2) *Irrigation Effect on Maize and Soybean (1976)*

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**Material and Method**

**Bariety:**  
Maize: Suwan No.1, Soybean: SJ 2

**Treatment:**  
Two levels of irrigation interval (I₁ and I₂), three rates of irrigation amount for vegetative growth stage (V₁, V₂ and V₃), and two rates of irrigation amount for reproductive growth stage (R₁ and R₂) were combined each other as follows. Thus, twelve treatment were made.

**Interval:**  
4 days  
7 days

**Rate of irrigation amount:**  

<table>
<thead>
<tr>
<th>(V)</th>
<th>(R)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>V₁ R₁</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>V₁ R₂</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>V₂ R₁</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>V₂ R₂</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>V₃ R₁</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>V₃ R₂</td>
</tr>
</tbody>
</table>

**Design and plot size:**  
The split plot design was employed with 2 replications, disposing the irrigation interval as main plot, the rate of irrigation amount for the vegetative growth stage as sub plot, and that for the reproductive growth stage as sub-sub plot.

**The size of sub-sub plot was:**  
Maize: 81 m² (9 m x 9 m)  
Soybean: 45 m² (7.5 m x 6 m)

**Sowing:**  
Maize: January 26, 1976  
Soybean: January 29, 1976

**Harvesting:**  
Maize: April 29, 1976  
Soybean: May 3, 1976

**Spacing:**  
Maize: 75 cm x 25 cm, 1 plant per hill  
Soybean: 60 cm x 20 cm, 2 plants per hill

**Fertilizer application (Kg/ha):**  
Maize: N: 150, P₂O₅: 75, K₂O:50  
Soybean: N: 20, P₂O₅: 50, K₂O:50

**Irrigation practice:**  
The furrow irrigation was done similarly as in the previous year. Total irrigation amount and rainfall during the experiment are summarized in Table 2-2.

**Climatic conditions**

The climatic conditions during the experimental period were nearly normal (See Appendix). The air temperature rose gradually from the seeding to the ripening stage; the average maximum temperature of every ten days during the reproductive growth stage was as high as 35° — 38°C. The rainfall was a little during the period except early February; irrigation was done almost regularly as scheduled.
Results

Maize

1. In the vegetative growth stage of maize, irrigation at the rate of 4 mm/day induced better growth than that of 2 mm or 7 mm/day. This effect of irrigation rate was still observed in the reproductive growth stage (Fig. 2-3). In the reproductive growth stage of maize, irrigation at the rate of 7 mm/day had more favorable effects than that of 4 mm/day (Fig.2-3 and 4).

It was observed that maize could recover from unfavorable growth condition caused by insufficient water supply (2 mm/day) in vegetative growth stage when sufficient water (7 mm/day) was provided in reproductive growth stage; however, unfavorable growth condition caused by excess water supply (7 mm/day) in vegetative growth stage could not be recovered by any means in reproductive growth stage. (Fig.2-4 and 5).

2. Water efficiency in terms of grain yield per unit amount of water was summarized in Table 2-4. To increase maize yield with high water efficiency, irrigation at the rate of 2 mm to 4 mm/day in the vegetative growth stage and 7 mm/day in the reproductive growth stage could be recommended (Table 2-3 and 4).

3. Different levels of irrigation interval, 4 days and 7 days, did not induce a significant difference in the growth and yield of maize.

Soybean

1. The growth of soybean plant was less vigorous with the irrigation of 2 mm per day in the vegetative growth stage. There was not seen a significant difference of the growth between the irrigation rates of 4 mm and 7 mm per day throughout the growing period. (Fig.2-6). The grain yield was not significantly affected by the irrigation rate. (Table 2-5, Fig.2-7).

2. Different levels of the irrigation interval did not induce any significant difference in the growth and grain yield of soybean.

3. From the view point of maintaining soybean yield with high water efficiency, the irrigation rate of 2 mm to 4 mm/day in the vegetative growth stage and 4 mm/day in the reproductive growth stage could be recommended (Table 2-5 and 6).

| Table 2-2. (a) Amount of irrigation water and rainfall on maize field |
|------------------------|-----------------|-----------------|-----------------|
| Treatment | Rate and interval | Irrigation | Rainfall | Total |
| Sign | mm/day day | mm | mm | mm |
| I,V,R | 2 - 4 4 | 115.7 + 176 = 291.7 | 42.1 + 6.7 = 48.8 | 340.5 |
| V,R | 2 - 7 4 | 115.7 + 308 = 423.7 | **"** **"** | 472.5 |
| V,R | 4 - 4 4 | 195.7 + 176 = 371.7 | **"** **"** | 420.5 |
| V,R | 4 - 7 4 | 195.7 + 308 = 503.7 | **"** **"** | 552.5 |
| V,R | 7 - 7 4 | 315.7 + 308 = 623.7 | **""** **""** | 672.5 |
| V,R | 7 - 10 4 | 315.7 + 440 = 755.7 | **""** **""** | 804.5 |
| I,V,R | 2 - 4 7 | 119.7 + 168 = 287.7 | **""""** | 336.5 |
| V,R | 2 - 7 7 | 119.7 + 294 = 413.7 | **""""** | 462.5 |
| V,R | 4 - 4 7 | 203.7 + 168 = 371.7 | **""""** | 420.5 |
| V,R | 4 - 7 7 | 203.7 + 294 = 497.7 | **""""** | 546.5 |
| V,R | 7 - 7 7 | 329.7 + 294 = 623.7 | **""""** | 672.5 |
| V,R | 7 - 10 7 | 329.7 + 420 = 749.7 | **""""** | 798.5 |

Remarks: * Irrigation or rainfall in the vegetative growth stage. 70 mm of irrigation for uniform germination was included.
** The same in the reproductive growth stage.
Table 2-2. (b) Amount of irrigation water and rainfall on soybean field

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Irrigation (mm)</th>
<th>Rainfall (mm)</th>
<th>Total (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I, V, R,</td>
<td>* *</td>
<td>* *</td>
<td>380.5</td>
</tr>
<tr>
<td>V, R,</td>
<td>91.7 + 208 = 299.7</td>
<td>34.3 + 46.5 = 80.8</td>
<td>380.5</td>
</tr>
<tr>
<td>V, R,</td>
<td>147.7 + 208 = 355.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>147.7 + 364 = 511.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>231.7 + 364 = 595.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>231.7 + 520 = 751.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>I, V, R,</td>
<td>91.7 + 224 = 315.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>91.7 + 392 = 483.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>147.7 + 224 = 371.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>147.7 + 392 = 539.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>231.7 + 392 = 623.7</td>
<td>* *</td>
<td>* *</td>
</tr>
<tr>
<td>V, R,</td>
<td>231.7 + 560 = 791.7</td>
<td>* *</td>
<td>* *</td>
</tr>
</tbody>
</table>

Remarks: \* and \*\* mean the same as in the former.

Table 2-3. Yield and yield components of maize

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain yield t/ha</th>
<th>No. of ears per m²</th>
<th>No. of grains per ear</th>
<th>100(^1) grain weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I, V, R,</td>
<td>2.50</td>
<td>4.9</td>
<td>250</td>
<td>20.6</td>
</tr>
<tr>
<td>V, R,</td>
<td>3.42</td>
<td>5.2</td>
<td>284</td>
<td>23.2</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.47</td>
<td>5.2</td>
<td>224</td>
<td>21.5</td>
</tr>
<tr>
<td>V, R,</td>
<td>3.46</td>
<td>5.1</td>
<td>307</td>
<td>22.2</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.13</td>
<td>4.6</td>
<td>262</td>
<td>17.9</td>
</tr>
<tr>
<td>V, R,</td>
<td>1.96</td>
<td>5.0</td>
<td>216</td>
<td>18.6</td>
</tr>
<tr>
<td>I, V, R,</td>
<td>2.14</td>
<td>4.8</td>
<td>210</td>
<td>21.3</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.84</td>
<td>5.0</td>
<td>261</td>
<td>21.7</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.22</td>
<td>4.6</td>
<td>210</td>
<td>21.3</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.94</td>
<td>5.2</td>
<td>258</td>
<td>22.2</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.25</td>
<td>4.8</td>
<td>222</td>
<td>21.2</td>
</tr>
<tr>
<td>V, R,</td>
<td>2.54</td>
<td>4.4</td>
<td>274</td>
<td>21.2</td>
</tr>
</tbody>
</table>

Remarks: 1) 13% moisture content.

Table 2-4. Water efficiency on grain yield of maize

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Efficiency(^1) (Kg/ha/cm)</th>
<th>Treatment</th>
<th>Efficiency(^1) (Kg/ha/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I, V, R,</td>
<td>74</td>
<td>I, V, R,</td>
<td>64</td>
</tr>
<tr>
<td>V, R,</td>
<td>73</td>
<td>V, R,</td>
<td>62</td>
</tr>
<tr>
<td>V, R,</td>
<td>59</td>
<td>V, R,</td>
<td>49</td>
</tr>
<tr>
<td>V, R,</td>
<td>63</td>
<td>V, R,</td>
<td>54</td>
</tr>
<tr>
<td>V, R,</td>
<td>32</td>
<td>V, R,</td>
<td>33</td>
</tr>
<tr>
<td>V, R,</td>
<td>24</td>
<td>V, R,</td>
<td>32</td>
</tr>
</tbody>
</table>

Remarks: 1) Calculated as the grain yield (Kg/ha) per unit amount of water (cm).
### Table 2-5. Yield and yield component of soybean

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain yield Gross t/ha</th>
<th>No. of Full grain t/ha</th>
<th>No. of pods Plants/m²</th>
<th>No. of full grains per plant</th>
<th>Weight of 100 grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>I₁V₁R₁</td>
<td>2.37</td>
<td>2.10</td>
<td>16.4</td>
<td>58.5</td>
<td>2.0</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>1.99</td>
<td>1.76</td>
<td>15.6</td>
<td>63.0</td>
<td>1.8</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>2.49</td>
<td>2.40</td>
<td>16.0</td>
<td>72.0</td>
<td>1.9</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>2.69</td>
<td>2.37</td>
<td>15.0</td>
<td>69.0</td>
<td>1.9</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>2.33</td>
<td>2.05</td>
<td>15.0</td>
<td>68.5</td>
<td>1.9</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>2.59</td>
<td>2.36</td>
<td>15.8</td>
<td>63.9</td>
<td>2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of Plants/m²</th>
<th>No. of full grains/pod</th>
<th>Weight of 100 grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>I₁V₁R₁</td>
<td>2.10</td>
<td>16.1</td>
<td>56.6</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>1.75</td>
<td>15.9</td>
<td>53.8</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>2.29</td>
<td>15.9</td>
<td>64.7</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>2.47</td>
<td>15.4</td>
<td>84.1</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>1.99</td>
<td>16.2</td>
<td>61.5</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>2.33</td>
<td>15.2</td>
<td>61.5</td>
</tr>
</tbody>
</table>

Remarks: Moisture content of grain was 13%.

### Table 2-6. Water efficiency on grain yield of soybean

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Efficiency (Kg/ha/cm)</th>
<th>Treatment</th>
<th>Efficiency (Kg/ha/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I₁V₁R₁</td>
<td>57</td>
<td>I₁V₁R₁</td>
<td>49</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>35</td>
<td>V₁R₂</td>
<td>29</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>54</td>
<td>V₁R₂</td>
<td>38</td>
</tr>
<tr>
<td>V₁R₂</td>
<td>43</td>
<td>V₁R₂</td>
<td>31</td>
</tr>
<tr>
<td>V₁R₁</td>
<td>33</td>
<td>V₁R₂</td>
<td>26</td>
</tr>
</tbody>
</table>

Remarks: Water efficiency was expressed as the grain yield (Kg/ha) per unit amount of water (cm) including irrigation and rainfall.
Fig. 2-3. Dry weight of maize plant in relation to rate of irrigation amount
Fig. 2-4. Leaf area index of maize in relation to rate of irrigation amount

Fig. 2-5. Yield of maize
Fig. 2-6. Dry weight of soybean plant as affected by rate of irrigation amount in vegetative growth stage

Fig. 2-7. Grain yield of soybean