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LENS

LENS Newsletter is produced twice a year at ICARDA in cooperation with the University of Saskatchewan, Canada with the financial support of the International Development Research Centre (IDRC), Ottawa, Canada. LENS, the newsletter of the Lentil News Service, is a forum for communicating lentil research results. Short research articles provide rapid information exchange, and comprehensive reviews are invited regularly on specific areas of lentil research. The newsletter also includes book reviews, key abstracts on lentils, and recent lentil references. The Lentil News Service provides information on lentil research free of charge through a question and answer service, photocopies, and searches of a lentil document collection.


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COVER PHOTO: Lentil harvest in Kameshly on a farmer’s field by swath-mowers of General Organization of Agricultural Mechanization of the Government of Syria. The 4m wide mower cuts the crop leaving it in a swathe.

Photo Credit: Dr. W. Erskine

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Breeding and Genetics

Talia 2 - a lentil cultivar for Lebanon

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1. Agricultural Research Institute, Tel Amara, LEBANON
2. ICARDA Terbol Station, Beqa’a Valley, LEBANON
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Abstract

Description is given of Talia 2, a new lentil cultivar released in Lebanon. In comparative performance of lentil cultivars at Beqa’a valley during 1980-89 seasons, Talia 2 gave an average seed yield of 1501 kg/ha in comparison with 1191 kg/ha for Lebanese local. Talia 2 matures earlier. It is less tall. The seed coat is mid-brown. The average seed weight is 2.76 g/100 seeds. The protein content is 28.8 and cooking time is 35 min.

Introduction

Lentil is an important dietary item in Lebanon. A total of approximately 4000 ha is grown with lentil annually (FAO 1987) and there is a considerable quantity of lentil seed imported. The joint breeding program of the Agriculture Research Institute, Tel Amara, Lebanon and the International Center for Agricultural Research in the Dry Areas (ICARDA) has produced a new lentil cultivar for Lebanon, which has been released as Talia 2.

Talia 2 is a small-seeded, red cotyledon lentil with a higher yield than Lebanese local (ILL 4399). The results of 13 yield trials spread over the seven seasons 1980/1981 to 1988/1989 and three sites in the Beqa’a valley (AREC American University of Beirut Farm, and Terbol and Kfardan Stations of ICARDA) show an average seed yield of 1501 kg/ha for Talia 2 compared to 1191 kg/ha for Lebanese local giving a yield advantage of 26% (Table 1). In a large-scale test carried out in the 1988/1989 season by the Agricultural Research Institute (ARI), Talia 2 yielded 777 kg/ha in contrast to Lebanese local which yielded 241 kg/ha.

Talia 2 flowers and matures earlier than Lebanese local and is less tall (Table 2). Its seed coat colour is mid-brown without any pattern. The average seed weight of Talia 2 is 2.76 g/100 seeds compared to 3.30 g/100 seeds for Lebanese local. The protein contents of Talia 2 and Lebanese local are 28.8 and 28.5%, respectively. The cooking times for Talia 2 and Lebanese Local are 35 and 25 mins, respectively. The methods used to measure cooking time and protein content are given in Erskine et al. (1985).

Talia 2 originates from a single plant selection, 78S 20013 made in 1978 at ICARDA, Aleppo from a germplasm accession ILL 16 collected at Salt in Jordan in 1972 by the Arid Lands Agricultural Development Program, Lebanon.

<table>
<thead>
<tr>
<th>Season</th>
<th>Location</th>
<th>Cultivar</th>
<th>LSD (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980/81</td>
<td>AREC</td>
<td>1844</td>
<td>1320</td>
</tr>
<tr>
<td>1980/81</td>
<td>Kfardan</td>
<td>992</td>
<td>896</td>
</tr>
<tr>
<td>1980/81</td>
<td>Terbol</td>
<td>1463</td>
<td>1198</td>
</tr>
<tr>
<td>1981/82</td>
<td>Kfardan</td>
<td>530</td>
<td>577</td>
</tr>
<tr>
<td>1981/82</td>
<td>Terbol</td>
<td>2352</td>
<td>1796</td>
</tr>
<tr>
<td>1982/83</td>
<td>Terbol</td>
<td>2298</td>
<td>1796</td>
</tr>
<tr>
<td>1983/84</td>
<td>Terbol</td>
<td>1622</td>
<td>1267</td>
</tr>
<tr>
<td>1984/85</td>
<td>AREC</td>
<td>257</td>
<td>761</td>
</tr>
<tr>
<td>1984/85</td>
<td>Terbol</td>
<td>1979</td>
<td>1500</td>
</tr>
<tr>
<td>1987/88</td>
<td>Terbol</td>
<td>1239</td>
<td>1153</td>
</tr>
<tr>
<td>1987/88</td>
<td>ARI</td>
<td>2600</td>
<td>2000</td>
</tr>
<tr>
<td>1988/89</td>
<td>Terbol</td>
<td>1565</td>
<td>1074</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>1501</td>
<td>1191</td>
</tr>
</tbody>
</table>
**References**


**ملخص**

يقدم هذا المقال وصفًا لصنف العدس الجديد تاليا ٢ المتعدد في لبنان. وتمّ تجربة نفط في وادي البقاع خلال المواسم ١٩٨٠ – ١٩٩٠ على ذلك العلامة متوسطة نيئة ١٥٠٠ كجم/كلغة مكافئ١١٩١ كجم/كلغة أعطها الصنف اللبناني المحلي. إضافة إلى أن ذلك الصنف أكثر باكورة وقاح طولا، والغلاف بدرين بني متوسط، ووزن حبة للبنك ٢.٧٦ حبة. أما المحتوى البروتيني فهو ٢٨.٨، وزمن الطهي ٣٥ دقيقة.

**إلى العلماء العرب الكرام**

تعلمون أن إدراج اللغة العربية ضمن هذه النشرة كان أحد أهم أهداف مشروع "انس" الذي كان يدعمه مركز بحوث التنمية الدولية IDRC، وبميزاد من السروى، تعلن اسيرة نحير "انس" عن وصول بعض الأوراق العلمية المكتوبة باللغة العربية، والتي أخذت تظهر على صفحات هذه النشرة بدءًا من المجلد ١٤. لذا يرجى أن تتمكن العرب، العاملين في مجال تحسين محصول العدس، الراغبين في نشر بحوثهم باللغة العربية إرسالها إلى العنوان التالي:

نشرة "انس"
قسم التوثيق
إيكلارد
صن. ب. ٥٤٦٦، حلب، سوريا

---

Lens Newsletter Vol. 17, No. 1, 1990
Effect of lentil residue management on the productivity and NPK removal by lentil-rice double cropping

R. Prasad, P.S. John, Mercy George, S. Singh, and S.N. Sharma
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Indian Agricultural Research Institute
New Delhi-110012, INDIA

Abstract

A field experiment conducted at the Indian Agricultural Research Institute, New Delhi for two years showed that rice grain yield was 0.3-0.5 t/ha more when grown after lentil than after fallow. Incorporation of lentil residues in soil resulted in a removal of 46-89 kg/ha of the primary nutrients (15-36 kg N, 25-10 kg P, 58.5-43 kg K, O) less than by lentil-rice double cropping. Incorporation of lentil residues is thus recommended as a soil recuperative practice.

Introduction

‘Wheat-rice’ is the most prevalent double cropping system in North-western India, producing about 10-14 t/ha of grain. However, this cereal-cereal double cropping system is fairly exhaustive and removes 400-500 kg/ha/yr of NPK (Sharma and Prasad 1980). Nutrient removal by this double cropping system far exceeds the applied doses of primary nutrients and the continuous depletion of soil fertility decreases crop yields. Lentil, a highly profitable crop is suggested as an alternative crop to wheat for maintaining soil fertility (George and Prasad 1989). John et al. (1989) reported that cowpea residue (grain harvested and straw incorporated in soil) gave higher grain and straw yield and N uptake by rice than fallow. The present investigation was made to study the effect of lentil residue management in the productivity and NPK removal by rice-lentil double cropping.

Materials and Methods

A field experiment was conducted during the 1983-85 seasons at the Indian Agricultural Research Institute, New Delhi. The soil of the field was sandy clay loam of pH 7.5 (1:2.5 soil to water). It was low in total N (0.063%) and available P (17.5 ppm).

Lentil was grown during winter (November - April) and rice during the following rainy season (July - October). There were 3 treatments, 1. fallow, 2. lentil (grain and residue (straw) removed and only root residue remained), and 3. lentil (grain) removed, residue (straw) incorporated in the soil one week after lentil harvest. (These plots needed light irrigation to incorporate lentil residue in the soil). No cultivation was done in May and June. Land was prepared by ploughing, flooding, and puddling in July and rice was transplanted.

Lentil variety Pant L-4 was sown in the third/fourth week of November and harvested in the last week of April. Lentil as well as fallow plots received 13 kg P/ha as ordinary super phosphate.

Rice variety Pusa 169 was transplanted in the first week of July and harvested in the last week of October. All plots received 60 kg/ha as urea, 22 kg P/ha as ordinary superphosphate, 42 kg K/ha as muriate of potash, and 20 kg zinc sulphate/ha.

Grain and straw yield of lentil and rice were recorded and samples were drawn for total N, P, and K analysed by the procedures described by Prasad (1982). NPK uptake by the crop was calculated by multiplying the grain and straw yields with their respective NPK contents and summing them.

Results and Discussion

Lentil grain yield was about 1.1 t/ha in the 1983/84 season and 1.9 t/ha in 1984/85 season (Table 1). Lentil straw yield was about 2.7 to 3 more than that of grain. The total biomass yield of lentil was 3.8 t/ha in the 1983/84 season and 7.5 t/ha in the 1984/85 season. Lower grain and straw yield of lentil in the 1983/84 season was due to lentil introduction for the first time to that field. In the second year, lentil Rhizobia, present in the soil, gave better nodulation, plant growth, and yield. Rice grain and straw yield was similar in the two years of study and the total biomass yield.
Table 1  Grain and straw yield of lentil and succeeding rice as influenced by lentil residue management

<table>
<thead>
<tr>
<th>Residue management</th>
<th>Lentil (t/ha)</th>
<th>Rice (t/ha)</th>
<th>Lentil + rice (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grain</td>
<td>Straw</td>
<td>Total</td>
</tr>
<tr>
<td>Fallow (no-residue-rice)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>1.1</td>
<td>2.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>1.1</td>
<td>1.1</td>
<td>2.2</td>
</tr>
<tr>
<td>SEm ±</td>
<td>0.08</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fallow (non residue)-rice</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>1.9</td>
<td>5.6</td>
<td>7.5</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>1.8</td>
<td>1.8</td>
<td>3.6</td>
</tr>
<tr>
<td>SEm ±</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Straw yield was recorded and samples taken for NPK analysis before incorporation in soil

was 9-11 t/ha. In the first year of the study (1983/84) grain yield of rice was significantly more when lentil straw was incorporated in soil. However, in the second year of the study (1984/85), lentil root residues alone significantly increased the grain yield of the succeeding rice crop. There was a further increase when lentil residue was incorporated, but it just missed reaching the level of significance at 5%.

Straw yield of rice grown after lentil was also significantly more than after fallow in both years. Lentil root residues alone significantly increased the straw yield of rice as compared to fallow. Incorporation of lentil residues produced significantly more rice straw than root residues only in the 1983/84 season.

The total productivity (grain yield) of lentil-rice double cropping was about 6 t/ha as compared to 3.9 to 4.6 t/ha for fallow-rice.

Removal of Nitrogen

Nitrogen, removed by lentil was 67.9 kg/ha in the 1983/84 season and 109.2 kg/ha in the 1984/85 season (Table 2). The variation in the quantity of N removed by lentil in the two seasons was due to large variation in the grain and straw yield in the two seasons. Grain accounted for about 58 to 65% of the total N removed by lentil crop. Thus incorporation of lentil residue resulted in a return of 35 to 42% of the total N removed by the lentil crop to soil.

Nitrogen removed by rice was significantly more (6-10 kg/ha) with rice grown after lentil than rice grown after fallow. Incorporation of lentil residue further increased the N removal by rice about 13-25 kg/ha more as compared to fallow.

Incorporation of lentil residues in soil gave higher productivity of the lentil-rice cropping system and higher N removal by lentil, but it resulted in 15.2 to 36.0 kg/ha less removal of N from soil as compared to treatment where lentil residues were removed.

Removal of Phosphorus

Phosphorus removal by lentil was about 9 kg/ha during the 1983/84 season, while it was 19 kg/ha in the 1984/85 season (Table 3). The variation in the quantity of P removal by lentil in the two seasons was due to a large variation in the grain and straw yield in the two seasons. In both seasons, the grain accounted for about half of the P removal by lentil crop. Thus incorporation of lentil residue resulted in a return of about half of total P removed by the lentil crop to soil.

Phosphorus removed by the rice crop was significantly more (3.6 kg/ha) when grown after lentil than after fallow in the 1983/84 season. Incorporation of lentil residues further increased the P removal by the rice crop, about 5.9 kg/ha more as compared to fallow.

Incorporation of lentil residues gave higher productivity of lentil-rice cropping system and higher P removal by rice, but it resulted in 2.4 to 10.4 kg/ha less removal of P from soil as compared to the treatment where lentil residues were removed.
Table 2 Nitrogen removal by lentil-rice double cropping as influenced by lentil residue management

<table>
<thead>
<tr>
<th>Residue</th>
<th>Lentil (kg/ha)</th>
<th>Rice (kg/ha)</th>
<th>Lentil + rice (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grain</td>
<td>Straw</td>
<td>Total</td>
</tr>
<tr>
<td>Fallow (no residue)-rice</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>39.6</td>
<td>28.3</td>
<td>67.9</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>38.2</td>
<td>38.2</td>
<td>76.4</td>
</tr>
<tr>
<td>SEm ±</td>
<td>2.90</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1984/85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fallow (no residue)-rice</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>71.1</td>
<td>38.1</td>
<td>109.2</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>66.3</td>
<td>66.3</td>
<td>132.6</td>
</tr>
<tr>
<td>SEm ±</td>
<td>1.80</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 Phosphorus removal by lentil-rice double cropping as influenced by lentil residue management

<table>
<thead>
<tr>
<th>Residue</th>
<th>Lentil (kg/ha)</th>
<th>Rice (kg/ha)</th>
<th>Lentil + rice total (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grain</td>
<td>Straw</td>
<td>Total</td>
</tr>
<tr>
<td>Fallow (no residue)-rice</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>4.1</td>
<td>4.5</td>
<td>8.6</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>3.9</td>
<td>3.9</td>
<td>7.8</td>
</tr>
<tr>
<td>SEm ±</td>
<td>0.30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1984/85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fallow (no residue)-rice</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>8.8</td>
<td>10.4</td>
<td>19.2</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>8.2</td>
<td>8.2</td>
<td>16.4</td>
</tr>
<tr>
<td>SEm</td>
<td>0.22</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Removal of Potassium**

Potassium removal by lentil was 42.6 kg/ha in the 1983/84 season and 55.0 kg/ha in the 1984/85 season (Table 4). The variation in the quantity of K removal by lentil in the two seasons was due to a large variation in the productivity in the two seasons. Grain accounted for about 82 to 84% of the total K removal by the lentil crop. Thus, incorporation of lentil residues resulted in a return of 16 to 18% of the total K removed by the lentil crop to the soil.

Potassium removal by the rice crop grown after lentil was more (4.4 to 7.4 kg/ha) as compared to that after fallow. Incorporation of lentil residues further increased the K removal by the rice crop, 10.7 to 12.1 kg/ha more as compared to fallow.

Incorporation of lentil residues gave higher productivity of lentil-rice cropping system and higher removal of K by rice, but it resulted in 28.5 to 429 kg/ha less removal of K from soil as compared to the treatment where lentil residues were removed.
Table 4 Potassium removal by lentil-rice double cropping as influenced by lentil residue management

<table>
<thead>
<tr>
<th>Residue</th>
<th>Lentil (kg/ha)</th>
<th>Rice (kg/ha)</th>
<th>Lentil + rice (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grain Straw Total</td>
<td>Grain Straw Total</td>
<td></td>
</tr>
<tr>
<td>Fallow (no residue)-rice</td>
<td>- - -</td>
<td>13.8 45.4 59.2</td>
<td>59.2</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>6.7 35.9 42.6</td>
<td>13.9 49.7 63.5</td>
<td>106.2</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>6.4 - 6.4</td>
<td>14.2 57.1 71.3</td>
<td>77.7</td>
</tr>
<tr>
<td>SEm ±</td>
<td>0.36 - -</td>
<td>0.28 1.78 1.90</td>
<td>-</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>NS - -</td>
<td>NS 6.15 6.57</td>
<td>-</td>
</tr>
</tbody>
</table>

| 1983/84                             |                |              |                       |
|-------------------------------------|                |              |                       |

| Fallow (no residue)-rice            | - - -            | 7.8 89.1 96.9 | 96.9                   |
| Lentil (residue removed)-rice       | 9.5 45.5 55.0    | 7.7 96.6 104.3 | 159.3                  |
| Lentil (residue incorporation)-rice | 8.8 - 8.8        | 7.8 99.8 107.6 | 116.4                  |
| SEm ±                               | 0.25 - -          | 0.55 2.74 2.85 | -                      |
| LSD 0.05                            | NS - -            | 1.91 9.48 NS   | -                      |

| 1984/85                             |                |              |                       |
|-------------------------------------|                |              |                       |

Table 5 NPK removal by lentil-rice double cropping as influenced by lentil residue management

<table>
<thead>
<tr>
<th>Residue</th>
<th>Lentil (kg/ha)</th>
<th>Rice (kg/ha)</th>
<th>Lentil + rice total (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grain Straw Total</td>
<td>Grain Straw Total</td>
<td></td>
</tr>
<tr>
<td>Fallow (no residue)-rice</td>
<td>- - -</td>
<td>76.6 73.8 150.5</td>
<td>150.5</td>
</tr>
<tr>
<td>Lentil (residue removed)-rice</td>
<td>50.4 68.7 119.1</td>
<td>85.8 82.5 168.2</td>
<td>287.3</td>
</tr>
<tr>
<td>Lentil (residue incorporated)-rice</td>
<td>48.5 - 48.5</td>
<td>97.7 95.0 192.7</td>
<td>241.2</td>
</tr>
</tbody>
</table>

| 1983/84                             |                |              |                       |
|-------------------------------------|                |              |                       |

| Fallow (no residue)-rice            | - - -            | 64.4 123.7 188.3 | 188.3                   |
| Lentil (residue removed)-rice       | 89.4 94.0 183.4  | 67.1 134.8 201.9 | 385.3                   |
| Lentil (residue incorporated)-rice  | 83.3 - 83.3      | 73.4 139.3 212.7 | 296.0                   |

| 1984/85                             |                |              |                       |
|-------------------------------------|                |              |                       |

Removal of total primary nutrients (NPK)

Removal of the total primary nutrients (NPK) by lentil crop was 119.1 kg/ha in the 1983/84 season and 183.4 kg/ha in the 1984/85 season (Table 5). The variation in the quantity of these elements removed by lentil in the two years was due to a large variation in the productivity in the two years. Grain accounted for about 50 to 60% of the total of NPK removed by the lentil crop. Thus, incorporation of lentil residues resulted in a return of 40 to 50% of the total NPK removed by lentil to soil.

The removal of NPK by rice crop when grown after lentil was more (13.6 to 17.7 kg/ha) than grown after fallow. Incorporation of lentil residues further increased the removal of primary elements by rice crop; 24.4 to 42.2 kg/ha more as compared to fallow.

Incorporation of lentil residues gave higher productivity of lentil-rice cropping system and higher NPK removal by rice, but it resulted in 46.1 to 89.3 kg/ha less removal of primary nutrients from soil as compared to the treatments where lentil residues were removed.

References


Effect of sowing date and row spacing on the yield of lentil varieties

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Abstract

The response of the lentil varieties (JLS-1 and Sehore 74-5) to sowing date on 15 and 30 Oct and 15 and 30 Nov and the three row spacings 15, 22.5, and 30 cm was studied in Central India during the 1982-84 seasons. Sowing lentil on 15 Oct was most advantageous. Delay in sowing time beyond 30 Oct decreased grain yield significantly. Sehore 74-3, a bold seeded cultivar, out-yielded the standard variety JLS-1 in both seasons. There was no significant variation in grain yield due to row spacing.

Introduction

Lentil, (*Lens culinaris* Medik.) is an important pulse crop in India. It is grown on an area of 288.2 thousand hectares with an annual production of 126.3 metric tonnes in Madhya Pradesh (MPDA 1984). The average yield 438 kg/ha is, however, low. The adoption of improved production technology coupled with suitable sowing time, row spacing, and high yielding varieties can improve the productivity substantially. The present investigation was an attempt to study the response of lentil varieties to different sowing dates and row spacings.

Materials and Methods

A field study was conducted at the Research Farm of J.N. Krishi Vishwa Vidyalaya, Campus- Rafi Ahmed Kidwai College of Agriculture, Sehore (M.P.) for the two winter seasons of 1982-84. The treatments consisted of different combinations of four sowing dates (15 and 30 Oct and 15 and 30 Nov), three row spacings (15, 22.5, and 30 cm), and two varieties (JLS-1 and Sehore 74-3). The treatments were replicated four times in a split plot design with sowing date in the main plots and combinations of row spacings and varieties in sub plots. The net sub plot was 3.6 x 5.0 m². The trial was sown on clay loam soil with an average of 215.0, 7.6, and 335.4 kg/ha of available N, P₂O₅, and K₂O respectively with pH of 7.30. A uniform seed rate of 30 kg/ha was applied for each plot. A basal dose of 100 kg/ha of diazomium phosphate (DAP) was given to each plot at the time of sowing. A pre-sowing irrigation was given to ensure good germination. One more irrigation (75 mm water) was given 45 days after sowing before flowering.

Total rainfalls of 95.8 and 100 mm were recorded during October - March in the 1982/83 and 1983/84 seasons, respectively.

Results and Discussion

Sowing date: Sowing date in the 1982/83 season had a significant influence on grain yield and yield components (Table). Lentil sown on 15 Oct on an average recorded a significant increase of 82.6 and 158.0% in grain yield as compared to the respective sowing times of 15 and 30 Nov. This sowing date 15 Oct also recorded 13% higher grain yield than sowing on 30 Oct.

During the second 1983/84 season however, the first two sowing dates were at par. Sowing on 30 Oct, on the basis of the two year average, produced 61.7 and 128.4% higher grain yield than 15 and 30 Nov, respectively. The increase in grain yield was mainly due to an increase in the various yield attributing parameters like the number of branches/plant, number of pods/plant and number of grains/plant, and 1000-seed weight. The early sown crop had favourable weather conditions early in the season, namely temperature, conducive to good germination, and crop development resulting in higher values of yield attributes and grain yield. The late sown crops suffered due to low temperatures early in the season and high temperature and hot winds later in the season at pod formation and grain development stages.
These results corroborate the findings of Shrivastava (1979), Ahlawat et al. (1982), and Duwedi et al. (1987).

**Row spacing:** The influence of row spacing on grain yield and yield components (pooled), except for the number of grains/plant, was not significant (Table). Similar findings were also reported by Shrivastava (1979) and Singh and Ram (1986).

**Variety:** The varietal effect on grain yield was significant. Variety Schore 74-3 yielded 24.2% more grain yield than JLS-1 on average. Variety Schore 74-3 also produced a higher number of branches, number of pods, and number of grains/plant and thousand grain weight than JLS-1.

The interactions were not significant for grain yield and yield components.

**References**


**Table** Effect of sowing dates and row spacings on grain yield and yield components (pooled data of two years) of lentil varieties

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain yield (kg/ha)</th>
<th>Number of branches/plant</th>
<th>Number of pods/plant</th>
<th>Number of grains/plant</th>
<th>1000-seed weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1982/83 1983/84 Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sowing date</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Oct</td>
<td>1564 1248 1406</td>
<td>4.70</td>
<td>45.53</td>
<td>57.82</td>
<td>33.01</td>
</tr>
<tr>
<td>30 Oct</td>
<td>1320 1170 1245</td>
<td>4.60</td>
<td>43.37</td>
<td>53.57</td>
<td>32.46</td>
</tr>
<tr>
<td>15 Nov</td>
<td>717 822 770</td>
<td>4.48</td>
<td>42.00</td>
<td>51.24</td>
<td>31.35</td>
</tr>
<tr>
<td>30 Nov</td>
<td>464 625 545</td>
<td>4.37</td>
<td>36.35</td>
<td>42.89</td>
<td>30.80</td>
</tr>
<tr>
<td>S.Em. ±</td>
<td>72 75 52</td>
<td>0.11</td>
<td>0.91</td>
<td>1.11</td>
<td>0.25</td>
</tr>
<tr>
<td>L.S.D. at 5%</td>
<td>230 239 153</td>
<td>0.31</td>
<td>2.68</td>
<td>3.28</td>
<td>0.74</td>
</tr>
<tr>
<td><strong>Row spacing (cm)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0</td>
<td>964 888 926</td>
<td>4.38</td>
<td>39.05</td>
<td>46.90</td>
<td>31.40</td>
</tr>
<tr>
<td>22.5</td>
<td>983 1002 993</td>
<td>4.61</td>
<td>42.36</td>
<td>52.45</td>
<td>32.40</td>
</tr>
<tr>
<td>30.0</td>
<td>1101 1008 1055</td>
<td>4.62</td>
<td>44.03</td>
<td>54.80</td>
<td>32.20</td>
</tr>
<tr>
<td>S.Em. ±</td>
<td>58 68 44</td>
<td>0.09</td>
<td>1.72</td>
<td>2.52</td>
<td>0.30</td>
</tr>
<tr>
<td>L.S.D. at 5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6.98</td>
</tr>
<tr>
<td><strong>Variety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JLS-1</td>
<td>914 854 884</td>
<td>4.26</td>
<td>37.30</td>
<td>45.38</td>
<td>30.02</td>
</tr>
<tr>
<td>Schore 74-3</td>
<td>1118 1078 1098</td>
<td>4.82</td>
<td>46.32</td>
<td>57.38</td>
<td>33.80</td>
</tr>
<tr>
<td>S.Em. ±</td>
<td>47 55 36</td>
<td>0.06</td>
<td>1.15</td>
<td>1.68</td>
<td>0.20</td>
</tr>
<tr>
<td>L.S.D. at 5%</td>
<td>133 156 100</td>
<td>0.17</td>
<td>3.19</td>
<td>4.65</td>
<td>0.56</td>
</tr>
</tbody>
</table>


Lentil weeds in Rampur, Chitwan Valley, Nepal

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Abstract
The weeds associated with lentil in the Chitwan Valley of Nepal are reported. Information on occurrence and dominance of weeds of lentil at the Agronomy Farm in Rampur, Chitwan Valley is given.

Introduction
Lentil (Lens culinaris Med.) is the most important grain legume of Nepal. The average total area sown to this crop was 114,333 ha with an average yield of 0.574 t/ha in the 1986-88 seasons (DFAMS 1988). The crop is highly infested with different kinds of winter weeds, thus the grain yield is decreased up to 72% due to weed competition (Chaudhary and Singh 1987). Ranjit and Bhattarai (1988) reported that the broad leaved weed species dominated weed composition and population in lentil fields in hilly and terai regions of Nepal. However, weeds associated with lentil in the Chitwan Valley of Nepal were not reported so far. Therefore, this study was undertaken to obtain information on the occurrence and dominance of weeds of lentil at the Agronomy Farm in Rampur, Chitwan Valley, Nepal.

Materials and Methods
In February 1989, a weed survey was made in the lentil field at the Agronomy Farm of the Institute of Agriculture and Animal Science (IAAS), Rampur (224 m MSL). The area under study is situated in the Chitwan Dun Valley (27º30' - 27º45'N latitude and 84º - 85ºE longitude) in Nepal. The climate is hot, humid, and sub-tropical. The one square meter quadrat was used to count weeds and crop plants. Twenty temporary sampling quadrats were taken randomly at the flowering stage of the crop. Frequency percentage, abundance, density, their relative values, and importance value indices (IVI) were calculated as per Ambashtha (1984) and Curtis and Cottam (1962).

Other weed species outside the sampling units were also collected to record all weed species associated with the crop.

Results and Discussion
Twenty-seven angiosperm weed species were identified from the survey area (Table). These species represented 23 genera and 15 families. Of the total number of the species recorded, the Leguminosae, Compositae, Polygonaceae, and Gramineae made up 18.5%, 14.8%, 14.8%, and 11.1%, respectively. These accounted for 59% of all species. The remaining families were represented by a single species. The monocot species were few in number. All the weeds recorded except Cynodon dactylon (L.) Pers. were annuals. Of the total species, 22 were recorded from the quadrats. The average density of the lentil plants was 52.7/m². However, the average density of weeds was recorded as 201 plants/m².

Frequency
There were 6 species which were found at a frequency level of 76-100% amongst quadrats. The weeds with 100% frequency comprised Vicia sativa L., Polygonum plebejum R. Br., Chenopodium album L. among the dicots and Cynodon dactylon (L.) Pers. and Digitaria sanguinalis (H.B.K) Henr. among the monocot species. There were only 7 weeds at a frequency level of 26-75%. The other species were recorded at frequency levels below 21%.

Abundance
The above five species with 100% frequency value, AgeratumHoustonianum Mill. with 60% frequency value, and Eulxine indica (L.) Gaertn. with 75% frequency value had more than 14 abundance value. The rest species had less than 14 abundance value.

Density
The density values presented in Table reveal that Vicia sativa, Chenopodium album, and Cynodon dactylon were recorded as 38.0, 36.5, and 28.5 plants/m², respectively. Rajbhandary (1988) also reported the dominance of Vicia sativa in lentil in Nepal. The weeds with 10-15 plants/m² comprised Ageratum Houstonianum, Polygonum plebejum, and Eulxine indica. The other species were found at less than one density value.
<table>
<thead>
<tr>
<th>Scientific name</th>
<th>IVI</th>
<th>%F</th>
<th>A</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cynodon dactylon (L.) Pers.</td>
<td>43.6</td>
<td>100</td>
<td>38.0</td>
<td>38.0</td>
</tr>
<tr>
<td>Vicia sativa L.</td>
<td>42.3</td>
<td>100</td>
<td>36.5</td>
<td>36.5</td>
</tr>
<tr>
<td>Chenopodium album L.</td>
<td>38.3</td>
<td>100</td>
<td>32.5</td>
<td>32.1</td>
</tr>
<tr>
<td>Digitaria adscendens (HBK) Henr.</td>
<td>35.1</td>
<td>100</td>
<td>28.5</td>
<td>28.5</td>
</tr>
<tr>
<td>Polygonum plebeium R. Br.</td>
<td>22.8</td>
<td>100</td>
<td>14.8</td>
<td>14.8</td>
</tr>
<tr>
<td>Ageratum houstonianum Mill.</td>
<td>21.8</td>
<td>60</td>
<td>23.0</td>
<td>13.8</td>
</tr>
<tr>
<td>Eclipta indica (L.) Gaertn.</td>
<td>20.6</td>
<td>75</td>
<td>17.4</td>
<td>13.1</td>
</tr>
<tr>
<td>Polygonum tansienum R. Br.</td>
<td>16.0</td>
<td>60</td>
<td>13.3</td>
<td>8.0</td>
</tr>
<tr>
<td>Heliotropium ovalifolium Forsk.</td>
<td>12.6</td>
<td>85</td>
<td>5.5</td>
<td>4.7</td>
</tr>
<tr>
<td>Polygonum barbatum L.</td>
<td>10.5</td>
<td>55</td>
<td>7.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Polycarpon prostratum (Forsk.) Asch. &amp; Sch.</td>
<td>7.6</td>
<td>35</td>
<td>7.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Vicia tetraspernum Macroch.</td>
<td>6.9</td>
<td>50</td>
<td>3.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Vicia hirsuta (L.) S.F. Gray*</td>
<td>5.5</td>
<td>35</td>
<td>3.9</td>
<td>1.4</td>
</tr>
<tr>
<td>Oxalis corniculata L.</td>
<td>4.1</td>
<td>20</td>
<td>4.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Gnaphalium purpureum L.</td>
<td>2.8</td>
<td>20</td>
<td>1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Anagallis arvensis L.</td>
<td>2.3</td>
<td>10</td>
<td>3.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Fumaria parviflora Lam.</td>
<td>1.9</td>
<td>15</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Wahlenburgia marginata (Thunb.) DC.</td>
<td>1.7</td>
<td>5</td>
<td>3.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Altemanthera sessilis (L.) DC.</td>
<td>1.6</td>
<td>10</td>
<td>1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Medicago lupula L.</td>
<td>0.9</td>
<td>5</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Solanum nigrum L.</td>
<td>0.9</td>
<td>5</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Lathyrus aphaca L.</td>
<td>0.9</td>
<td>5</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Lautaca aspeniifolia (L.) DC.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lactuca polysepalas Benth.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mazus pumilus (Burm. f.) Steen.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Potentilla supina L.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rumex dentatus L.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* also reported by Ranjit and Bhattachar (1988) as common lentil weeds-species present in the fields, but ecological data not assigned.

**Importance Value Index (IVI)**

The four species of weeds with more than 27 IVI were Cynodon dactylon, Vicia sativa, Chenopodium album, and Digitaria adscendens. These species contributed 67.1% to the total weed population. Of these, Digitaria adscendens was found in vegetative stage at the time of the survey. In addition to these four species, the other three weeds namely Polygonum plebeium, Ageratum houstonianum, and Eclipta indica had indices more than 20. The weeds with less than 2 IVI value comprised six species namely Fumaria parviflora Lam., Wahlenburgia marginata (Thunb.) DC., Altemanthera sessilis (L.) DC., Medicago lupula L., Solanum nigrum L., and Lathyrus aphaca L.

The weeds covered in the present study and earlier report of Ranjit and Bhattacharrr (1988) were Chenopodium album, Anagallis arvensis L., Vicia hirsuta (L.) S. F. Gray, and Vicia sativa. But the species Capsella bursa-pastoris (L.) Medik., Spergula arvensis L., Sienebiera pinnaatida, Atoficus pratensis L., and Phalaris minor Retz. reported in the previous study were not found in the present study.

The 18 weeds of the present study are additional plant pests associated with lentil crop in Nepal. Chaudhary and Singh (1987) reported the abundance of Chenopodium album and Vicia sativa along with Melilotus indica (L.) All., Anagallis arvensis, and Phalaris minor in Indian lentil fields. Of these, Melilotus indica and Phalaris minor were not found in the present study.

**References**


Lentil production in highland Balochistan, Pakistan: Current status

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    P.O. Box 362, Quetta, PAKISTAN
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    P.O. Box 63, Quetta, PAKISTAN

Abstract

The production of lentil in the Balochistan highlands of Pakistan is currently largely subsistence in character. The productivity, both per farmer and throughout the area is low. Consumption in both rural and urban areas is, however, widespread and sustained. Urban consumption is reliant upon imported material. Very small seed size and lack of cleanliness in the marketing of the local landrace are important factors in the current low level of local productivity. The scope for increasing production through adapted larger-seeded varieties and improved agronomy seems large at present.

Introduction

The Indo-Pakistan sub-continent is an important lentil growing area. In the period 1973-85, Pakistan had a total area of 75,900 ha annually under lentils, constituting 4.9% of the total area under pulses in the country. This produced 30,700 t with an average yield of 393 kg/ha. Seventy five percent of this production was from the Punjab while the remainder was from the Sind and North-West Frontier Province. However, the area officially under lentil in Balochistan was almost negligible being less than 200 ha (Government of Pakistan 1988). Lentil, being a suitable legume species for cultivation under the Mediterranean conditions could be more widely and intensively grown in the Balochistan highlands, where the climate is also Mediterranean, albeit of a severe continental type. In addition, lentils could become a much more important source of dietary protein, since their relative price is only about one fifth of that of red meat (GOP 1988).

A formal survey was conducted in November 1988 in the southern, central, and northern areas of highland Balochistan. On the basis of previous informal surveys and data gathering, it had been determined that a sample size of 77 farmers including 23 from Khuzdar district (region 1), 31 from Kalat, Kachhi, Quetta, and Pishin districts (region 2) and 23 from Loralai and Zhob districts (region 3) would be a sufficient and adequately representative sample. Within the three selected regions of highland Balochistan, villages as well as farmers were selected for questioning at random with the initial provision that they were currently lentil producers.

The survey was made as a first step to collect information to:
(a) The present status of the lentil crop, its area, production, and yields in highland Balochistan,
(b) The reasons why so few farmers grow lentils, and
(c) The opportunities for future increases in the area and production intensity of lentils in highland Balochistan.

Characteristics of lentil farmers

The lentil producers interviewed were in general both larger than average land owners with 27 ha and animal owners (39 sheep and goats). However, the total land area under lentil was less than 0.5 ha per respondent per year with yields averaging between 300-425 kg/ha in the last three years, which was sufficient only for their own domestic consumption needs. More than 80% of all farmers were operating a mixed dryland crop/livestock enterprise which was reliant solely on family labour. Threshing operations in Balochistan are usually done by human and animal labour and thus constitute a major input to farming operations especially for cereals. Sixty-eight percent of the farmers felt that lentil required 75% less labour than was needed for wheat and thus increased competition for labour would not be a constraint to greater lentil production.

Ninety percent of the farmers presently growing lentil indicated that their families were growing the crop at the time of the establishment of Pakistan in 1947 and that there has been little change in the hectarage since then. As the
The population of Balochistan has increased at least fourfold in that time, it is evident that the lentil area is not responsive currently to urban market demand. Answering the question why they do not grow more lentils, half the farmers indicated that the lack of demand and low prices for the crop were the main reasons for their unwillingness to grow more lentils. The second most important reason cited was that of preferring wheat over lentil and other crops due to concerns for domestic food security.

A large majority of farmers considered that lentils needed better quality land than wheat. The predominant cropping sequence was continuous monoculture on individual fields; the farmers perceive this system to be beneficial as they believe that yields of all crops are higher if each crop is sown in the same field as the year before. This suggests that soil borne diseases are not a major problem and also possibly that inoculation by native Rhizobia may be of importance.

Yields are low (<350 kg/ha), which suggests that a potential for an increase exists. The farmers were asked about the main problems they experienced when growing lentils. Insects are a major concern for farmers. It was not possible to ascertain definitely from the farmers which insects were involved, but from their descriptions the likelihood is that aphids and army worms are the major contributors to yield losses.

**Lentil consumption and disposal**

The farmers were asked to detail the various ways they use their lentil grain and straw (Table).

It is evident from the data presented in the table that only 10% of lentil production is available for sale outside of domestic uses. Furthermore, the suggestion that only 6% of the crop is used for next year's seeds implies, using average yields, that seed rates may be as low as 25 kg/ha. This could be a major factor in the low yield levels obtained.

Despite the very small area under currently lentils in highland Balochistan, consumption, in contrast, is widespread and sustained. Boiled lentil grains are used sepa-rately, or with bread, as curries, and soups are also now becoming popular among segments of society. As part of the lentil survey, households were asked how much and how often they ate lentils. More than 80% of the families were eating lentil at least 1-3 times a week. If it is assumed that an average household is growing less than 0.75 ha of lentil with an average yield of 300 kg/ha, then consumption per household will be approximately 4.3 kg/week which implies that with 10 consuming members per household (Nagy and Sabir 1987) each consumer is getting somewhat less than 150 gm per lentil meal. This is not a large intake and suggests that there is a scope, and perhaps a need, for a greater home consumption.

The farmer households were also asked about their personal preference between small-seeded and large-seeded lentils. The local landrace has a very small grain size (14.5 gm/1000 whole seeds) whereas "imported" lentils have larger seed size, such as those from Sind (25.2 gm/1000 whole seeds) or the Punjab (27.3 gm/1000 whole seeds). Seventy-five percent of respondents said that they preferred a larger seed size. This could mean that there might not be much increase in the market demand for the local ultra-small seeded lentils, even if local production could be considerably augmented. In contrast, the successful introduction of a large-seeded cultivar adapted to the environmental conditions of highland Balochistan could overcome this lack of consumer interest, and lead to an increased demand (and profitable market) for lentil grown in Balochistan.

**Marketing and prices**

Although only one local Balochi variety is produced, there are at least three other varieties that are imported and sold in various town and city markets. The three main imported varieties are Sindhi, Punjabi, and Turkish. A Quetta market survey indicated that most of the province's lentil requirements are met by imported Turkish material (approximately 25 gm/1000 whole seeds). In 1989 the average prices were around 9.5 Rs/kg (de-hulled) with Turkish lentils having a slight premium. Informal consumer surveys have suggested that the predominance of sales of the Turkish material over Punjabi and Sindhi is as a result of their cleanliness.

It is evident that the growth, production, marketing, and consumption of lentils in Balochistan is neither well understood nor documented. This paper attempts to re-dress this position. Lentils are not a major crop in Balochistan, but potentially could be more important than seems to be the case today. As large increases are forecast in the human population, there is obviously a great need for agronomic research to improve lentil production in Balochistan. Improved seed rates, water harvesting, insect control, and provision of an improved large seeded frost tolerant variety are all possible major interventions. These conclusions
largely underpin AZRI’s research program which has been ongoing since 1985 and which has the identification of cold tolerant large seeded varieties and improved methods of water harvesting as its principal thrusts. Insect control issues and seed rate considerations will also receive more attention in the future.

References


Although lentil genotypes varied for BI and this parameter was correlated with lodging scores, the association was not strong enough to justify the utilization of the instrument in a breeding program. This method was compared to other proven methods that can induce lodging artificially or predict to a high degree standing ability.

Introduction

Lentil (Lens culinaris Medik.) lodges at physiological maturity, but the peak is reached at full maturity. Lodging results in grain and straw losses specially when the crop is harvested by a machine (Erskine and Goodrich 1988). The major goal of the national lentil programs in West Asia and North Africa is to reduce the cost of lentil production by a machine harvest, accordingly studies were conducted at ICARDA to identify sources of standing ability.

In many countries and at ICARDA the incidence of lodging is evaluated using a scale of 1 to 5. As lodging is affected by environmental factors such as soil moisture, it is necessary to develop methods whereby lodging can be induced artificially or predicted closely when environmental conditions are not conducive.

Artificially induced lodging was attempted in many other crops. Laude and Pauli (1965) pinched the culms of cereal plants to the ground. Sisler and Oslen (1951) induced lodging by using a long board to push plants.

At ICARDA, research was conducted to induce lodging artificially. As part of this research, a lodging instrument was developed and this investigation was carried out to calibrate the instrument and to test lentil genotypes.

Materials and Methods

The Instrument

The instrument illustrated in Fig. 1 induces lodging in lentil by pressing a row of plants towards the soil surface. The ability of the plant to spring back to the original height, after release of pressure, is used as an indicator of elasticity. The latter is a function of inherent ability to stand and resist forces inducing lodging. Hence, the pressing force of the instrument simulates the natural forces of wind and rain which cause lodging.

The instrument is anchored, in a levelled position, to the soil by its pointed feet. The pressing rod is adjustable and can be fixed at the desired height by side screws.

Lentil genotypes

ILL 5582 was used in calibration of the instrument. Thirty lentil genotypes were used in testing.
Fig. 1 Lodging instrument

Treatments

Tests were conducted during the years 1987 and 1988 at Tel Hadya, ICARDA main research station at Aleppo to calibrate the instrument for desired height and duration of pressing. A 0.5 m row of lentil plants (200 plants/m²) was pressed by the instrument for the following combinations:

Pressing Ht (cm): 5, 8, 10, and 14
Pressing duration (min): 5, 15, 20, and 60

The instrument was used to induce lodging in 30 lentil genotypes at ICARDA main station, Tel Hadya in 1987. The design was RCBD with 3 replications.

Measurements

Canopy height was measured prior to and 24 hrs. after pressing using a styrofoam sheet. From these measurements the Bending Index (BI) was calculated as described by Mera (1987) who measured canopy height before and after natural lodging:

\[ BI = \frac{H_1}{H_2} \]

Lodging scores were recorded and correlated with bending indices.

Results and Discussion

Lodging induced by the instrument resulted mostly in stem lodging as the pressing force falls mainly on the stem and branches with less force on the roots. The combination 5 cm pressing height and 20 to 30 minutes duration of pressing resulted in damage to the genotype ILL 5582, a genotype with goodstanding ability, that was the most close to simulate natural lodging. Hence, this combination was used in the study to induce lodging. The correlation between lodging scores and induced bending index was 0.285, i.e. \( r^2 = 0.08 \) only 8% of variation in lodging score is explained by induced bending index. Although the lodging instrument was designed to induce lodging in all environments, specially dry environments in which less biomass is produced and hence less lodging, the weak correlation between BI and lodging scores would limit the utility of the instrument in a breeding program. Other approaches tested at ICARDA have proven more successful in meeting this objective. Hanati et al. (unpublished data) was able to demonstrate that increased soil moisture can be used effectively as a screening technique to induce lodging. Erskine and Goodrich (1988) established stem diameter as a useful criterion in single plant selection for reduced lodging. This latter method is easy to apply, less expensive, and non-destructive.

References

Developmental and cytological effects of herbicides Prometryne, Trifluralin, and EPTC in lentil

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Assiut 71516 EGYPT

Abstract

The cytological and developmental effects of the herbicides prometryne Gesagard, trifluralin Treflan and EPTC Eptam were studied in lentil seeds at different concentrations. All herbicides reduced seed germination, seedling growth, and mitotic activity of root-tip cells of lentil and these effects increased as the concentration of all herbicides increased. Trifluralin was most potent in reducing seedling growth and mitotic index, while EPTC showed higher potency in reducing germination percentage and in inducing chrestogenic effects which resulted in the formation of different types of aberrations, i.e., C-metaphase, binucleate, tetraploid cells, unequal tripolar anaphase, bridges, lagging, and stickiness of chromosomes.

Introduction

In Egypt, as in many other countries, the large scale application of pesticides has been extended to almost all the fields. These pesticides may be considered as a main source of soil and water pollution in rural areas of Egypt.

The side effects of these chemicals, especially herbicides and their residues on treated crop plants and successive crops, particularly their effects at the cell level, are not clearly known. This fact emphasizes the need for adopting a reliable mutagen testing when these agrochemicals are being applied continuously.

Several investigators suggested the study of chromosomal aberrations as a suitable monitoring system to detect mutations caused by various chemicals in higher plants (Wuu and Grant 1967; Tobgy et al. 1969; Amer and Farah 1976; Surianni 1978).

This paper investigates the cytological effects of three herbicides namely Prometryne, Trifluralin, and EPTC in root-tip cells of lentil. Prometryne was chosen because it is recommended in Egypt for annual weed control in lentil. Trifluralin is widely used in many field crops and vegetables, and EPTC is recommended for some other crops like onion and potatoes at relatively high rates (9.5 - 141/ha) that may lead to the presence of high residue levels. Lentil was also selected as an inexpensive testing system for the mutagenic effects of these herbicides in higher plants.

The effect of these herbicides on germination and seedling growth was also investigated.

Materials and Methods

The effects of the herbicides Prometryne 80% WP (prometryne: 2,4-bis (isopropylamino)-6-(methylthio)-s-triazine), Trifluralin 48% EC (trifluralin: a,a,a-trifluoro-2,6-dinitro-N-N-dipropyl-p-toluidine), and EPTC 72% EC (EPTC: S-ethyl dipropyl thiocarbamate) were monitored on germination, growth, mitotic activity, and chromosomal aberrations in lentil.

The seeds were soaked in fresh aqueous preparation of different concentrations of each herbicide (Table 1) for 6 h. at a temperature of 20 ± 2°C. The seeds were then thoroughly washed in running water and germinated in petri-dishes. The control samples were soaked in distilled water under the same conditions.

<table>
<thead>
<tr>
<th>Herbicide concentration (ppm)</th>
<th>Germination (%)</th>
<th>Seedling growth</th>
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<tbody>
<tr>
<td></td>
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</table>

1, 2, 3 = Concentration of two times, one time and half the field rate, respectively.

Table 1 Effect of the herbicides Prometryne, Trifluralin, and EPTC on seed germination and seedling growth of lentil

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Data were collected on germination, seedling growth, and cytological examination. For the cytological study, the roots which reached 0.5–1.0 cm in length were excised and fixed in 3:1 ethanol: glacial acetic acid for 24 h. The roots were stored in 70% ethanol at 4°C. Five preparations were made and 1% aceto-orcein was used for staining. Hydrolysis in 0.1 N HCl at 70°C for 10 min. was used before staining. The frequency of mitotic activity and mitotic aberration was calculated.

Results and Discussion

Effect on germination and seedling growth

The effect of the three herbicides on the germination is shown in Table 1. EPTC was the most potent inhibitor of lentil seed germination, while Trifluralin was the least active one. It was also observed that these compounds decreased seedling growth especially at higher concentrations. Trifluralin was more effective in reducing seedling growth than the other herbicides. Thick roots and stunting of seedlings were also observed in case of treatment with Trifluralin. It was suggested that growth stunting might be an outcome of inhibition of mitosis and/or chromosomal damage with secondary physiological changes (Sparrow et al. 1952; and Abd-Alla and El-Keredy 1977).

Cytological observations

Antimitotic effects

The percentage of the different mitotic stages in the root tips of lentil treated with different concentrations of the tested herbicides are presented in Table 2.

The results of Trelfan treatments clearly showed that each of the three concentrations 19.53, 78.13, and 312.50 ppm caused a significant gradual reduction in the percentage of different mitotic stages, i.e. prophase, metaphase, anaphase, and telophase compared with the control. At the

<table>
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<th>Herbicde Concentration (ppm)</th>
<th>Interphase No.</th>
<th>Interphase %</th>
<th>Prophase No.</th>
<th>Prophase %</th>
<th>Metaphase No.</th>
<th>Metaphase %</th>
<th>Anaphase No.</th>
<th>Anaphase %</th>
<th>Telophase No.</th>
<th>Telophase %</th>
<th>Mitotic index (%)</th>
<th>Mitotic inhibition (%)</th>
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<td>12.7 ± 0.58*</td>
<td>11.19</td>
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<td>9.0 ± 0.53**</td>
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<td>11.5 ± 0.54**</td>
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<td>64</td>
<td>1.9</td>
<td>7.4 ± 0.45**</td>
<td>48.25</td>
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</table>

*, ** Significant at 0.05 and 0.01 level
1), 2), 3): Concentration of two times, one time and half the field rate, respectively
highest concentration (1250 ppm), none of these stages was observed. The data also indicated that the percentage of the interphase stage was increased above the control level at all the tested concentrations. The mitotic index (MI) % decreased at all concentrations with its lowest value (1.2%) in the highest concentration used.

Data collected on the herbicide EPTC revealed that the four mitotic stages were also reduced under each concentration used, while the percentage of cells with interphase was increased compared with the control. The mitotic index for each concentration was reduced with increasing the concentration of the herbicide, and reached about half of the control value in the highest concentration applied.

The results of the herbicide Prometryne were similar with that of EPTC except that the last herbicide had a slight effect on mitotic activity.

It may be concluded from the results that all the tested herbicides acted as antimitotic agents. The most potent one was the herbicide: Trifluralin. This compound caused complete inhibition of mitosis at the concentration of 1250 ppm. These results are in general agreement with those found by Lignowski and Scott (1972), Reddy and Suberamaniam (1984), Badr (1986), and Badr and Ibrahim (1987).

Spindle disfunction

The tested herbicides the inhibited spindle formation leading to C-metaphase (Plate 1-a). C-metaphase cells after restitution are known to give rise to polyploid cells (Plate 1-b). Spindle disfunction also lead to the scattering of chromosomes at meta-anaphase, irregular formation of cell plate at ana-
telophase, and unequal distribution of chromosomes (Plate 1-d). The error of spindle organisation could even lead to split and tripolar spindle (Plate 1-e). Sticky telophase cells with laggards (Plate 1-d) were also observed.

Inhibition of cytokinesis

The tested herbicides suppressed the cytokinesis leading to the formation of binucleate cells (Plate 1-f). Kihlman and Levan (1949) concluded that such a change had led to polyploidy.

Clastogenic effects

Only EPTC induced clastogenic effects such as breaks, fragments, laggards, and bridges (Plate 1-g). Clastogenic effects were more pronounced at the highest concentration used (Table 3). The results obtained are also in agreement with those found using different herbicides in the root-tips cells of different plant materials (Anderson 1969; Lignowski and Scott 1972; Bartele and Helton 1973; Banda and Sharma 1980; Jain and Sarbhoy 1988).

The results obtained suggest a possible role of herbicides, even the recommended ones, in affecting lentil plants, especially when higher rates are incorrectly applied. Therefore, much care is needed in the application practice of these chemicals, and attention must be paid to the residue levels of persistent herbicides used in the area. Furthermore, field studies are apparently important to clarify the role of the regular use of such pesticides in affecting the characteristics and stability of the crop.

| Table 3 The percentage of different mitotic aberrations in lentil root-tips induced by the treatment with different concentrations of Prometryne, Trifluralin, and EPTC |
|-----------------------------------------------|------------------|------------------|------------------|------------------|------------------|
| Type of Aberration | Prometryne | Trifluralin | EPTC |
|                   | 625 | 1250 | 2500 | 5000 | 19.53 | 78.13 | 312.50 | 1250.00 | 3750 | 7500 | 15000 |
| C-metaphase | 5.7 | 7.0 | 8.1 | 10.5 | - | 11.3 | 14.0 | 16.7 | - | 8.6 | 9.9 | 14.6 |
| Tetraploid cells | 1.3 | 2.8 | 3.1 | 4.1 | - | 7.6 | 7.2 | 6.3 | - | 2.2 | 2.7 | 3.7 |
| Binucleate cells | 3.1 | 4.0 | 4.5 | 5.6 | - | 8.2 | 8.8 | 11.5 | - | 4.7 | 4.4 | 6.9 |
| Unequal tripolar | 0.3 | 0.9 | 1.4 | 2.3 | - | 3.1 | 4.0 | 5.2 | - | 0.5 | 0.7 | 2.0 |
| Bridges | - | - | - | - | - | - | 0.4 | 1.0 | - | - | 0.5 | 1.6 |
| Fragments | - | - | - | - | - | - | - | - | - | - | 0.2 | 0.8 |
| Lagging chromosomes | - | 0.2 | - | 0.8 | 1.4 | 2.0 | 3.1 | - | - | 0.5 | 1.2 | - |
| Stickiness | 3.2 | 3.6 | 4.3 | 5.3 | 6.9 | 7.6 | 8.3 | - | 4.4 | 4.7 | 5.3 | - |

1) Abnormalities were absent from control roots
2) 3, 4): Concentration of two items, one time and half the field rate, respectively
تأثيرات خلوية وتكوينية لمبيدات الأعشاب
جيجيسبارد وترريفلان رابطًا في العدس

ملخص

درس التأثيرات الخلوية والتكوينية لثلاثة مبيدات أعشاب: جيجيسبارد (برومترين) وترريفلان (تريفيولين) وإيثام (EPTC) في نبات العدس، وذلك بتراكز مختلف. وقد حدثت المبيدات الثلاثة من إعداد البذور، ونمو الهرود، والانقسام غير المباشر (اليريزي) لخلايا النجسة في جذور العدس. وترازيت تلك التأثيرات مع زيادة تركيز جميع تلك المبيدات. وكان تريفلان الأكثر تأثيرًا في إضعاف نمو الهرود وقليل دليل الانقسام غير المباشر، أما إيثام فأنه أكثر في خفض نسبة الإضافة والحصول على أزهار غير ملائمة مما أدى إلى إحداث أحماض مختلفة من الاحترافات الصبغية مثل: إطوط الاستيائي - ج، ثلاثية النوى، وخلايا ربيعة التضاعف، وعدم التساوي في الطرف الانفصالين الثلاثي القطب، والجزور الصبغية، وظهور صبغيات مظلمة ورقيقة.

References

Lentil gall midge (*contarinia lentis*) - an aggressive pest of lentil

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CZECHOSLOVAKIA

Abstract

A detailed description is given of the egg, larva and imago of the lentil gall midge (*Contarinia lentis*). The damage caused by this pest, and the pest's life-history in lentil crops in Czechoslovakia are described briefly.

Introduction

In Czechoslovakia, the first outbreak of lentil gall midge (*Contarinia lentis* Aczel, 1942) was reported by Baudys in 1929. Enormous losses of yield due to this midge in Hungary forced Hungarian farmers between the period 1935-1941 to stop growing lentil as a crop (Fleischmann 1938; Nanninger 1942; Aczel 1944). From 1964 onwards, this midge has been responsible for considerable crop losses in France (Coutin 1965 Minssen and Pacquetecau 1969; Dardy and Wimmer 1983). From 1984 onwards, similar gall midge problems have been encountered in Czechoslovakia (Kolesik 1987, 1988). The lentil gall midge has, however, not yet reached pest status in countries other than those mentioned already (Tahhan and Hariri 1982; Skuhra 1986).

In 1985 we started to study the morphology, life cycle, ecology, and control of this midge. The present work was carried out to acquaint research and production workers with an insect that could attain pest status in lentil crops grown in other countries under certain circumstances.

Materials and Methods

Ten specimens of each stage of the lentil gall midge were measured. The eggs and larvae were obtained in 1984 from a heavily-damaged lentil crop growing in Hlohovec, Czechoslovakia. The adults measured emerged from midge larvae maintained in damp sand.

The life cycle of the pest in the field was studied in the neighbourhood of Hlohovec during the period 1985-1988.

Results and Discussion

Life history

In Czechoslovakia the lentil gall midge has one generation each year. The adult midges emerge from the previous-year's lentil fields between the end of May and the beginning of July. The females mate close to their sites of emergence and are then blown by the wind to new lentil fields. Once they are in a suitable crop, the gravid females lay their eggs in the buds of lentil flowers. Once larvae hatch from these eggs and start to feed, the plant responds by producing the characteristic gall. In about July, larvae of the last midge instar fall to the soil, where they hibernate in cocoons until next spring.

The amount of damage caused by the midge is expressed as the percentage of the total pods that are galled. There is a linear function between lentil yield y and damage x:  

\[ y = 0.01 e \ (100 - x) \]

where e is the yield expected in the absence (0%) of damage (Kolesik and Kolesik 1989). Lentil gall midge damage can be extremely serious in certain localities. In the 1985-1988 seasons the level of damage in affected lentil stand crops in Czechoslovakia ranged from 3 to 52%. Despite high losses in certain localities, however, the average crop loss throughout the whole country was 5% in 1985 (resulting yield: 5025 t obtained from 5542 ha), 5% in 1986 (5631 t, 5646 ha), 3% in 1987 (6317 t, 5846 ha), and 4% in 1988 (5761 t, 4780 ha) (Kolesik and Kolesik 1989).

Morphology

Egg

The eggs dissected from the abdomen of the female are kidney-shaped and have a flagellum that issues from the shorter side of the egg. The eggs are transparent and their contents are homogenous (Fig. 1). The average length of the eggs is 0.22 mm (range 0.18 - 0.26 mm). The average egg width is 0.10 mm (range 0.09 - 0.10 mm). The average fla-
gellum length is 0.24 mm (range 0.17 - 0.29 mm). The cytoplasm of the egg becomes divided into several segments several hours after laying. At the end of the embryonic development, the first instar larva can be seen moving within the egg shect (Fig. 1).

**Larva**

The first instar larva is transparent and is about as long as the egg. The final instar larva is yellow and has an elongate cylindrical body. The average length of the final instar is 2.3 mm (range 1.9 - 2.7 mm) and its average width is 0.6 mm (range 0.4 - 0.7 mm). The larva consists of the head, and one collar, three thoracic, and nine abdominal segments. The head is trapezoidal, 73 μm (range 68-79 μm) long and 64 μm (range 54-70 μm) broad. Each antenna has two segments. The first is 8 μm (range 7.9 μm) long and 13 μm (range 11-16 μm) broad; the second 15 μm (range 14-17 μm) long and 8 μm (range 7-9 μm) broad. Both the dorsal and ventral sides of the larval skin are smooth. Dart fields are clearly visible on the ventral side of the second and third thoracic, and all abdominal segments. Although none of the head, collar, sternal, lateral, dorsal, pleural, ventral, or anal papillae possess setae, the three pairs of the terminal papillae have a short seta. In contrast the fourth pair of the terminal papillae are enlarged, sclerotized and without setae (Fig 2). On the ventral side of the first thoracic segment there is a spatula sternalis, which helps the larva to drop off its host plant (Figs. 3 and 4). The total length of the spatula sternalis = 141 μm (range 126 - 152 μm), the depth of the depression = 9 μm (range 7 - 13 μm), the width between the tips of the lobes = 28 μm (range 22-35 μm), the span of the lobes = 45 μm (range 41-52 μm). Aguilar and Coulon (1967) gave the following measurements: total length = 200 μm, depth of the depression = 15 μm, width between the lobes = 40 μm, and span of the lobes = 60 μm.

**Male**

Body length is 1.6 mm (range 1.3-1.9 mm). On the head, the eyes are holoptic and consist of a great number of ommatidia, and the antennae each consist of 14 segments. (Fig. 5). The first segment (scape) is 44 μm (range 39-50 μm) long and 50 μm (range 43-54 μm) wide; the second (pedicel) 37 μm (range 32-43 μm) long and 41 μm (range 36-43 μm) wide. The following 12 segments (flagellomers) are bi-
nodal; the first and the second are fused (Fig. 7). The measurements of the fifth flagellomeres are presented in Table 1. The last flagellomer is 99 μm (range 86-116 μm) long, its apical lobe is 14 μm (range 11-16 μm) long (Fig. 8). Each node is covered with microtrichia. There is a whorl of simple firm setae and a whorl of looped circumpilar on each node. Both whorls extend about to the half of the next node. The palps are made of four segments (Fig. 9). The measurements of palps are presented in Table 2. The wings have simple venation (Fig. 10) and are covered with hairs. Wing length is 1.5 mm (range 1.3-1.7 mm). Wing width is 0.6 mm (range 0.5-0.7 mm). Description of genitalia (Fig. 11). Clasper segment is slightly narrowed distally, inferior lamella is deeply divided, superior lamella and subgenital plate are angular, and the aedeagus is slight. The legs are covered with hairs. The tarsal claws are simple, about twice as long as the empodium, and bent at the last third (Fig. 12). The colour of freshly-caught males is as follows: flagellum, dark brown; scape and pedicel, pale brown; eyes, black; neck, pale yellow; palps, yellow-grey; thorax, dark brown; legs, sulphur yellow with a black scale strip along segments (segments near joints are brown); abdomen, non-sclerotized parts are sulphur yellow; tergites, dark brown; sternites, pale grey; and the halteres are grey.
Female

Body length is 1.7 mm (range 1.4-2.0 mm). Antennae consist of 14 segments (Fig. 6). Scape is 40 μm (range 34-45 μm) long, and 43 μm (range 39-48 μm) wide. Pedicel is 42 μm (range 36-43 μm) long and 38 μm (range 34-43 μm) wide. Twelve flagellomers, each consisting of cylindrical node and a comparatively short neck. The first and the second flagellomers are longer than the others. The node of the fifth flagellomer is 48 μm (range 45-57 μm) long and 27 μm (range 25-32 μm) wide, the neck is 15 μm (range 11-18 μm) long and 11 μm (range 9-14 μm) wide. Each node is covered with microtrichia and firm setae. The terminal flagellomer is 64 μm (range 52-84 μm) long and ends in a 12 μm (range 7-14 μm) long taper (Fig. 13 left). The palps consist of four segments. The measurements of palps are presented in Table 3. Wing length is 1.6 mm (range 1.4-1.8 mm). The ovipositor is long and retractile and tapers into a pair of narrow terminal lobes (Fig. 13 right). The colour and other morphological characteristics of the female are the same as those of the male.

**Description of Infestation**

The attack by larvae of the lentil gall midge is characterized by the flower organs degenerating and being replaced by the production of a gall 6-8 mm long and 3-5 mm wide (Fig. 14). No seed is formed within the gall. The proportion of flowers galled on one plant can be as high as 80%.

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Fig. 8 The last segment of male antenna

Fig. 9 Palps

<table>
<thead>
<tr>
<th>Table 1 Measurements of male palps in μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>1st palp</td>
</tr>
<tr>
<td>2nd palp</td>
</tr>
</tbody>
</table>

Fig. 10 Wing

Fig. 11 Male genitalia
Table 3: Measurements of female palps in mm

<table>
<thead>
<tr>
<th></th>
<th>1st palp</th>
<th>2nd palp</th>
<th>3rd palp</th>
<th>4th palp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>Width</td>
<td>Length</td>
<td>Width</td>
<td>Length</td>
</tr>
<tr>
<td>Average</td>
<td>28</td>
<td>17</td>
<td>46</td>
<td>22</td>
</tr>
<tr>
<td>Range</td>
<td>25-32</td>
<td>14-20</td>
<td>41-50</td>
<td>20-27</td>
</tr>
</tbody>
</table>

References


Acknowledgement

We are grateful to Dr. S. Finch (Institute of Horticultural Research, Wellesbourne, Warwick, UK) for providing the text correction.

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Fig. 12 Tarsal leg segment with claws and empodium

Fig. 13 (left) The last two segments of female antenna (right) Ovipositor

Fig. 14 Infestation symptom (left, a gall; right, a normal pod)

نباة العدس المقصية

- *Contarinia lentis*

ملخص

يعطي هذا البحث وصفًا للبيضة والرقة والحشرة الكاملة لهذه النباة، ويعرض اختصارًا للضرر الناجم عنها، وتاريخ حياتها على محفظ العدس في تشيكوسلوفاكيا.
Identification of resistant sources to ascochyta blight in lentil

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National Agricultural Research Centre
Islamabad, PAKISTAN

Abstract

A study was conducted of ascochyta blight reactions of lentil genotypes under artificial epiphytotic conditions in the field. The disease severity was recorded on 1-9 scale. Out of 152 genotypes tested to blight, 17 cultivars were highly resistant, 40 were resistant, and 34 showed an average reaction while the rest were susceptible to highly susceptible.

Introduction

Lentil (Lens culinaris M.) is an important pulse crop grown during the winter season in Pakistan. In recent years, ascochyta blight, one of the major factors limiting the expansion of lentil cultivation, attacked the lentil crop. Severe foliar infection causes yield losses of over 40% (Gossen and Mornall 1983). Ascochyta lentinis Bond and Vassil was recorded on lentil for the first time in Pakistan during 1982 and its seed borne nature was also confirmed by (Khan et al. 1983). Bondartzeva and Vassilievsk (1940) made investigations on the blight of lentil caused by A. lentinis. The chemical control of lentil blight has been studied and some fungicides were found effective (Bashir et al. 1986; Iqbal et al. 1989), but their use at the farmer’s level was uneconomic and laborious. Khatri and Singh (1975) tested 947 lentil lines against the pathogen. Only one line showed no pod infection. Varietal differences in resistance to blight were also found by Singh et al. (1982). During the 1984/85 season, a severe epiphytotic of A. lentinis on lentil crop planted at NARC, Islamabad was observed (unpublished work). Most of the local and exotic cultivars were susceptible to blight. The present investigations were undertaken to identify sources of resistance to lentil blight and their possible use in breeding for disease resistance.

Materials and Methods

A total of 152 cultivars of lentil received from the National Agricultural Research Centre (NARC), Islamabad; Ayub Agricultural Research Institute (AARI), Faisalabad; and the International Centre of Agricultural Research for Dry Areas (ICARDA), Syria were screened during the rain season of 1988/89 at NARC, Islamabad, under artificial epiphytotic conditions supplemented with infection cum indicator rows. The lines were planted in October in a single row plot of 4 m long with 30 cm row to row spacing. To provide the desired quantity of inoculum for disease development, a highly blight susceptible lentil variety "Masoor 85" was planted after every two test entries.

In the first week of January, diseased plant debris, collected from the previous year, was chopped and spread in the field. In mid-February, a spore suspension of A. lentinis (5 x 10^6 spores/ml) was sprayed. Due to unfavorable weather conditions for the development and spread of the disease, spraying of spore suspension was repeated weekly.

Inoculated plants were sprayed twice with water every day. The first spray in the morning and the other one in the evening to provide maximum humidity. The water spray continued till the killing of spreader rows.

Disease intensity was recorded twice at the times of flowering and maturity, respectively on a numerical rating scale of 1-9 (Table 1). The genotypes were grouped into different categories according to their reaction to the disease.

<table>
<thead>
<tr>
<th>Disease grade</th>
<th>Disease intensity</th>
<th>Disease reaction</th>
<th>Number of entries</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No visible lesions observed</td>
<td>Highly resistant</td>
<td>17</td>
<td>11.2</td>
</tr>
<tr>
<td>3</td>
<td>Few scattered lesions usually seen after careful searching</td>
<td>Moderately resistant</td>
<td>40</td>
<td>26.3</td>
</tr>
<tr>
<td>5</td>
<td>Lesions common and easily observed on plants</td>
<td>Average reaction</td>
<td>34</td>
<td>22.4</td>
</tr>
<tr>
<td>7</td>
<td>Lesions very common and all damaging</td>
<td>Moderately susceptible</td>
<td>19</td>
<td>12.5</td>
</tr>
<tr>
<td>9</td>
<td>Lesions extensive on all plant parts, defoliation, drying of branches, and killing of some parts</td>
<td>Highly susceptible</td>
<td>42</td>
<td>27.6</td>
</tr>
</tbody>
</table>

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### Table 2: Reaction of lentil genotypes to ascochyta blight

<table>
<thead>
<tr>
<th>Disease reaction</th>
<th>Lentil genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Precoz x 830-2, Precoz x L 830, Precoz x 747 A 9, Precoz x L 830, Precoz x 747 A 9, I.L. 5562 x I.L. 936, FLIP 84-71L, FLIP 84-71L, I.L. 858, Lenka, 785 26018, 785 26015, FLIP 84-43L, FLIP 84-81L, FLIP 84-55L, FLIP 84-12L</td>
</tr>
<tr>
<td>1</td>
<td>88533, 88531, 88537, 88534, 88530, 88537, 88546, 88547, 86654, 86658, 86668, 86679, FLIP 84-71L, I.L. 858, Lenka, 785 26018, 785 26015, FLIP 84-43L, FLIP 84-81L, FLIP 84-55L, FLIP 84-12L</td>
</tr>
<tr>
<td>2</td>
<td>88534, 88531, 88537, 88530, 88537, 88546, 88547, 86654, 86658, 86668, 86679, FLIP 84-71L, I.L. 858, Lenka, 785 26018, 785 26015, FLIP 84-43L, FLIP 84-81L, FLIP 84-55L, FLIP 84-12L</td>
</tr>
<tr>
<td>3</td>
<td>88534, 88531, 88537, 88530, 88537, 88546, 88547, 86654, 86658, 86668, 86679, FLIP 84-71L, I.L. 858, Lenka, 785 26018, 785 26015, FLIP 84-43L, FLIP 84-81L, FLIP 84-55L, FLIP 84-12L</td>
</tr>
</tbody>
</table>

### Results and Discussion

The results (Table 2) showed that out of 152 lentil varieties/lines screened under field conditions, 17 varieties showed immunity to the disease. 40 varieties were resistant, and 34 showed intermediate (average) reaction, while the rest were susceptible to highly susceptible to blight.

Precoz (I.L. 4605), a bold seeded lentil variety, was found highly resistant to blight. The genotypes with Precoz as a parent showed the same reaction. Precoz has subsequently been tested in the blight areas of Pakistan and maintained its resistance to blight. It is now in use as a resistant parent in the development of blight resistant varieties.

Out of 509 lentil genotypes in Argentina assessed for disease reaction to ascochyta blight, 115 were reported as highly resistant (Mitidieri 1974). In India, Khatri and Singh (1975) tested 947 lines and found that only five were highly resistant. Indicating either high aggressiveness of the isolates or narrow diversity of the genetic material studied. Morrall and Sheppard (1981) reported significant differences among breeding lines of lentil with regards to disease reaction. In this study, a great diversification in lentil to blight reaction is revealed to confirm that developing highly resistant cultivars should be a future objective for disease control.

### References


**Rhizoctonia solani: a new root rot disease of lentil in Pakistan**

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**Pulses Programme**  
**National Agricultural Research Centre**  
**Islamabad, PAKISTAN**

**Abstract**

In field and laboratory trials at the National Agricultural Research Centre, Islamabad, Pakistan, in spring of 1988 and 1989, lentil was observed to be affected by root rot (*Rhizoctonia solani*) recorded for the first time in Pakistan. The symptoms are described.

Lentil was observed to be affected by a root rot disease at the National Agricultural Research Centre, Islamabad during the spring of 1988/89 season. Foliage of diseased plants were dull green in color which turned pale yellow and/or reddish brown later on. The lower leaves showed wilting and within a few days these symptoms progressed upwards and ultimately the whole plant died. The roots of wilted plants were brown to reddish brown in color and showed rotting symptoms. Vascular system was completely destroyed by the causal fungus.

The causal fungus was isolated on Potato Dextrose Agar (PDA) from infected roots. The pathogenicity was tested by sowing clean lentil seeds in soil infested artificially with the causal fungus. The pathogen was reisolated and found to be identical with the original one.

The fungus colony on PDA medium was light brown in color and produced a number of sclerotia within a few days. The sclerotia were variable in size and shape, and were superficially borne on mycelium. The mycelium was brown, septate, and the number of branches was constricted at the point of origin. The fungus was identified as *Rhizoctonia solani* (Wilson and Brandsberg 1965). *R. solani* causing root rot lentil was reported by Kannaiyan and Nene (1973) in India. But this is the first record in Pakistan although its association with the root rot of chickpea (*Cicer aritinum*) and many other crops was already reported by Mirza and Qureshi (1978).

**References**


Current Science 57(7): 257.  

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**Occurrence of Epicoccum and Stemphylium leaf spot of Lens culinaris Medik. in Hungary**

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**Tapioszele, HUNGARY**

**Abstract**

In field trials conducted in Hungary during the 1988/89 season, *Epicoccum purpurascens* Ehrenb. ex Schlecht. and *Stemphylium botryosum* Walf. were observed as new pathogens on lentil. Both fungi caused leaf spots on adult plants, but the older leaves were more susceptible to pathogenic attack than younger leaves. The pathogens were isolated from spotted leaflets then identified. Their pathogenicity was observed in a glasshouse, and both were pathogenic to lentil plants. The oldest leaflets were the most highly infected. Severe symptoms of disease were also observed on the leaves damaged by *Tetranychus urticae* Koch red mite. Different leaf-pathogens cause major yield losses on lentils. The pathogens *Botrytis cinerea* Pers ex Fr. (Folk 1974), *Peronospora lentis* Gaum, and *Uromyces viciecraccae* Constant (Podhradzky 1968) were earlier observed in Hungary. Two new fungi were observed causing leaf spot on lentil plants in the summers of 1988 and 1989.

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Materials and Methods

The plant material was collected from diseased plants as leaves with spots. The leaflets cut from leaves with spots, were investigated microscopically for pathogenic conidia. Some were placed in a moisture chamber and were incubated until sporulation.

The fungi were identified according to culture and morphological characters (Domsch, Gams and Anderson 1980).

Results and Discussion

The two new fungi (Epicoccum purpurascens Ehrenb. ex Schlcht. and Stemphylium botryosum Wallr.) were identified from spotted lentil leaflets. Their symptoms were not distinguishable from each other or the early symptoms of Botrytis cinerea Pers ex Fr. The symptoms were small reddish spots on older leaflets. The sporulation was not observed on samples collected from the field.

The spots rapidly spread in the moisture chamber and became brownish or blackish. Sporulation was observed on decayed leaflets and on moist blotter around them.

E. purpurascens grew well on oat meal agar and malted Leonian's media, and sectors were often formed similarly (Kilpatrick and Chilvers 1981). The colonies grew fast reaching 6, 5-8 cm in diameter after 10 days, with sectors bearing different aerial mycelium. The fungus sporulated well in sectors without aerial mycelium. Sporulation was not observed in sectors with extensive aerial mycelium. The blastoconidia were found in sporodochia (Fig. 1) and were globose to pyriform, 14, 4-26, 8 um in diameter.

The conidia are subglobose or ovoid, constricting at the median (Fig. 2). The characters observed were similar to those reported by Corlett et al. (1982) and Domsch et al. (1980). Mature sexual form was not observed in cultures, but was on overwintered lentil straw lying on the soil. However, the pathogenicity of ascospores harvested from Pleospora tarola (Simmons 1985) was not tested. (Fig. 3).

Fig. 1. Sporodochium of Epicoccum purpurascens

S. botryosum grew also well on tested media, but sectors were not formed. Its colonies are fast growing too and small stromates are formed in them. The fungus sporulated well on plates, forming conidia on dark conidiophores.

Fig. 2. Conidia of Stemphylium botryosum

Fig. 3. Mature ascis and ascospores of Pleospora tarola

In glasshouse experiments, both fungi caused symptoms on infected lentil plants. These were small reddish brown on younger leaves similar to field symptoms, but were larger and blackish on older leaves of E. purpurascens and greyish in the centre with reddish ring on leaves with S. botryosum. Serious infection was developed on plants previously damaged by red mite. (Tetranychus urticae Kohl). A similar effect was observed earlier in our investigations on Alternaria alternata /Fr./ Keissler - Vicia faba L. and Botrytis cinerea Pers. ex Fr. - Arachis hypogaea L. parasite - host relationships (Simay 1987 and 1990). These results show that both fungi are weak parasites.
E. purpurascens is a well known soil fungi (Domsch et al. 1980), and it occurs on different plant material. It causes leaf spot on different plants too (Gupta and Karwasra 1982; Mueller 1964), but was not known as plant pathogen earlier in Hungary. S. botryosum is however a well known plant pathogen for leguminous plants in Hungary (Voros and Husz 1965; Simay 1988 and 1989). Although it is also known on lentil in other countries (Bark and Zahid 1986), this is the first report on the occurrence of this pathogen on lentil in Hungary.

References


Lens culinaris Medik

بتلعق الأوراق المصابة عن الفطرين

Epicoccum و Epicoccus

ملخص

لوحظ في التجارب الحقلية المفيدة في هنغاريا خلال الموسم 1988/1989 Epicoccum purpurascens Ehrenb. 89/1988 Stemphylium botryosum ex Schlecht اكتُرُضُت جذورًا على الأوراق، وقد سُبِب هذان الفطراً تقع الأوراق على النباتات الكاملة، إلا أن الأوراق الأخرى كانت أكثر عرضة للإصابة من الأوراق الأخرى. وقد تمَّ عزل الفطَّرْين من ورقات مصابى بالتبقع ثمّ جرى تجديدهما، ودراسة قدرتها المرضية في الدفيئة. كان كلاهما معرضًا للأنشطة المعدة، وكانت الورقات الأقدم أكثر عرضة للإصابة. وشهدت أعراض شديدة للمرض على الأوراق المصابية وتبعد مختلفة Tetranichus urticae Koch بالعكوب الأضرار مرض الأوراق إلى ضائع كبير في خلال الدراسة. وفي هنغاريا Botryis cinerea Pers ex Fr. (Folk 1974), Perenospora lentis Gaum, & Uromyces viciae-craccae Constant (Podhradsky 1968) وَ، وَلَوَحَا في صيف 1988 و 1989 فطراً جذوراً يَبِسَبان

تبوقع الأوراق على الالم.
LENS Bookshelf


This book reports the results of a project jointly undertaken between ICARDA and IFPRI. The theme is to analyse the existing evidence on the value of legumes in production systems in the region with respect to both their contribution to soil fertility under stressful conditions, and the possibilities for expansion in their use as livestock feed; and to assess in-depth the potential pay-off of further investment in the improvement of lentil (taking into account the contribution to human nutrition, foreign trade, and the sustainability of production systems in the region) in order to determine the appropriate allocation of its resources.


Legumes are of immense value in the rainfed farming systems of the Mediterranean area because they are an important source of protein for humans and livestock, and can play a key role in improving the soil. Food legumes have been grown in these areas for thousands of years, but their productivity has been limited by the low yield potential of the commonly grown land races and their susceptibility to pests, diseases and other environmental stresses. The concept of forage legumes as crops, however, has yet to be developed, and then the crops fitted into the farming systems. ICARDA and UNDP organized a workshop on 'The Role of Legumes in the Farming Systems of the Mediterranean Areas', June 20-24, 1988, in Tunis, and the proceedings are published in this volume. The papers review the roles of pasture, forage and food (chickpea, faba bean, lentil and pea) legumes, and relate them to human and animal nutrition, sustainability of production, crop rotations and socioeconomic conditions.

Key Lentil Abstracts


Vascular wilt caused by Fusarium oxysporum f.sp. lentis is the major disease on lentil (Lens culinaris) in Syria. Although extensive screening has been done in the field at ICARDA, it was necessarily opportunistic because of the unevenness of wilt distribution. A simple, rapid and repeatable technique has been developed in the plastic house to screen lentil germplasm at the seedling stage for resistance to wilt. The technique involved planting of one row of each of the test lines with a susceptible check at every 5th row in metal trays containing field soil and inoculation of 14-day old plants with a liquid culture of F. oxysporum isolated from the stems of wilted plants. Final disease incidence was recorded eight weeks after sowing. A total of 162 lines were screened using this technique and 29 suggested presence of resistance as no disease developed. The repeatability of the technique was high with a correlation of r = 0.86 (P < 0.01) between repeated sowings of 25 lines. Eighteen of the lines were grown in the field where their reaction was same as in the plastic house.


This study was conducted to determine the effects of some factors, namely temperature (10, 15, 20, 25 and 30°C) and media (potato dextrose agar, lentil dextrose agar and (Czapek), on the growth in vitro of Fusarium oxysporum f.sp. lentis in order to produce sufficient inoculum for the development of a screening technique, as well as to clarify such aspects of disease epidemiology as mode of seed transmission and association with nematodes and antagonistic bacteria. The optimum temperature for fungal growth was 22°C. Maximum mycelial growth and sporulation were obtained on lentil dextrose agar. In vitro studies revealed an antagonistic effect between the fungus and a Pseudomonas
sp. isolated from infected soil. The following nematode genera were associated with wilt in the field: Diatylenchus dipsaci, Aphelenchoides spp. Aphelenchus spp., Helicotylenchus spp., Heterodera spp. Meloidogyne spp., Pratylenchus spp. and Tylenchorhynchus spp. with the former being the most prevalent. The fungus was not present either in the endosperm or under the seed coat of seed from a crop showing wilt symptoms.


Seasonal and genetic variation in the potential feeding value of lentil straw, a regionally important sheep feed, was measured in two seasons on eleven diverse macrospuma lentil selections under rainfed conditions in north Syria. Digestible dry matter (DMD) was 46% in the 1981-1982 season and 43% in the 1982-1983 season. The genotype-year interaction mean squares for all straw quality parameters were greater than their respective genotypic mean squares indicating low genetic variation, as judged by laboratory methods of assessing straw value and a poor expected response to selection for improved straw quality. In another experiment, the partition of dry matter within the straw of six selections was measured in one environment. Proportions of leaf, branch, pod and root tissue within straw were 38, 34, 23 and 5% respectively. Their mean DMD values were 62, 36, 44 and 22%, respectively. The results indicated that variation in straw quality is largely due to differences in the partition of dry matter between plant parts.


Principal component analyses were utilized to ascertain phenetic relationships within Lens, a genus which has been recently subjected to intensive bipsystematic and evolutionary study. The first analysis was conducted on a combination of qualitative and quantitative characters and a second analysis was conducted on quantitative characters only. In the first analysis, L. orientalis grouped closest to L. culinaris, the cultivated species. The second closest to L. culinaris was L. nigricans while L. ervoides was the most removed. Two accessions of L. nigricans and one accession of L. ervoides were spatially removed from their respective groups. The second analysis yielded similar results except that a larger number of L. nigricans separated from the main group. These results agreed with recent cytogenetic studies and also provided new insight in understanding the evolution of Lens.


Lentils (Lens culinaris Medik.) were sown on eight sowing dates from April to November in two seasons in Canterbury, New Zealand. In 1984/85, six sowing dates were combined with two lentil cultivars (Olympic and Titore) and two irrigation treatments. In 1985/86, Titore was sown on two dates, with four irrigation treatments. An additional experiment grown under rain shelters examined the response of Titore to four irrigation regimes. The 1984/85 season was dry and rainfall was only 70% of the long-term mean. In this season, seed yield was high, 3.3 t/ha from the May sowing. The 1985/86 season was wetter than average and seed yields were lower, ranging from 0.6 to 1.5 t/ha. Under rain shelters, seed yield ranged from the equivalent of 0.32 to 2.5 t/ha. Sowing date had the most marked effect on seed yield. In the 1984/85 season, all autumn and winter sowings yielded 2.4-3.3 t/ha, whereas the spring sowings yielded 0.5-1.5 t/ha. In 1985/86, unirrigated plots from the May sowing yielded 1.5 t/ha, whereas all other plots yielded c. 0.8 t/ha. Generally, the small-seeded cultivar Titore outyielded Olympic. Dry matter (DM) accumulation followed similar trends to seed yield. Seasonal DM accumulation followed a sigmoidal curve. Functional growth analysis indicated that plants from autumn/winter sowings had a weighted mean absolute growth rate of 110-171 kg/ha per day, whereas spring-sown plants grew at 96-137 kg/ha per day. The maximum crop growth rate was 230 kg/ha per day in the July 1984 sowing. There was little positive response to irrigation in both seasons. Under rain shelters, there was a linear increase in both dry matter and seed production with increased total water. Fully irrigated plots produced 1.27 g DM and 0.72 g seed/m per mm of water received. In the first experiments there was no relationship between maximum potential soil moisture deficit (D) and yield. Under rain shelters, however, there was a linear relationship which indicated a limiting deficit of c. 130 mm. The relationship showed that, for each millimetre increase in D above D, 0.39% of the maximum yield was lost. Under the rain shelters, there was a strong relationship between yield and actual evapotranspiration (ET). Water-use efficiency (WUE) ranged from 2.81 g DM/m² per mm ET in unirrigated plots to 0.69 g seed/m² per mm ET. The
The effects of duration of the hibernal quiescent period, migrational state, food plant (pea, lentil, or alfalfa), and absence of food on fecundity and fertility of pea leaf weevil, *Sitona lineatus* (L.), were compared in the laboratory. Two rearing techniques were used to determine precopositional and ovipositional periods, number of eggs laid, and rate of egg laying for *S. lineatus* field-collected monthly over several seasons. The fecundity of *S. lineatus* was significantly affected by the food provided, with weevils fed pea foliage having the highest fecundity. The lowest level of oviposition was observed for weevils provided lentil foliage or starved. The spring migrational state of *S. lineatus* and number of months spent in hibernal quiescence had a significant effect on oviposition.

### Latest Lentil References

#### General


#### Breeding and Genetics


#### Physiology


Microbiology

Agronomy

Pests

Plant Pathology
Quality and Processing


Second International Food Legume Research Conference
12 - 16 April 1992, Cairo, Egypt

The First International Food Legume Research Conference (IFLRC-I) on pea (Pisum sativum), lentil (Lens culinaris), faba bean (Vicia faba), and chickpea (Cicer arietinum) was held at Spokane, Washington, U.S.A. in 1986. It was a resounding success with over 500 registrants from 50 countries. The program consisted of 91 papers coauthored by 202 contributors from 40 countries. The Conference Proceedings was published as: Summerfield, R.J. (ed.). World Crops: Cool Season Food Legumes. 1988. Kluwer Academic Publishers, Dordrecht, The Netherlands.

The success of IFLRC-I has prompted development of the Second International Food Legume Research Conference (IFLRC II) from April 12-16, 1992 in Cairo, Egypt. Recent success in development of low neurotoxin lines of grass pea (Lathyrus sativus) has resulted in the addition of this promising cool season food legume to the list of species covered.

The objectives of IFLRC-II are to 1) review and assess recent results from national and international research programs on cool season food legumes and 2) develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multidisciplinary research efforts will be emphasized.

The organizing committee is developing the program and details will be available in the Second Announcement. The primary function of this First Announcement is to alert everyone to the time and date so they can make plans to attend. In addition the organizing committee wishes to develop an updated mailing list of interested food legume researchers and those involved in technology transfer of these research results.

For further information regarding reservation for 1992 IFLRC-II, Cairo, Egypt, please contact:

Dr. A.E. Slinkard
Crop Development Centre
University of Saskatchewan
Saskatoon
Saskatchewan, S7N OW0
Canada

Len Newsletter Vol. 17, No. 1, 1990
ANNOUNCEMENTS

REPORTING OF MUTANTS IN LENS

Manuscripts that report new mutants in lentil will not be accepted for publication in LENS unless 1) the mode of inheritance has been determined, 2) seed of the homozygous mutant is provided to the Lentil Gene Bank (heterozygous for lethal or semi-lethal mutants), and 3) a gene symbol is proposed (the gene symbol should be patterned after the system used for genes in Pisum, as outlined in the Pisum Newsletter 9: 67-70, 1977, a copy of which can be obtained from either of the Technical Editors).

FORMATION OF LENTIL GENE BANK

As genetic information on lentil increases, the need for a central gene bank arises. Accordingly, the Crop Development Centre, University of Saskatchewan is initiating a Lentil Gene Bank to serve as a repository for lentil genes. Thus, as soon as a researcher describes a gene in the literature, determines its mode of inheritance and assigns a gene symbol, he is requested to send 20 seeds carrying the gene and 20 seeds carrying its contrasting allele to the Lentil Gene Bank. All genotypes in the bank will be available to interested researchers within the limits of available seed.

As soon as you have described a gene in lentils, determined its mode of inheritance and assigned a gene symbol, please submit seed samples to:

Lentil Gene Bank
c/o Dr. A. E. Slinkard
Crop Development Centre
University of Saskatchewan
Saskatoon
Saskatchewan, S7N 0W0
CANADA

For further Information write to Training Department
Forthcoming Conferences and Events - 1990

1990

November

Modern Methods of the Study of Rhizobium
Bangkok, Thailand 01-28 Nov.
Contact: NIFTAL Project Director, NIFTAL Project, 1000 Holomua Rd., Paia, Hawaii 96779-9744, USA.

This course aims to provide training in rhizobia culture, strain identification, genetics of rhizobia, and inoculant production and field application. The course sponsors are the Biological Nitrogen Fixation Resource Center, for South and Southeast Asia, Thailand Department of Agriculture, NIFTAL (Nitrogen Fixation by Tropical Agricultural Legumes) Project and Miran, and the University of Hawaii’s Biotechnology Program.

1992

June

1st European Conference on Grain Legumes
Angers, France, 1-3 June

Contact: Secretariat, First European Conference on Grain Legumes, UNIP, 12, Avenue George V, 75008 Paris, France.

The conference will cover the following legume species: Field pea, faba bean, white lupin, chickpea, and lentil. Oral presentations and posters will be grouped into the following nine areas of interest: Genetic resources and breeding, molecular biology and biotechnology, plant physiology, agronomy, pathology, seed composition, use for animal feed, use for human feed, and economics.

April

Second International Food Legume Research Conference
Cairo, Egypt, 12-16 April
Contact: Dr. A.E. Slinkard, Crop Development Centre, University of Saskatchewan, Saskatoon, Saskatchewan, S7N OWO, Canada.

The objectives of the conference are to 1) review and assess recent results from national and international research programs on cool season food legumes and 2) develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multi-disciplinary research efforts will be emphasized.
Contributors' Style Guide

Policy
The aim of LENS Newsletter is to publish quickly the results of recent research on lentils. Articles should normally be brief, confined to a single subject, good quality, and of primary interest to research, extension, and production workers, and administrators and policy makers.

Style
Articles should have an abstract (maximum 250 words) and whenever possible the following sections: introduction, materials and methods, and results and discussion. Authors should refer to recent issues of LENS for guidance on format. Articles will be edited to maintain uniform style but substantial editing will be referred to the author for his/her approval. Occasionally, papers may be returned for revision.

Disclaimers
The views expressed and the results presented in the newsletter are those of the author(s) and not the responsibility of ICARDA or the University of Saskatchewan. Similarly, the use of trade names does not constitute endorsement of or discrimination against any product by ICARDA.

Language
LENS Newsletter is published in English but ICARDA will publish articles submitted in Arabic and French.

Manuscript
Articles should be typed double-spaced on one side of the page only. The original and two other legible copies should be submitted. The contributor should include his name and initials, title, program or department, institute, postal address, and telex number if available. Figures should be drawn in India ink, not photocopies. Define in footnotes or legends any unusual abbreviations or symbols used in a figure or table. Good quality black and white photographs are acceptable for publication. Photographs and figures should preferably be 8.5 cm or 11.4 cm wide.

Units of measurement are to be in the metric system: e.g., l/ha, kg, g, m, km, ml ( = milliliter), m².

The numbers one to nine should be written as words except in combination with units of measure, all other numbers should be written as numerals: e.g., nine plants, 10 leaves, 9 g, ninth, 10th, 0700 hr.

Examples of common expressions and abbreviations
3 g; 18 mm; 300 m²; 4 Mar 1983; 27%; 50 five-day old plants; 1.6 million; 23 ug.; 5°C; 1980/81 season; 1980-82 seasons; Fig. No.: FAO-USA. Fertilizers: 1 kg N or P₂O₅ or K₂O/ha.

Botanical: Include the authority name at the first mention of scientific names. Cultivar(s) = cv(s), variety = var(s), species = sp./ssp., subspecies = subsp., subgenus = subg., forma = f., forma specialis = f. sp.

References


Submission of articles
Contributions should be sent to LENS, Library, ICARDA, P. O. Box 5466, Aleppo, Syria.
تعليمات النشر باللغة العربية

سياسة النشر:

تهدف هذه المادلة العلمية إلى نشر نتائج البحوث الجديدة بالسرعة الممكنة. وبالإضافة إلى التدريس، متخصصون في مختلف المجالات الكلية ويعملون على افتراض مستقبل ومشارييعهم العلمية. هذه الملاحظات تنمضى بالكثير من الوعي وتحدد أساليب إنتاج ونشر البحوث العلمية والمنصات، دعماً لتيسير تناول الناشرين عبارة عن وجهة نظر مثالية.

منهج الكتابة:

كتبت وترتبت البحوث بالشكل التالي: (1) عنوان مناسب لا يزيد عن 70 حرفاً، يليه اسم وعنوان الباحث / الباحثين. (2) ملخص باللغة العربية يتألف من بيئة واحدة لا يزيد عن 200 كلمة، توجيه العمل والنتائج المترشح которые بالمنطق وأوضاع معرفة ممكناً. (3) مقدمة بخصوص موضوع البحث، وتندرج بشكل تقليدي أعمال البحث السابقة المتعلقة بالموضوعات. (4) المواد والطرق تشمل المعلومات الخاصة بموضوع تطبيق التجريب، والمواقع والطرق المستخدمة، مع تدقيق تجميع التجريب المثبّت. (5) النتائج والنقاش، وتشير المعلومات والبيانات التي حصل عليها الباحث، وبدأت مهتميتها، (6) التوصيات إن وجدت، وتكشف بعضات محددة، ومقدمة (7) كلمة الشكر في الزمن. (8) ملخص بالإلكتروني مترجح من العربية بإملاءهن علي ينصب في روح اللغة الإنجليزية. (9) الراجع، وترتب إذا إلى النص بكتابة كتنية مؤلف عام النشر بين فضتين. وإذا كان المرجع أكثر من ثلاثة مؤلفين، تكتب كنية الأولى إضافة إلى كلمة "وأُخَرَين" إذا كان المرجع باحث أو.

الجداول والأشكال والصور:

تفضل الجداول الصغيرة على الكيفية، والبسيط على الفئة. يرجى أن يتم تحمل جدول على طريقة حسب ورد، والحصص في النص، مع عنوان مناسب. وتعمل الصور (الأبيض والأسود فقط)، وتعمل الصور والرسوم الأصلية وليس صوراً عنها، على أن تكون بعرض عرض واحد (8.8 سم) أو عرضين (17.7 سم)، ونشر إلى مكاتب النبات في النص، ويرفع فيها أن تكون واضحة، والملاحظ، وتحمل عنواناً وأرقاماً متسلاة حسب ورد، في النص.

الأرقام ووحدات القياس:

Arabic figures تستعمل في جميع مطبوعات إيكاردا الأرقام العربية مثلاً: طن، كم، غ، م، مم، م2، SI Unites

الاحصائيات والرموز:

إحصائيات ورموز منظمة الأغذية والزراعة (FAO)، ف.م.ع (الفريق المعول عليه)
ICARDA Investing in the Future
ICARDA’s historical background and research objectives are outlined in English and Arabic. For your copy, contact CODI.

FABIS (Faba Bean Information Service)
This service was established in June 1979 when FABIS Newsletter No. 1 appeared. Now produced triannually, it publishes up-to-the-minute short scientific papers in English and Arabic languages on the latest research results and news items. FABIS has also produced other publications, including Genetic Variations within Vicia faba. For further information, write: FABIS.

RACHIS (Barley, Wheat and Triticale Newsletter)
This ICARDA service is aimed at cereals researchers in the Near East and North Africa region and Mediterranean-type environments. It publishes up-to-the-minute short scientific papers on the latest research results and news items. RACHIS seeks to contribute to improved barley, durum wheat, and triticale production in the region; to report results, achievements, and new ideas; and to discuss research problems. For further information, write: RACHIS.

Opportunities for Training and Post-Graduate Research at ICARDA
ICARDA has active training courses on the development and improvement of food legumes, cereals, and forages with ICARDA’s research scientists, trained instructors, and proven programs. For a complete brochure of the training opportunities at ICARDA, write: Training Coordination Unit.

Free Catalog of ICARDA Publications
Request your list of all currently available publications from the Communication, Documentation and Information Department (CODI).

ICARDA Information Brochure
ICARDA’s historical background and research objectives are outlined in English and Arabic. For your copy, write: CODI.

This checklist, compiled to bring information to the attention of the scientific community and especially to those collaborating with ICARDA, consists of references of books, reports, and journals prepared and/or edited by ICARDA scientists and published outside ICARDA as of 1973. Each reference includes within year of publication: author, primary title, pagination, place of publication and publisher, ISBN, AGRIS reference number and price. For your copy write: CODI.

Introduction to Food Legume Physiology
This comprehensive 105-page technical manual is designed for food legume scientists and their support staff. It covers several areas of food legume physiology in a practical way, with examples whenever possible. The book contains four chapters covering the following: plant structure and physiological functions; mineral nutrition; photoperiodism, vernalization, crop canopy and radiation; and growth analysis; and physiology and crop improvement. For your copy, write: Training Coordination Unit.

Screening Chickpeas for Resistance to Ascochyta Blight A Slide-tape Audio-tutorial Module
This slide-tape audio-tutorial module is the first in the food legume training series. It is designed for the use of legume trainees during the training courses at ICARDA as well as for scientists and their support staff in the various national programs. This module is also useful educational material for universities and training departments in national research systems. For your copy of this publication or package, write: Training Coordination Unit.

Checklist of Graduate Theses Prepared with Support from ICARDA 1980-1988
This checklist, compiled to bring information to the attention of the scientific community, consists of references of theses by graduate students supported by ICARDA during the period 1980-1988. Each reference is listed in a sequence determined by the calendar year in which the thesis was accepted; by the country code and name of the University; by the level D (Doctorate) or M (Master); and
by the graduate student’s name (nationality given in parentheses after the name). For your copy, write: CODI.

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This brochure is intended primarily to assist Master of Science candidates, who are enrolled at national universities within ICARDA region and selected for the Graduate Research Training Program. It explains to them the opportunity they have to conduct their thesis research work at ICARDA research sites under the supervision of international scientists. For your copy, write: Training Coordination Unit.

Checklist of Journal Articles from ICARDA 1978 - 1988
This checklist, compiled to bring information to the attention of the scientific community, consists of references of articles by ICARDA research scientists submitted to refereed scientific journals as of 1978. Each reference includes within year of publication: author, primary title, volume number, issue number, pagination, language of the article and/or summary when necessary, and AGRIS reference number. For your copy write: CODI.

ICARDA Library Catalogue of Serials Holding 1989
This catalogue contains serial titles held in ICARDA Library. It includes holdings data of 574 serials covering monographic serials published in the countries of ICARDA region, annual reports, newsletters, abstract journals, and journals. For your copy write: CODI.

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The Graduate Research Training Program (GRT) is intended primarily to assist Master of Science candidates who are enrolled at national universities within the ICARDA region. Men and women who are selected for the program will have an opportunity to conduct their thesis research work at ICARDA research sites under the co-supervision of university and center scientists. For further information on terms of award, nomination procedure, selection criteria, appointment conditions, the university's responsibilities, and the student's responsibilities, write: GRT Program, Training Coordination Unit.

TO OBTAIN PUBLICATIONS:
Address requests for publications to the specific department or service cited above, at: ICARDA, P.O. Box 5466, Aleppo, Syria.

When you contact any of the programs, departments or services cited above for your copy, please indicate that you saw the announcement in the LENS Newsletter

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التربيئة والموثقات

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لنس
نشرة علمية متخصصة بالعدس
مجلد 17 ، عدد 1 ، 1990

المركز الدولي للبحوث الزراعية في المناطق الحافة
( ايكاردا ) ، حلب ، سورية

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