EVALUATION AND SELECTION OF COLD AND DROUGHT RESISTANT LENTIL GENOTYPES FOR HIGHLANDS OF BALOCHISTAN

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ABSTRACT

Five selected lentil genotypes from ICARDA (nursery of previous year were evaluated along with some advanced lines and local checks for combining high yield with cold and drought tolerance. Experiment was conducted at Arid Zone Research Centre, Quetta, Pakistan during the winter season 2009-10. Data were recorded on parameters which play important role in selecting high yielding genotypes such as days to 50% flowering, days to 90% maturity, plant height (cm), number of pods per plant, 100 seed weight (g), yield per hectare (kg) and total dry matter (kg). Performance of the genotypes was evaluated under the prevailing natural cold (1.8 - 31.7 °C) and artificially imposed drought (135 days) stress conditions. Significant differences were observed for all the parameters except for total dry matter. Entry FLIP 2004-13L gave maximum grain yield of 1688 kg ha⁻¹, closely followed by entry ILL-8081 and Quetta local which produced 1508 and 1342 kg ha⁻¹, respectively. Lowest yield (724 kg ha⁻¹) was recorded for MPT-1. Entries FLIP 2004-13L, FLIP 2005-19L and FLIP 2004-7L which not only produced highest yield but also showed tolerance to abiotic stresses (cold and drought) and were therefore promoted in advanced yield trials for further evaluation.

Keywords: Genotypes, nursery, cold tolerance, drought tolerance, yield components.


INTRODUCTION

Lentil (Lens culinaris Medik.) locally known as “Masoor” is one of the oldest agricultural crops grown more than 8,500 years ago. Production of this winter season annual crop spread from the Near East to the Mediterranean area, Asia and Europe. It was introduced to the United States in the early 1900s. In Pakistan, lentil is the second most important pulse crop of rabi season next to chickpea (Bakhsh et al. 1991). The area under lentil in Pakistan has dropped from 65,000 hectares (in 1995-96) to 30,000 hectares (in 2008-09). Subhani et al. (2007) has reported that reduction in area is mainly because of low productivity of the lentil crop compared to the crops sown during the same growing period of the year. The crop has received little research attention to improve its yield and quality. It grows well in limited rainfall areas of the world.

Lentil is a protein/calorie crop. Protein content ranges from 22 to 35%. Lentil is an excellent supplement to cereal grain diets because of its good protein/carbohydrate content. It is used in soups, stews, casseroles and salad dishes. Sometimes they are difficult to cook because of the hard seed coats that result from excessively dry production conditions. Lentils can be used as livestock feed because of their high protein content and lack of digestive inhibitors. It is also used as a green manure crop which can provide a large amount of fixed nitrogen.

Lentils have been grown extensively in the semi-arid parts of the world, where they have slightly lower yields, but good seed quality. High humidity and excessive rainfall during the season encourages vegetative growth, which prevents good yield and can reduce seed quality. Excessive drought and/or high temperatures during the flowering and pod-filling period also reduce yields.

Geographically entire Balochistan province falls in arid to semi-arid region. Lentil is one of the important winter crops grown in many parts of the province and is cultivated on an area of 3051 hectares with the production of 1928 tons (Anonymous, 2008-09). As compared to other parts of the country, area and production for lentil crop is very low. Both area and production contribute only 8.2% and 11%, respectively (Anonymous, 2007-08). Major factors that contribute for this statistics are continuous drought and the unavailability of quality seed. Presently farmers are relying on low yielding local varieties which are susceptible to abiotic stresses like cold and drought and lack of adapting the modern production practices. Agrawal (2009) has reported that farmers can increase yield by 30-40% and even more if they combine the new varieties with improved crop management practices.
Present study was conducted to evaluate different selected genotypes with some advanced lines and local varieties under the natural cold climatic conditions of Quetta and artificial drought condition imposed to select best entry with the aim to combining high yield with cold and drought resistance.

MATERIALS AND METHODS

Twelve lentil genotypes were evaluated in this experiment. Among of them five (FLIP 2004-13L, FLIP 2005-15L, FLIP 2005-19L, FLIP 2004-7L, FLIP 2005-13L) were advanced from previous year (2008-09) nursery, received from ICARDA, four advanced lines (ILL-8081, MPT-1, MPT-1 (R), MPT-4), two local varieties (Quetta local and Kharan Local) and one commercially released variety (Shiraz-96) was used in the experiment as check. Experiment was laid out in Randomized Complete Block Design. Each entry was sown in four rows of 4 m length by keeping 30 cm row to row distance. Recommended dose of NPK fertilizer (20:50:30) kg ha⁻¹ was applied in the field. Trial was sown in the third week of October 2009 at Arid Zone Research Centre, Quetta, Pakistan. Normal agronomic practices were carried out during the growth period. In order to evaluate the performance of genotypes in stress condition, only single irrigation (35 mm) was supplied to the experiment. Total of 149.2 mm rainfall was received at different intervals during the growth period (Table 2). Data were recorded on days to 50% flowering, days to 90% maturity, plant height (cm), number of pods per plant, 100 seed weight (g), yield per hectare (kg) and total dry matter (kg). Recorded data were statistically analyzed using analysis of variance method as proposed by Steel and Torrie (1960).

### Table 2. Average data (on monthly basis) of rainfall, minimum and maximum temperature during cropping season 2009-10 at AZRC Quetta.

<table>
<thead>
<tr>
<th>Month</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>October-2009</td>
<td>14.0</td>
<td>26.9</td>
<td>0</td>
</tr>
<tr>
<td>November-2009</td>
<td>16.0</td>
<td>21.1</td>
<td>0</td>
</tr>
<tr>
<td>December-2009</td>
<td>1.8</td>
<td>14.8</td>
<td>45.4</td>
</tr>
<tr>
<td>January-2010</td>
<td>2.0</td>
<td>15.6</td>
<td>29.8</td>
</tr>
<tr>
<td>February-2010</td>
<td>4.0</td>
<td>15.8</td>
<td>45.2</td>
</tr>
<tr>
<td>March-2010</td>
<td>9.8</td>
<td>24.8</td>
<td>9.6</td>
</tr>
<tr>
<td>April-2010</td>
<td>13.5</td>
<td>29.9</td>
<td>9.0</td>
</tr>
<tr>
<td>May-2010</td>
<td>17.2</td>
<td>31.7</td>
<td>10.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>149.2 mm</strong></td>
</tr>
</tbody>
</table>

Source: AZRC Metrological Data Unit.

RESULTS AND DISCUSSION

Significant differences were observed among all genotypes for days to 50% flowering, days to 90% maturity, plant height, number of pods plant⁻¹, 100 seed weight and yield hectare⁻¹. Significant genetic variability was also reported for yield and its component by Rao and Yadav (1988). Similar findings were also reported by Hossain et al. (2008). Non significance was observed among genotypes only for total dry matter. Analyzed data of different yield components are given in Table 1.
Days to 50% flowering data ranged from 139 days for (MPT-1) to 154 days for Kharan Local and for days to 90% maturity entries FLIP 2005-15L and FLIP 2004-7L took 176 days to 194 days for Kharan Local. Plant height data ranged from 20.0 cm for MPT-1 to 29.5 cm for Kharan Local. High variations were found among all genotypes for number of pods plant\(^{-1}\) and ranged from 51 for Shiraz-96 to 106 for FLIP 2004-13L, whereas data for 100 seed weight ranged from 1.6 g for Quetta Local to 3.6 g for MPT-4. Data for yield hectare\(^{-1}\) also revealed variation for all genotypes and yield ranged from 724 kg ha\(^{-1}\) for MPT-1 to 1688 kg ha\(^{-1}\) for FLIP 2004-13L. Similarly total dry matter data ranged from 3403 kg ha\(^{-1}\) for FLIP 2005-15L to 5555 kg ha\(^{-1}\) for MPT-4.

Highest yield (1688 kg ha\(^{-1}\)) and maximum number of pods plant\(^{-1}\) (106) were recorded for FLIP 2004-13L. Rajput and Sarwar (1989) reported similar findings and suggested that selection criteria based on number of pods plant\(^{-1}\) should be given due emphasis for exploiting maximum yield potential in lentil. Lowest yield of 724 kg ha\(^{-1}\) was recorded for MPT-1. Similarly same entry gave lowest plant height (20.0 cm) and second lowest total dry matter (3611 kg ha\(^{-1}\)) yield as compared to other genotypes. This indicates that plant height and total dry matter has implications on yield. These parameters play important role especially in selecting high yielding genotypes for abiotic stresses, whereas parameters like days to flowering, days to maturity and seed weight seems to have less importance in the selection criteria.

**CONCLUSION AND RECOMMENDATIONS**

Among all entries evaluated in the experiment, entry FLIP 2004-13L gave maximum grain yield of 1688 kg ha\(^{-1}\), closely followed by entry ILL-8081 and Quetta local which produced 1508 and 1342 kg ha\(^{-1}\) respectively. Based on results, entry FLIP 2004-13L which not only produced highest yield but also showed tolerance to abiotic stresses (cold and drought) was promoted in advanced yield trials for further study.

**REFERENCES**


