, 35,000 and 70,000 plants/feddan). These densities were obtained in distributions by the following hill spacing and number of plants/hill. The variety used was Mayak:

<table>
<thead>
<tr>
<th>System</th>
<th>Plant spacing (cm)</th>
<th>Row spacing (cm)</th>
<th>Hill spacing (cm)</th>
<th>Plant/hill</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>17.500</td>
<td>60</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>II.</td>
<td>35.000</td>
<td>60</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>III.</td>
<td>35.000</td>
<td>60</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>IV.</td>
<td>70.000</td>
<td>60</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>

Results and Discussion

Effect of N fertilization

Two experiments were conducted. Data in Table 1 showed that an average of both experiments showed that increasing N level from 30 to 60 kg/feddan increased plant height, stem diameter, leaf area, leaf area index, head diameter, and dry weight of leaves, stems, head and tops. However, increasing N level from 60 to 90 kg/feddan did not significantly increase these characters. Also, increasing N level from 30 to 60 kg/feddan significantly increased yield and its components, i.e. head diameter, 500-seed weight and seed weight/head, Table 2.

Thus, the present results indicated that application of 60 kg N/feddan to sunflower was enough to maximize growth of the plants, seed and oil yields under the conditions of this study.

Effect of plant population density

As plant population increased leaf area, head diameter, dry weight of leaves, stems and heads were decreased but leaf area index increased in both experiments, Table 3. However, plant height (in both experiments) and stem diameter (in the second one) were not significantly affected by population density.

Seed and oil yields of sunflower and their components (head diameter, seed weight/head, 500-seed weight) were significantly affected by plant population density. However, oil content was not significantly affected.
Table 1. Effect of N levels on plant characteristics at peak flowering.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>N levels (kg/fed)</th>
<th>Plant height (cm)</th>
<th>Stem diameter (cm)</th>
<th>Leaf area (dm²)</th>
<th>Leaf area index</th>
<th>Head diameter (cm)</th>
<th>Dry weight (g) of leaves</th>
<th>Stem</th>
<th>Head</th>
<th>Total top</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>198.9</td>
<td>1.89</td>
<td>35.9</td>
<td>2.93</td>
<td>9.2</td>
<td>26.8</td>
<td>59.9</td>
<td>13.5</td>
<td>100.2</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>213.6</td>
<td>2.10</td>
<td>48.6</td>
<td>4.12</td>
<td>10.0</td>
<td>38.6</td>
<td>93.2</td>
<td>15.2</td>
<td>127.0</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>N.S.</td>
<td>7.96</td>
<td>6.49</td>
<td>7.6</td>
<td>4.66</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>116.5</td>
<td>1.54</td>
<td>31.8</td>
<td>2.87</td>
<td>7.7</td>
<td>24.8</td>
<td>25.0</td>
<td>79.7</td>
<td>57.77</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>121.5</td>
<td>1.66</td>
<td>35.1</td>
<td>3.28</td>
<td>7.7</td>
<td>32.9</td>
<td>32.7</td>
<td>7.94</td>
<td>72.94</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>129.0</td>
<td>1.78</td>
<td>34.5</td>
<td>3.01</td>
<td>8.2</td>
<td>36.0</td>
<td>29.6</td>
<td>8.4</td>
<td>74.0</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>5.78</td>
<td>5.69</td>
<td>N.S.</td>
<td>8.80</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Effect of N levels on yield and yield components.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>N levels (kg/fed)</th>
<th>Head diameter (cm)</th>
<th>Seed Weight/head (g)</th>
<th>500 seed weight (g)</th>
<th>Seed yield (ton/fed)</th>
<th>Oil content (%)</th>
<th>Oil yield (ton/fed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>13.7</td>
<td>37.7</td>
<td>24.81</td>
<td>1.09</td>
<td>45.52</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>15.0</td>
<td>49.5</td>
<td>28.72</td>
<td>1.43</td>
<td>44.54</td>
<td>0.64</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>0.08</td>
<td>5.95</td>
<td>2.02</td>
<td>0.214</td>
<td>N.S.</td>
<td>0.143</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>14.28</td>
<td>53.73</td>
<td>28.60</td>
<td>1.34</td>
<td>45.17</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>15.15</td>
<td>61.47</td>
<td>31.60</td>
<td>1.58</td>
<td>44.75</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>15.55</td>
<td>62.52</td>
<td>32.27</td>
<td>1.51</td>
<td>43.97</td>
<td>0.57</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>0.07</td>
<td>5.06</td>
<td>2.12</td>
<td>0.14 N.S.</td>
<td>0.08 N.S.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Effect of plant population density on plant characteristics at flowering peak.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Plant population density</th>
<th>Plant height (cm)</th>
<th>Stem diameter (cm)</th>
<th>Leaf area (dm²)</th>
<th>Leaf area index</th>
<th>Head diameter (cm)</th>
<th>Dry weight (g) of leaves</th>
<th>Stem</th>
<th>Head</th>
<th>Total top</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>211.3</td>
<td>2.20</td>
<td>55.9</td>
<td>2.31</td>
<td>11.0</td>
<td>44.2</td>
<td>84.7</td>
<td>18.3</td>
<td>147.2</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>197.0</td>
<td>1.98</td>
<td>49.8</td>
<td>3.88</td>
<td>9.2</td>
<td>32.6</td>
<td>58.0</td>
<td>13.7</td>
<td>104.2</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>211.5</td>
<td>2.03</td>
<td>40.5</td>
<td>3.86</td>
<td>10.0</td>
<td>33.1</td>
<td>69.1</td>
<td>15.5</td>
<td>117.7</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>205.4</td>
<td>1.75</td>
<td>27.3</td>
<td>4.53</td>
<td>8.4</td>
<td>21.1</td>
<td>54.6</td>
<td>9.8</td>
<td>85.5</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>0.21</td>
<td>11.75</td>
<td>0.92</td>
<td>1.41</td>
<td>6.74</td>
<td>12.26</td>
<td>4.42</td>
<td>17.8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>116.5</td>
<td>1.89</td>
<td>35.4</td>
<td>1.51</td>
<td>8.7</td>
<td>28.5</td>
<td>40.6</td>
<td>9.5</td>
<td>78.6</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>117.3</td>
<td>1.47</td>
<td>32.2</td>
<td>2.63</td>
<td>8.0</td>
<td>26.0</td>
<td>24.2</td>
<td>7.82</td>
<td>50.02</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>124.9</td>
<td>1.64</td>
<td>39.3</td>
<td>3.28</td>
<td>7.6</td>
<td>49.1</td>
<td>28.7</td>
<td>7.91</td>
<td>52.71</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>130.8</td>
<td>1.69</td>
<td>28.2</td>
<td>4.52</td>
<td>7.3</td>
<td>21.4</td>
<td>22.2</td>
<td>7.18</td>
<td>50.78</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>NS</td>
<td>6.198</td>
<td>0.657</td>
<td>0.67</td>
<td>4.375</td>
<td>7.25</td>
<td>1.073</td>
<td>9.849</td>
<td>15.9</td>
</tr>
</tbody>
</table>
Inspite of the reduction in yield components, such increase in seed and oil yield could be explained by the number of harvestable plants which increased from 14,875 to 28,525 to 49000 plants /feddan, when plant population density increased from 17,000 to 35,000 to 70,000 plants/feddan, respectively, Table 4.

Regarding the plant population density of 35,000 plants/feddan, the average results of treatment used by two systems (II & III), revealed that system III resulted in greater harvestable plants, seeds and oil yields by 10.2, 13.1 and 10.2%, respectively, over system II, as an average of both experiments.

Table 4. Effect of plant population density on yield and yield components.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Plant population diameter (cm)</th>
<th>Seed weight/head (g)</th>
<th>500 seed weight (g)</th>
<th>Seed yield (ton/fed)</th>
<th>Seed oil content (%)</th>
<th>Oil yield (ton/fed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>16.2</td>
<td>60.8</td>
<td>29.59</td>
<td>1.04</td>
<td>44.87</td>
<td>0.47</td>
</tr>
<tr>
<td>II</td>
<td>13.9</td>
<td>41.0</td>
<td>26.22</td>
<td>1.16</td>
<td>44.69</td>
<td>0.52</td>
</tr>
<tr>
<td>III</td>
<td>13.9</td>
<td>43.2</td>
<td>26.40</td>
<td>1.35</td>
<td>43.93</td>
<td>0.59</td>
</tr>
<tr>
<td>IV</td>
<td>13.4</td>
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<td>24.86</td>
<td>1.48</td>
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<td>0.66</td>
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</tr>
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<td></td>
</tr>
<tr>
<td>I</td>
<td>17.38</td>
<td>72.22</td>
<td>31.18</td>
<td>1.02</td>
<td>43.64</td>
<td>0.46</td>
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<td>II</td>
<td>15.38</td>
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<tr>
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<td>1.59</td>
<td>44.26</td>
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<tr>
<td>IV</td>
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