Dry Beans and Chickpeas - What's the Next Step?

A. Vandenberg and A.E. Slinkard
Crop Development Centre, University of Saskatchewan
5 1 Campus Drive, Saskatoon S7N 5A8

Over the past 20 years, the production and marketing of pulses became a major agricultural industry in western Canada. Saskatchewan dominates the lentil industry, produces a large part of the crop, and is now on the verge of new developments in the dry bean and chickpea sectors. These two new pieces in the pulse crop development puzzle are falling into place after many years of research and development efforts by farmers, traders, and professional agronomists in the private and public sectors - crop scientists, soil scientists, plant pathologists, weed scientists, extension specialists, and agricultural engineers. In 1996, the area of dry bean production expanded to almost 2500 ha in Saskatchewan. Most of this area was irrigated pinto bean production in the Lake Diefenbaker area, but small pockets of commercial and seed production on dryland began to develop. Expansion of dry bean should continue in 1997. For the chickpea crop, 1996 was the pivotal year for demonstrating to the emerging grower base the true value of ascochyta resistance. The chickpea production area in 1996 was about 4000 ha, and a significant expansion will occur in 1997 using only ascochyta resistant varieties of both desi and kabuli type.

In 1996 and 1997, regional performance trials for dry bean and chickpea were grown at numerous locations across Saskatchewan. The trials were located so that the various production regions available in Saskatchewan were sampled to assess productivity and risk. The results of these trials were made available in publications like the Varieties of Grain Crops 1997, and the Pulse Production Manual published by the Saskatchewan Pulse Growers. In general terms, dry bean productivity was highest under irrigation and in the Thin Black soil zone where August rainfall contributes significantly to yield potential. The northern half of the Dark Brown soil zone also was productive. Outside these areas, dry bean production becomes limited by lack of late season moisture to the south, and by the cool, short growing season to the north. The results of the chickpea trials in general showed that productivity was high in the Dark Brown soil zone (with some risk of quality loss through late maturity if late season moisture is available), and that quality was excellent in the Brown soil zone. Chickpea quality was very poor at Thin Black sites and on heavy clays in parts of the Dark Brown soils where seasonal precipitation was above average. So, we more or less know where to grow these crops. This leads to the question:
What's the next step, or more realistically, what strategy will now be followed in the development of these crops for Saskatchewan?

An important component of the strategy will be maintaining the flow of improved varieties, One of the major barriers to the successful introduction of these crops in previous attempts to establish them (1970s and 1980s) was poor adaptation to Saskatchewan, and the problem still exists. Over the next several years, the Crop Development Centre (CDC) and other plant breeding programs will focus on release varieties of dry bean and chickpea with earlier maturity, improved quality, higher levels of disease resistance, and better pod clearance in the case of dry beans. Continued improvement in these key features is the base for development of this sector of the pulse industry. Over the next five years we will also start to contemplate using some of the tools in the biotechnology kit for genetic improvement. How far this will go depends on how

much time and effort is spent in this area. In general, the economic return for using the more expensive technologies on small acreage crops is low, so the rate of progress tends to be slower. This is especially so in the case of some of the annual legumes which are difficult to manipulate in tissue culture systems.

Another part of the emerging development strategy is a plan to overcome some of the limitations posed by the fact that both dry bean and chickpea are large seeded pulses. Rapid seed multiplication of new varieties is a problem because of the low seed increase ratio. For example, compare the seed multiplication scenario for a lentil variety the size of Eston (35 g/l 000 seeds) with that of a large kabuli chickpea (500 g/1000 seeds). Assuming both crops yield about 1000 kg/ha, release of 500 kg of Eston lentil would generate sufficient certified seed after three years to plant more than 200,000 ha (more than the world wide market demand for this type of lentil). For the chickpea variety, release of 500 kg of breeder seed would generate seed for slightly more than 1000 ha in the same time frame. Another way of looking at it is that it would take 2 extra years to produce the same volume of exports compared to Eston lentil. This is a significant biological barrier to rapid introduction of new varieties of dry bean and chickpea.

Strategies for overcoming this seed increase barrier include release of larger quantities of breeder seed or release of a greater number of varieties, or both. A flexible plan for overcoming this barrier has been developed in collaboration with the Saskatchewan Pulse Growers (SPG). The CDC will use winter nurseries and contract in-season increases to produce large quantities of breeder seed. This breeder seed is available to any qualified Select seed grower in Saskatchewan. For example, if 50 Select seed growers request a plot of a new pinto bean variety, the seed will be grown in 50 separate fields across Saskatchewan. Acceptable performance will result in the variety being grown for a second year. In this way, the variety will adapt itself to the microenvironment in parts of Saskatchewan suitable for pinto bean production. An important aspect to this strategy is that the SPGA will support the breeding program with check off funds on production of pulses. In exchange, the CDC will not collect royalties on the pedigreed seed. Demand for new varieties will be forecast by effective communication with growers. In theory, more pedigreed seed should be produced more quickly, allowing more rapid introduction of new varieties, and greater use of certified seed. Both outcomes should improve the competitiveness of the pulse industry.

Four pinto bean varieties were released by the CDC in the past two years. Pinto bean 92121 (proposed name is CDC Camino) was released in 1996. This variety has good pod clearance but may be too late-maturing for most of Saskatchewan. Breeder seed was increased in Arizona and Washington in 1996 for release to Select growers in the spring of 1997. Great northern bean 92070 (proposed name CDC Nordic) was handled similarly. It is as early as Othello and the seed is large and attractive to buyers. In 1997, three more pinto varieties and one additional great northern were released, All four will be increased in 1997 in the northern hemisphere and options will left open for further increase next winter in the south

One of the critical needs for both the chickpea and dry bean crops is development of sound and reliable agronomic packages that are economically viable. Some information will be generated by seed growers, but replicated scientific experimentation will also make a significant impact on the

development of both crops. For chickpea production, the need is greatest for weed control strategies, and for methods to reduce seeding costs and improve stand establishment. For the dry bean crop, the major agronomic challenges are developing better seeding and harvesting systems for direct seeding applications over a wide range of soil and stubble types, and dealing with seed borne bacterial disease and white mold. The research and development effort on agronomy made possible by the Agri-Food Innovation Fund (AFIF) will have a major impact on the future of the dry bean and chickpea crops. A research network, or hub and spoke system, was established in 1997 with pulse industry input. The goal is to focus on pulse agronomy, genetics, and pathology at seven locations around Saskatchewan to help shorten the learning curve for farmers and processors with interests in these crops. This will assist in rapid introduction of new varieties and new agronomic technology.

The dry bean industry will continue to expand in Saskatchewan. Expansion of the potato industry in the Lake Diefenbaker area will create opportunities for row crop beans in irrigated crop rotations. On dryland, the introduction of new harvesting technology like the new lifter system commercialized by Keho Alta Products of Barons, Alberta, will help expand the production base. This development fits well with the release of earlier bean varieties with improved pod clearance. These developments, combined with the decline in dry bean production in some of the traditional production regions in North America, lead us to conclude that by 2005, Saskatchewan will be producing a minimum of 20,000 hectares of dry bean annually. Marketing of dry beans world wide is similar to the marketing of lentil. If a given production region can produce good quality product at a reasonable price, buyers will respond. This is the reason that North Dakota dry bean industry expanded from no production to 250,000 ha annually between 1970 and 1990.

The chickpea industry will also expand. Over the next five years, production should climb to about 30,000 ha annual production. This assumes, of course, that the ascochyta blight fungus, does not overcome the resistance incorporated into current and near future varieties. Expansion of chickpea could occur in several ways. If genetic improvements result in the development of kabuli varieties that produce seed in the 500-600 g/1000 range, our market share will increase because of our natural advantages in productivity and quality. An even greater expansion of chickpea production might be possible if we can demonstrate that chickpea is an acceptable feed grain. It is possible to develop early maturing, small-seeded kabuli types that could compete with feed pea production in areas south and west of Saskatoon , especially if weed control options are developed. Lower seed costs and ease of harvesting (no lodging) make this crop an attractive alternative to feed pea if weeds can be controlled and the much larger feed market is developed.

Another strategy in place for development of both crops is an expansion in crop quality research. Both dry bean and chickpea are staple items in the North American pulse canning industry. Dr. Bob Tyler in the Department of Applied Microbiology and Food Science at the University of Saskatchewan will be using AFIF support to develop canning quality protocols and profiles for the expanded breeding effort in both crops. Development of a local quality support team will be valuable to future efforts at establishing a local canning industry.

So what's the next step for the dry bean and chickpea sectors? Full speed ahead in all directions!!