Food Legume Improvement and Development

Proceedings of a workshop held at The University of Aleppo, Syria, 2-7 May 1978

Geoffrey C. Hawtin and George J. Chancellor, Editors

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Food Legume Improvement in Tunisia

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Agriculture is considered to be the main source of the national economy of Tunisia. Most of the cultivated land is restricted to the north of the country and farming is almost entirely under rainfed conditions. In this region, with mild winters and hot summers, the annual rainfall varies from 400 to 800 mm. The bulk of this precipitation normally occurs in the late fall, winter, and early spring, but its amount, intensity, and distribution fluctuates widely between years. This interseasonal variability is a feature of most of the climatic factors within the Tunisian environment. Great variations in the total rainfall, the onset of the growing season and its duration, the rainfall distribution during the season, the occurrence of frost and hail, and the timing of stress periods make predictions based on seasonal averages of environmental conditions very misleading and dangerous. Data derived and observations made in any one season must thus be considered against this background of variability when making predictions concerning the future.

The soils in northern Tunisia are very variable: black and grey-brown rendzinas are common, but good deep soils of alluvial origin are also found throughout the region. Grain legumes are generally only grown in areas with an annual rainfall greater than 350 mm and on average occupy 100,000 ha of land, which is 6% of the cereal production area. The annual acreage of grain legumes, however, varies considerably (see Table 1), being dependent on the amount and distribution of the rainfall over the whole season. Average yields of grain legume crops are low, about 800 kg/ha for broad beans, 650 kg/ha for lentils, 600 kg/ha for dry peas, and 850 kg/ha for chick-peas (Table 1), and could easily be doubled or tripled with adequate fertilization and other practices. However, farmers are wary of using fertilizers, as previous experience has given very poor returns, probably due to the use of varieties with low yield potentials, late maturity, and disease susceptibility.

Utilization and Marketing

Most of the grain legumes are consumed as dry seed by the population, although a small amount is also used for animal feed. Although Tunisia exports approximately 11,000 tonnes of broad beans and 4600 tonnes of chick-peas per year, the substantial difference between production and domestic consumption of dry beans and peas necessitates the annual importation of about 2600 and 1350 tonnes of these crops, respectively.

Although the average price of grain legumes has increased rapidly over the past 2 years as a result of lower average yields, the prices paid to farmers remain very unstable due to low quality and irregular production. This instability results from factors that include the variable climate, the poor varieties, and the losses from disease and pest attacks, which cause low and variable yields; and the lack of on-farm storage facilities, which means that the farmers must sell their produce soon after harvest in a glutted market and at a consequently low price.
TABLE I. Area (ha), production (metric tonnes), and average yield (kg/ha) of dry legumes in Tunisia for the period 1971–77.

<table>
<thead>
<tr>
<th>Year</th>
<th>Broad beans</th>
<th>Lentils</th>
<th>Dry peas</th>
<th>Dry beans</th>
<th>Chick-peas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>37507</td>
<td>22504</td>
<td>600</td>
<td>4567</td>
<td>2284</td>
</tr>
<tr>
<td>1972</td>
<td>30000</td>
<td>18000</td>
<td>600</td>
<td>5085</td>
<td>3000</td>
</tr>
<tr>
<td>1973</td>
<td>53571</td>
<td>43515</td>
<td>812</td>
<td>5085</td>
<td>4248</td>
</tr>
<tr>
<td>1974</td>
<td>57847</td>
<td>54105</td>
<td>940</td>
<td>3372</td>
<td>3562</td>
</tr>
<tr>
<td>1975</td>
<td>61177</td>
<td>66476</td>
<td>1090</td>
<td>628</td>
<td>436</td>
</tr>
<tr>
<td>1976</td>
<td>58500</td>
<td>24170</td>
<td>423</td>
<td>1400</td>
<td>730</td>
</tr>
</tbody>
</table>
Production Practices

Cultivation generally follows a 2- or 3-year rotation scheme, the 2-year system involving a legume followed by a cereal, and the 3-year rotation a forage–legume–wheat pattern. Both rotations are common throughout the arable areas and give good control over weeds in the cereal crops. However, the three-course system is the most economic and farmers are increasingly favouring it over the more simple traditional two-course rotation.

Grain legumes are always grown as rainfed crops. Broad beans are planted from mid-October to late November and harvested from late May onward; lentils and peas are planted during the period mid-November to late December and harvested in mid- to late June; and chick-peas and dry beans have the shortest growing season from planting in early March to mid-April to harvesting from the end of July. Production practices are mechanized in some regions of the country, but in many areas sowing, weed control, and harvesting are all carried out by hand. Although still well below the optimum, fertilizer use on legumes in Tunisia has been steadily increasing in recent years. Currently, phosphate is the only fertilizer routinely applied (at between 130 and 180 kg/ha), as the soils do not lack potash, and nitrogen is not normally required by legume crops especially under conditions of reasonable soil fertility. Together with moisture stress, weeds are perhaps the most important constraint to pulse production in Tunisia, and the elimination of these competitors will do much to increase yields and hence total production in the country. Herbicides have been used for weed control for several years, but usage has been confined to only 10% of the legume area, while over 50% is still hand weeded. At present, Treflan is used to control grass weeds, and other compounds such as Gesatop 50 for dicotyledons, but much work still needs to be done on the phytotoxicity of such chemicals to the current or succeeding crops in the rotation, to prevent adverse effects from their more widespread usage.

Insects

The two most important insect pests are the larvae of *Hypera crinita* (leaf weevils), which are very common in broad beans, and aphids, which affect all the pulse crops to a varying degree depending upon climatic conditions during the growing season, higher temperatures tending to result in earlier and heavier infestations and hence more crop damage. At present, control of *Hypera* is achieved through spraying with Phosaline (Azophene), and of aphids by Primor and Dimethoate.

Diseases

The main disease problems on legume crops include chocolate spot (*Botrytis* sp.), blight (*Ascochyta* sp.), wilt (*Fusarium* sp.), and rust (*Uromyces* sp.). Crop losses vary with climatic conditions and may be considerable in some seasons. Benomyl (Benlate) is currently used to control infections of *Botrytis*, whereas the other diseases are usually minimized through the modification of cultural techniques.

Other Pests

*Orobanche*, the parasitic broomrape, can be a problem in some areas and, although there are no sharply defined control measures, infestations may be minimized by cultural and rotational techniques.

Most grain legume varieties grown in Tunisia are local cultivars traditionally adapted to survive the unfavourable growing conditions characteristic of rainfed culture in the dry lands. However, these varieties have low yield potentials and very little resistance to pests and diseases and, as a result, regularly produce low and very variable yields. The identification and introduction of improved grain legume varieties with disease and pest resistance and adaptability, combined with high yield potential, stability, and adequate grain quality are thus essential prerequisites to the expansion of legume production in Tunisia. Lack of sufficient mechanization in these crops is a further problem, and considerable work remains to be done in this field to popularize the pulse crops with the farming community.
Research Activities

Legume research and extension work is mainly carried out by the Technical Division of the Office of Cereals (ex-Wheat Project) in cooperation with the National Agronomic Institute of Tunisia (INAT) and the National Agronomic Research Institute of Tunisia (INRAT).

Research is predominantly geared to the development and introduction of high-yielding varieties and the screening of varieties for disease and lodging resistance, drought tolerance, and adequate grain quality; the improvement of local varieties through selection and crossing with high-yielding cultivars; and the optimization of cultural practices, including fertilizer applications (especially phosphorus), rates and dates of sowing, weed and insect control measures, tillage practices, and rotational systems. The varietal testing work involves a number of different nurseries of broad beans and chick-peas grown at two locations, namely Bourbia, with an annual precipitation of 320–400 mm, and Mateur, where the rainfall is between 500 and 600 mm per year.

Extension work, on the other hand, involves encouraging the farming community to adopt improved technologies and practices through information dissemination by the mass media; conducting farmer’s field demonstrations; organizing meetings and field days to illustrate the results of good technical practices; and helping to ensure the availability and timely distribution of adequate supplies of seed, fertilizer, and herbicides to the farmers.

However, both research and extension activities are severely hampered by the scarcity of physical resources and trained manpower. As a result, the food legume crops, which are so important in terms of their contributions to the protein nutrition of the population and to soil fertility, have been seriously neglected in terms of practical research related to varietal and cultural improvement. It is becoming increasingly urgent that we focus much more research attention and expertise on improving the two major legume crops of specific importance to the country, namely broad beans and chick-peas, to allow the expansion of production justified by their contributions to both agriculture and nutrition. This can only be done by establishing increasing linkages and cooperative activities with other national and international research efforts working in the region, especially in the fields of training and information exchange, as well as the more widely used facilities of the regional nursery program. At the same time, it is vital that increasing linkages be established between the research and the extension activities of the national improvement efforts, so that the new technologies and practices developed by research, together with cooperating research programs, can be translated into the real improvements in production that result from farmers actually implementing these innovations in the correct way.