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Production Aspects and Prospects of Chickpea

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Abstract. *Chickpea is a self-pollinating pulse crop that has been cultivated for more than 7000 years. Its crop history and uses are discussed. Specific agronomic and crop protection requirements, together with crop improvement aspects are briefly described. The total area under chickpea and total production have shown little change over the last 20 years. Chickpea is a cool-season sub-tropical legume often grown on residual moisture. This imposes certain restrictions on its agroclimatic adaptation. Production can expand considerably if certain conditions are met.*

Introduction

This paper aims to give a brief summary of the main aspects of chickpea production, and to describe the crop's prospects. It presents general information and not detailed research results. The review is based on the following references: van der Maesen 1972; Russell 1985; Summerfield and Roberts 1985; Saxena and Singh 1987; Summerfield 1988; these are not mentioned again in the text. Three special uses of chickpea are highlighted which would otherwise not receive much attention.

Chickpea is a crop with an ancient history, and has been grown in West Asia and the Indian sub-continent for many millennia. The oldest chickpea finds are from excavations at Haçilar near Burdur in Turkey, and they were estimated by the carbon-dating method to date from about 5450 B.C. The first written record is in Homer's Iliad of around 900 B.C., where the Greek hero Menelaos is being shot at with arrows that bounce off his breastplate like "chickpeas thrown up by the winnower". It is believed that the Hellenes took the crop westwards from Turkey to the Mediterranean region, and eastwards to West Asia and the Indian subcontinent. There is no mention of chickpea in the Bible, though lentil features in the book of Genesis. The Greeks, Phoenicians, and Romans helped to spread chickpea cultivation through the Mediterranean countries, including northern Africa; more recently, Asian immigrants acquainted several eastern African countries with the crop during the 19th Century. Ethiopia, long a center of trade, has a much longer history of chickpea use. The New World saw the crop introduced by Spaniards and Portuguese merchants, while Asian settlers added new varieties later, for instance in the West Indies. A spectacular expansion of chickpea production took place in Australia, where from 1985 to 1987 the area increased from 8000 to 71000 ha, according to the Food and Agriculture

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Table 1. Chickpea area, production, and productivity in the world from 1961-65 to 1983-87.

Year	Area ('000 ha)	Production ('000 mt)	Yield (kg ha^{-1})
1961-65	11863	7042	594
1969-71	9933	6508	655
1974-76	10144	6245	616
1979-81	9530	5971	624
1983-87	9888	6908	698

Source : FAO Production Yearbook 1961-1987 (FAO 1962-1988).

Organization (FAO) Production Yearbook 1987. The present total world area under chickpea is roughly 10 million ha.

Table 1 shows that area, production and yield of chickpea have not changed much over the past 20 years. It is different for a crop like soybean (Fehr 1987), where commercial interest plays an important role. However, as will be discussed, changes are anticipated in the future.

Uses of Chickpea

There is a wide variety of chickpea usage, including those that are rather unusual. The chickpea plant produces acid exudates, which are occasionally used for medicinal and other purposes. One method of capturing the acid is by spreading cloth over the plants early in the morning, and wringing out the liquid it absorbs. This liquid is used to make a popular and refreshing drink, loved by children. When chickpea seeds are rather soft and still immature, their taste is characteristic, slightly sweetish, and pleasing to many consumers. Such seeds are eaten green, e.g., in India, Ethiopia, and Turkey, where it is not uncommon to see young and old walk or cycle the streets with small bundles of plants, from which the fresh seeds are eaten. In the USA and western Europe chickpea was largely unknown until rather recently, when it was probably introduced through health-food stores, and then became increasingly popular. Chickpeas soaked, boiled, and prepared with a variety of ingredients such as salt, pepper, and lemon, feature prominently in the menus of salad bars.

Types of Chickpea

Chickpea, like groundnut and unlike pigeonpea, is a self-pollinating crop with a negligible percentage of outcrossing (van Rheenen, in press). This is important for its breeding methodology. Most breeders follow the pedigree method, the bulk population breeding method, or a combination of the two, with possible modifications to suit local conditions. The backcross method is also used to transfer desirable characters from a donor parent into a popular cultivar. Although the advantages of population improvement techniques and

recurrent selection schemes have been stressed (Gallais 1987; Jensen 1978), they are not widely used for chickpea or soybean (Fehr 1987).

We distinguish two different chickpea types; kabuli and desi. Kabulis have white flowers, no anthocyanin in the aerial plant parts, and relatively large seeds with a thin testa. Desis usually have purple flowers, anthocyanin pigmentation in the stem and leaves, and relatively small, wrinkled seeds with thick seed coats. In growth habit chickpea plants can be upright, semi-upright, and even spreading, like creepers. They may be more than a meter tall, but can also be as short as 10 cm.

Appropriate agronomic practices are important if optimum yields are to be obtained. Recommended agronomic packages vary from place to place, e.g., at ICRISAT Center we sow on broadbeds or ridges, keeping the row distance at 30 cm and spacing the seeds 10 cm apart in the row. But the recommended practice in the state of Maharashtra, India, is to drill seed on the flat at a rate of 65 kg ha^{-1}. No fertilizer needs to be applied on the black Vertisols of ICRISAT Center, but in Maharashtra, 100 kg diammonium phosphate (DAP) ha^{-1} is recommended.

Irrigation can double the yield in peninsular India but at higher latitudes, for instance in the state of Haryana, India, its effect is less favorable.

Stresses that affect Chickpea

The chickpea crop often faces biotic or abiotic stresses which differ from zone to zone (Table 2).

Abiotic Stresses

Chickpea is often referred to as a cool-season subtropical legume, but much of the crop is grown in the tropics, where at times during the growth cycle unfavorably high temperatures are encountered. This can be a major factor in yield reduction (Baldev 1987, personal communication). As the crop is often grown on residual moisture, the high temperatures aggravate the drought stress.

Biotic Stresses

More than 50 pathogens have been reported to affect chickpea, but only a few devastate the crop. The most important are ascochyta blight, fusarium wilt, dry root rot, collar rot, stunt, botrytis gray mold, and black root rot.

These stress factors are very important to breeders as they affect the yield stability of the crop; by breeding for stress resistance, a more reliable crop performance can be expected. Except for collar rot, resistance sources have been identified for all the diseases mentioned. However, for botrytis gray mold and ascochyta blight, the resistance is not strong, and a severe epidemic can cause considerable damage. The inheritance of resistance to fusarium wilt has been studied in detail. Three genes have been identified that can, in any homozygous combination of two, convey resistance to a plant. Genetic studies on the resistance to ascochyta blight have attributed this trait also to a small number of genes.

Table 2. Desirable characters for chickpeas in different zones of the world and their priorities.

	Zones (°latitude)				
Desirable characters	A 0-20	B 20-25	C 25-30	D 30-45	
Stable, high yield	+	+	+	+	
Good seed quality	+	+	+	+	
Resistance to stresses					
Biotic					
Fusarium wilt	2-1	2-1	2-1	3	
Ascochyta blight	-	-	6[1]	1	
Botrytis gray mold	-	5	3	-	
Root rots	3	3	5	4	
Stunt	4	4	4	5	
Helicoverpa	1-2	1-2	1-2	6	
Leaf miner	-	-	-	2	
Nematodes	?	?	??	??	
Abiotic				Spring	Winter
Drought	1	1	1	1	-
Salinity	3	3	2	-	-
Excessive moisture	-	4	5	-	2
High temp.	2	2	4	2	-
Low temp.	-	-	3	-	1

1 : in case of epidemics, the crop damage is severe.
+ : required.
- : not required.
? = uncertain.

There is only one report on the inheritance of dry root rot resistance, and the data presented support the hypothesis that it is monogenic (Ananda Rao and Haware 1987). For the other major diseases, genetic data are lacking.

Future Prospects

It is likely that the production of chickpea will considerably expand in future. There are two main factors on which this depends; one is productivity, both in respect of stability and potential yield level, and the other is demand. Yield stability depends on the efforts made to remove or alleviate the effects of stress conditions in which the crop improvement disciplines of agronomy, breeding, entomology, pathology, physiology, and biotechnology are all involved. In this respect we may be optimistic, as we may also be about yield levels, which need continued attention from breeders and physiologists.

On the demand side, we observe that the large Asian market is not easy to saturate. The European and American markets can considerably expand as the consumption of chickpea—already a popular ingredient of salads—is likely to increase. The demand for the

very many snacks that can be made from chickpea will increase if these are popularized. And finally, novel uses of chickpea, be it in the processed food industry or in new recipes, could enhance the prospects of this lovable legume.

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