

REGIONAL ADAPTATION STUDIES WITH CHICKPEA

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Chickpea (**Cicer** arietinum) is a drought tolerant pulse crop adapted to the Brown (on fallow) and Dark Brown (on stubble) soil zones of Saskatchewan. Its drought tolerance is a function of its deep, extensive root system, often extending more than two meters deep. The two major types are the kabuli or garbonzo bean and the desi. However, the kabuli and the desi chickpea differ markedly in their management practices and in their marketing and utilization.

The kabuli chickpea produces a large, irregularly-shaped seed with a delicate white (zero tannin) seed coat. The seed is so large it cannot be planted with most seeders except air seeders and even then the thin seed coat may not prevent seed damage, especially **if the** seed moisture level is below about 13%. The thin seed coat facilitates excessively rapid water uptake (imbibition) when the seed is planted, resulting in membrane rupture and forcible extrusion of soluble nutrients into the soil. Seed rotting fungi, especially **Pythium**, multiply rapidly and infect the seed, resulting in seed rot and greatly reduced emergence, especially in cold soils. The incidence of seed rotting can be reduced by treating the seed with metalaxyl and delaying seeding until the soil temperature at seeding depth reaches 10°C.

The kabuli chickpea is a premium priced product and, **if** the seed is large enough (>52 g/100 seeds), it is canned for use as garbonzo beans in salad bars, three-bean salad and similar uses. Quality is largely a function of its large seed size and bright coloured seed.

The desi chickpea produces a small to medium-sized, irregularly-shaped seed with a thick, hard, coloured seed coat. The thick seed coat reduces the rate of imbibition, which in combination with the water soluble, fungistatic tannin precursors in the seed coat, results in a low rate of fungal invasion and little or no seed rotting. As a result, desi chickpea is very tolerant of cold soils and can be (even should be) seeded early (as soon as the soil temperature at seeding depth reaches 4 to 5°C). The chickpea seedling will tolerate temperatures of -2 to -3°C for a short period and, if the shoot is frozen by lower temperatures, regrowth will occur from the uppermost of the two scale nodes located at or below the soil surface. Thus, desi chickpea is much easier to grow than the kabuli chickpea. However, it also commands a lower price. The desi chickpea is usually decorticated (dehulled) and split. Then it is used as split chickpea or ground into flour for special ethnic food uses. The high oil concentration in chickpea flour (5 to 8%) means that it must be freshly ground or stored in air tight packages at low temperature to prevent the development of rancidity.

India is the major chickpea producer, but most of these chickpeas are consumed domestically. Australia is the major chickpea (mostly desi) exporter. However, the severe drought in Australia in 1993 and 1994 resulted in a world-wide shortage of chickpeas and record prices. These high prices stimulated interest in chickpea production in Saskatchewan and about 300 acres (120 ha) were grown in 1994, about 4000 acres (1600 ha) in 1995 and indications are over 10,000 acres (4000 ha) will be grown in 1996. Unfortunately, Australia harvested a large crop in December 1995 and the price has dropped markedly. Even at that, acreage in Saskatchewan is projected to increase to 50,000 acres (20,000 ha) by the year 2000. This increased production will result in a lower price which will expand the demand for Canadian chickpeas domestically and overseas. However, several years will be required for this to occur and excess product will be available in some of the early years.

Variety Adaptation

This increased production of chickpea in Saskatchewan and the introduction of a few varieties has stimulated interest in determining the best areas for chickpea production and which varieties are best adapted. The first major acreage of chickpea in Saskatchewan was devoted to Cheston desi chickpea and UC27 kabuli chickpea. Both of these varieties are susceptible to ascochyta blight, caused by ***Ascochyta rabiei***, a seed- and stubble-borne fungal disease specific to chickpeas. This is a very devastating disease in that a heavily inoculated plant of a susceptible variety will die in about three weeks. The only effective control is by using resistant varieties and growing them in a relatively dry area -- the Brown and Dark Brown soil zones of Saskatchewan.

In 1995 an ascochyta susceptible desi chickpea CDC Marengo was released by the Crop Development Centre. Also, in 1995 small lots of two ascochyta resistant kabuli chickpeas, Sanford and Dwelley, were introduced from the USDA chickpea breeding program at Washington State University. In addition, the ascochyta resistant desi chickpea Myles was developed at Washington State University and small lots will likely be shipped into Saskatchewan in 1996. Also, a short green cotyledon specialty type desi chickpea was introduced, making a total of seven different chickpea cultivars. Data were urgently needed on their adaptation and performance throughout the Brown and Dark Brown soil zones and so a grant was obtained from Canada-Saskatchewan Green Plan Fund for a 2-year study starting in 1995. The seven chickpea varieties were grown at 10 locations (Table 1) in Saskatchewan with the assistance and cooperation of various Extension Agrolologists and Agriculture and Agri-Food Canada researchers. These seven varieties were seeded in 4-row plots with rows 30 cm apart and 4 m long with four replications at each site.

Results

As a group the desi chickpeas outyielded the kabuli chickpeas and CDC Marengo and Cheston (brown desi) were the highest yielding varieties (Table 1). The ascochyta resistant desi chickpea variety Myles yielded nearly as much as CDC Marengo and

Cheston. Yield was reasonably high at all locations except Kindersley. The lower yields of the kabuli chickpeas is due to their late maturity (Table 2). Thus, chickpeas are adapted to the Brown and Dark Brown soil zones of Saskatchewan except that they are a bit late maturing. Dwelley kabuil was the latest maturing variety and the lowest yielding. UC27 kabuli was higher yielding and earlier than Sanford, but it is ascochyta susceptible. Dwelley and UC27 had larger seed size than Sanford, while Sanford was the tallest variety.

Future Outlook

Some advanced selections of ascochyta resistant kabuli chickpeas were evaluated at three locations in 1995. Results of the three best lines are summarized in Table 3. All three are higher yielding and earlier maturing than Sanford. Eight of the more promising lines are being increased in Arizona over the 1995-96 winter and will be evaluated further in 1996 with the best one released in 1997. The ascochyta resistant desi chickpeas are only one year behind and should be ready for release in 1998.

Summary

Chickpeas are well adapted to the Brown and Dark Brown soil zones of Saskatchewan., Ascochyta resistance is required before large scale production occurs. Ascochyta resistant varieties with earlier maturity will be available in 1997 (kabuli) and 1998 (desi). Projected acreages for Saskatchewan are 50,000 acres by 2000 and 150,000 acres by 2005. Markets may be limiting the first few years, but world demand is increasing rapidly.

Table 1. Yield of chickpea varieties in the Regional Chickpea Trials in Saskatchewan in 1995.

Type/Variety	Assiniboia	Battleford	Kindersley	Shaunavon	Swift Current	Weyburn	Riverhurst	Rosetown	Saskatoon	Scott	Mean
----- kg/ha -----											
Desi											
CDC Marengo	2422	1519	757	3107	1434	1365	1508	2730	3054	1921	1982 (100)*
Cheston	2487	1634	496	3049	1832	1571	1458	2530	2823	1917	1980 (100)
Green	1444	898	324	2527	600	961	1257	2610	2431	1627	1468 (74)
Myles	1455	2358	526	2595	1659	1590	1447	2326	2359	2262	1859 (94)
Kabuli											
UC27	1411	1752	359	2471	988	1313	1215	2585	2728	1977	1680 (85)
Sanford	1437	2511	428	2171	891	1013	1039	2146	2433	1865	1593 (80)
Dwelley	1536	2036	463	2033	1121	887	1412	1763	2524	1537	1532 (77)
Standard error	153	268	95	162	189	128	76	121	105	113	

* Yield as percentage of CDC Marengo.

Table 2. Agronomic data from entries in the Regional Chickpea Trials in the Brown and Dark Brown soil zones of Saskatchewan in 1995.

Type/variety	Yield (kg/ha)	100 seed wt (g)	Days to flower	Days to mature	Height (cm)
	(10)*	(10)	(5)	(6)	
Desi					
CDC Marengo	1982	288	48	111	39
Cheston	1980	173	49	108	34
Green	1468	173	49	109	28
Myles	1859	192	48	112	41
Kabuli					
UC27	1680	477	48	111	40
Sanford	1593	407	56	118	51
Dwelley	1532	472	56	119	47

* Number of station years in parenthesis.

Table 3. Agronomic performance of advanced selections of ascochyta resistant Kabuli chickpeas averaged over three sites in Saskatchewan in 1995.

Entry	Yield (kg/ha)	Seed wet (g/100 seeds)	Days to maturity
92018-24	3192 (131)*	31	111
92037-48	3 170 (130)	41	109
92066-25	2909 (119)	45	112
Sanford	2435 (100)	44	118

* Percent of Sanford in parenthesis.