

8/Chickpea[?]



Chickpea QuickTips



Seeding Rate	Target 4 plants/ft ² (44 plants/m ²).
Seeding Depth	2 to 3 inches (5 to 7.5 cm).
Seeding Date	Late April to early May for desi (5°C at 2 inches or 5 cm). Early May for kabuli (10°C at 2 inches or 5 cm).
Recommended Varieties	Kabuli Several available, use ascochyta resistant. Desi Myles, CDC Desiray.
Best Performance	On cereal stubble in the Brown and Dark Brown soils zones.
Rolling	Generally not necessary.
Registered Herbicides & Registered Fungicides	Refer to Table 5.6 (Weed Control) and the Saskatchewan Agriculture and Food Guide to Crop Protection.
Rotational Frequency of Chickpea Production For Disease Control	4 years for ascochyta.
Swathing	Only late in the season to hasten dry down.
Direct Harvesting	18% moisture in vines, pods, and seeds.
Storage Moisture	15%

8/Chickpea Production

Chickpea Production Contents

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Chickpea

Introduction

Chickpea is native to the Middle East and has been grown traditionally throughout the semi-arid regions of India and the Mediterranean. Today, chickpea is the third most important pulse crop (after dry bean and pea) and makes up 20% of the world pulse production. The traded volume is similar to lentil. Major producers of chickpea include India, Pakistan, and Mexico. Turkey, Mexico, Iran, Australia and Canada are the main exporters. Mediterranean, South Asian and South American countries are the main importers. North America has a small domestic market for chickpea and chickpea products.

Chickpea is used exclusively as food in many countries, though it is used as livestock feed in Mexico. The large, white-seeded types, known as kabuli chickpea or garbanzo bean, is a popular salad item. Traditional uses include boiling, roasting, canning or processing into hummus (a traditional dish in the Middle East.) The small, dark-seeded type, known as desi chickpea, is used as split chickpea in dhal or ground into flour. The seeds have a high oil content (> 5%) so chickpea flour goes rancid if stored without refrigeration for more than a few months.

Chickpea has a higher yield potential than lentil in the Brown soil zone, primarily due to its heat and drought tolerance.

The nutritional composition of kabuli and desi chickpea seed, compared to other feed sources, is shown in Table 8.1. Analysis indicates that the potential feeding value of chickpea is high.

Plant Characteristics

Kabuli chickpea has large, rounded, cream to white seeds with a thin, white (zero tannin) seed

Table 8.1 Nutritional composition of chickpea compared to other common feeds (90% dry matter basis).

Nutrient	Chickpea		Barley grain	Field pea	Soybean meal	Wheat grain
	Kabuli	Desi				
Crude protein (N x 6.25)%	20.9	21.2	11 - 25	22.5	47.0	13.3
Crude fibre (%)	3.35	9.70	5.00	5.50	3.40	2.60
E.E. (fat)%	5.60	3.40	1.70	1.38	1.90	1.80
Ash (%)	2.92	2.97	2.30	3.30	6.00	2.40
ADF (%)	4.48	13.04	6.20	8.19	5.40	4.00
NDF (%)	16.31	23.72	18.00	16.65	8.90	12.25
Est. TDN (ruminant)%	>80	<79	74	79	79	80
D.E. (swine) kcal/kg	-	-	3150	3480	3620	3470
Calcium (%)	0.11	0.12	0.06	0.11	0.28	0.50
Phosphorus (%)	0.39	0.35	0.34	0.41	0.61	0.35
Lysine (%)	1.36	1.36	0.40	1.64	3.12	0.40
Methionine + Cystine (%)	0.60	0.63	0.37	0.48	1.40	0.40
Threonine (%)	0.76	0.72	0.36	0.94	1.90	0.41

E.E. = ether extract; ADF = acid detergent fibre; NDF = neutral detergent fibre; TDN = total digestible nutrients; DE = digestible energy.

coat. The seeds are about twice the size of field pea (260 to 600 g/1000 seeds). They are usually sold whole, and larger seeds receive a higher premium. About 10 to 15% of the chickpea production in the world is kabuli and the remainder is desi. Desi chickpea seeds are smaller (120 to 300 g/1000 seeds), more angular, and the thicker seed coats vary in colour from green to purple, brown, or black (Figure 8.1). Desi chickpea varieties usually are shorter, higher yielding, earlier maturing and more resistant to mechanical damage, disease, frost and insect damage than kabuli chickpea plants.

• **The chickpea seeds remain below the ground during germination, offering the plant some late spring frost tolerance and the ability to regrow if the top growth is damaged in the seedling stage.**

Like pea and lentil the first two nodes of the plant produce scale leaves, and the first scale leaf may be below the ground. The first true

Figure 8.1 Seed of desi (top) and kabuli (bottom) chickpea.



8.4 Chickpea



Figure 8.2 Chickpea seedlings.



Figure 8.3 Normal and unifoliolate leaves of chickpea.

leaf is produced at the 3rd node position (Figure 8.2). Leaves are approximately two inches (5 cm) long with 9 to 15 leaflets. Some kabuli chickpea varieties like Sanford, Dwelley and CDC Xena have single or unifoliolate leaves instead of leaflets (Figure 8.3).

On average, the plant produces a new node every 3 to 4 days, and flowers at about the 13 or 14 node stage. The plants are small, but the taproot extends to rooting depths similar to wheat. Chickpea is late maturing, has an indeterminate growth habit and usually needs drought stress to hasten maturity.

Plants begin to flower approximately 50 days after they emerge. Kabuli chickpea flowers are white; desi chickpea flowers are pink to purple. Single flowers are formed on a short stem from the base of the leaf, and generally self-pollinate before they open. In general, plants mature in 110 to 130 days and reach a height of 8 to 24 inches (20 to 60 cm), depending on available soil moisture. The mature pods contain one or two seeds. The pods form several inches above the ground and are relatively shatter resistant. In Saskatchewan, the average yield of kabuli and desi chickpea is approximately 1200 lb/ac (1345 kg/ha) and 1400 lb/ac (1570 kg/ha), respectively.

Equipment and Modifications

Most existing farm equipment can be used or modified to successfully produce chickpea. Rolling can be done prior to plant emergence but is usually not required as chickpea plants remain upright and do not lodge. Rolling should be considered, if the seedbed requires firming. Rolling can reduce cutterbar damage and may improve seed quality by reducing earth tag (earth

sticking to seeds) and speeds up swathing or direct harvesting.

Seed drills or air seeders must have adequate metering devices to handle the large kabuli seed. Most conventional gravity flow seedboxes are unable to handle the large kabuli seed. It is advisable to run a trial sample of your seed through the seeder to ensure adequate seeding rates and monitor for broken or cracked seed emptying through the opener. If in doubt, a germination test should be conducted as only slight visible damage may result in severe reduction in germination. If an air seeder or air drill is used, extra caution is necessary to avoid seed damage.

- **Kabuli chickpea seeds are sensitive to seed coat damage.**
- **The air velocity should be set as low as possible without the hoses plugging.**
- **To obtain low enough air-flow rates to reduce seed damage in some machines, it may be necessary to reduce the ground speed. Since a lower ground speed requires lower seed flow rates, the air velocity can be reduced. Refer to the manufacturer's recommendations for optimum fan speeds and machine configuration.**

Kabuli chickpea requires gentle handling to prevent splitting and reduced germination. Even non-visible damage to the seed can result in a substantial loss in germination.

Chickpea is generally straight-cut combined, as chickpea plants maintain an upright stature and do not lodge. Vine lifters are generally not required. The same specialized harvest equipment used for lentil harvesting, such as a flexible or floating cutter bar, is also useful for chickpea.



Adaptation

Chickpea is a cool season plant usually grown as a winter crop in India, the Middle East, Australia, and South and Central America.

• **Chickpea production in Saskatchewan is best suited to the Brown and Dark Brown soil zones.**

• **Ascochyta blight can cause devastating losses in all soil zones, so only ascochyta resistant varieties should be grown.**

Production problems of seedling blight and late maturity are less likely in the Brown soil zone. Chickpea grows best when daytime temperatures are between 21 and 29°C and nighttime temperatures are between 18 and 21°C. The best temperature for germination and rapid emergence is 12°C, but, with desi chickpea, germination will begin at soil temperatures as low as 5°C. Kabuli is more sensitive to cold and should not be seeded into soil with an average temperature of less than 12°C at placement depth. As cotyledons remain below ground, plants can tolerate some late spring frost and regrow if the top growth is damaged. However, frost in the fall can damage immature seeds (especially of kabuli chickpea) and prevent the seeds from turning from immature green to the desirable golden colour. Desi chickpea is more tolerant to frosts than kabuli chickpea.

Chickpea is relatively drought tolerant. The long taproot allows it to use water from a greater depth than other pulse crops. In the absence of disease, chickpea performs best with 6 to 10 inches (15 to 25 cm) of rainfall during the growing season, and when cropped on well-drained soils.

Table 8.2 Alternative crop yields when grown on fallow or wheat stubble at Swift Current.

Crop	Fallow	Stubble	Stubble/fallow
	lb/ac (kg/ha)		%
Spring wheat	2580 (2890)	1700 (1905)	66
Mustard	1640 (1840)	980 (1100)	60
Desi chickpea	1460 (1635)	1110 (1245)	76

Average of 6 – site years.

Field Selection and History

As with all pulses, field history is important for chickpea production. Chickpea does well on well-drained soils of neutral pH; it is not particularly adapted to saline soils. Soils prone to waterlogging or surface standing water after heavy rains can dramatically reduce yields or drown plants. Seed planted into wet, cold soil can quickly develop seed rot or infection by seedling diseases. Excess soil moisture will inhibit root growth and nodulation, and cause plant stunting and yellowing of leaves. Seedlings subjected to waterlogging develop shallow root systems that reduce water and nutrient uptake once the soil dries. Chickpea is a crop that is a suitable choice for land considered marginal for production of many annual crops.

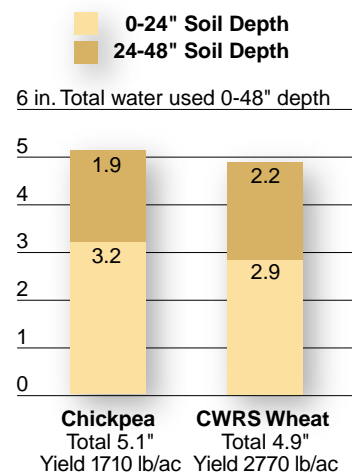
• **Because of its deep rooting system, chickpea is better suited to lighter textured, sandy soils than other pulse crops.**

• **Chickpea has an indeterminate growth habit. Therefore, planting chickpea on fallow may encourage excessive vegetative growth and extended maturity.**

• **Avoid fields with salinity problems.**

Although yields on fallow in the Brown soil zone typically are higher, research conducted by Agriculture and Agri-Food Canada at Swift Current has shown that chickpea is well adapted to stubble cropping. Seed yields of chickpea grown on wheat stubble produced a higher

Figure 8.4 Water used by wheat and desi chickpea.



Source Miller, P. and A. J. Bussan, 1998.

Source Adapted from Miller and Bussan, 1998.

8.6 Chickpea

Figure 8.5.1 CDC Desiray Chickpea



Source Saskatchewan Pulse Growers, 2000

proportion (76%) of its fallow yield than did CWRS wheat (66%) or the oilseed (60%) (Table 8.2).

However, the water use efficiency of chickpea (the amount of grain produced per unit of water used), is not as high as pea. Chickpea avoids drought due to its deep rooting system, but leaves the rooting zone as dry as wheat at the end of the growing season. Both crops use similar amounts of soil moisture during the growing season (Figure 8.4). However, chickpea often leaves a drier soil at harvest than wheat, due to its late maturity and utilization of any late-season rainfall.

Figure 8.5.2 CDC Xena Chickpea



Chickpea is sensitive to residues of herbicides, such as Accord, Ally, Amber, Assert, Curtail, Lontrel, Muster, Odyssey, Poast FlaxMax, Prestige and Prevail. Refer to the Saskatchewan Agriculture and Food "Guide to Crop Protection" regarding residual herbicide carryover.

• **Always follow label recommendations and check product labels carefully.**

A bioassay is recommended to determine if the residues of these herbicides are still active. Activity after 5 years is not uncommon. Conditions for breakdown and degradation vary from product to product and are dependent on environmental and soil factors.

Figure 8.5.3 CDC Yuma Chickpea



Chickpea is a short stature crop with an open canopy, which allows weeds to be very competitive as they easily grow through and above the crop canopy. As few herbicides are available for chickpea production, steps should be taken to minimize weed problems before the crop is seeded. Weedy fields, particularly those with perennial sow thistle, Canada thistle, kochia and quack grass, should be avoided (for further information see Chapter 5./Weed Control). Since volunteer

mustard, canola or flax can be difficult to control, chickpea should not be planted following these crops in the rotation.

Although ascochyta disease of chickpea is different from the ascochyta which plagues the other pulses, it is advisable to grow chickpea in a rotation that includes a variety of crops and in which chickpea does not follow chickpea or other pulses.

• **Chickpea should not be planted on the same field more than once in four years.**

• **In order to reduce the risk of infection chickpea, should not be planted within 3 miles (4.5 km) of an ascochyta-infected field for at least one and preferably two years.**

Varieties

A number of kabuli type chickpea varieties, and one desi type chickpea, are grown in Saskatchewan (see Chapter 3./Variety Selection, Chickpea).

Of the kabuli chickpea varieties Dwelley is very late, Sanford is late, B-90, CDC Yuma and CDC Xena are medium and CDC Chico is considered early in maturity. No kabuli varieties have large enough seed to merit the maximum premium price available for extra-large-seeded varieties exported from Mexico. B-90 is a small seeded variety with round seeds. Markets for this type of chickpea are presently being developed. The desi chickpea variety Myles, is considered early maturing. CDC Desiray is a new desi-type variety with plump seeds and a light tan seed coat. The domestic market for desi chickpea is limited.

A number of environmental conditions will influence time to maturity, but Myles desi chickpea

will generally mature in 100 to 110 days. Kabuli type varieties are later maturing than desi types.

All present, recommended varieties have good resistance to ascochyta blight up until flowering. However, under prolonged cool, wet conditions after flowering, all varieties can suffer yield reductions, if ascochyta becomes established in the crop.

Crop Management

Seeding Considerations

Prior to seeding, the application of a non-selective herbicide, such as glyphosate, can be used to control winter annual and early emerging spring annual weeds.

As noted, seed selection is extremely important to ensure crop quality.

- **It is very important to have chickpea seed tested for germination and seed-borne diseases.**

- **It is especially important to use seed free of ascochyta and seedling blights and to seed only ascochyta resistant varieties.**

- **Though the majority of chickpea varieties are classified as resistant to ascochyta blight, the term is relative and is not to be confused with immunity. Severe ascochyta pressure will result in significant yield loss with these varieties.**

Chickpea seed has an exposed embryo with the root tip protruding, so it is very susceptible to mechanical damage. Seed germination and seedling vigour should always be tested. (See Chapter 3./Variety Selection, Table 3.1 for a list of seed test laboratories.)

Chickpea requires inoculation with the correct *Rhizobium* in order for the plants to fix their own nitrogen. (See Chapter 4./Plant Nutrition for further information on inoculation

and fertilization requirements).

Kabuli chickpea is particularly susceptible to damage when seeded at low temperature in wet soils, as a result of rapid water uptake during the first 24 hours after seeding. The thin seed coat of the kabuli chickpea does not restrict the rate of water uptake, and cell membranes may rupture in the cells of the cotyledons. The seeds may even split in extreme cases and soluble nutrients may be forcibly extruded from the seed. Seed rotting fungi, especially *Pythium*, can then feed on these nutrients, infect the seed, and kill the seedling before it can emerge. A partial solution is to delay seeding until the average soil temperature at the depth of seeding warms to 10 to 15°C, whereby most seedlings can emerge before they are destroyed by *Pythium*. The registration of Apron FL, a seed treatment fungicide for *Pythium* control, permits producers of kabuli chickpea to treat their seed and plant kabuli chickpea during the first week of May. Early seeding of treated seed helps to reduce frost problems in the fall as it allows the crop to mature earlier. Desi chickpea does not usually require a seed treatment. The influence of seeding dates on desi chickpea is shown in Figure 8.6.

- **The recommended seeding date is late April to mid-May for desi chickpea and early to mid-May for kabuli chickpea.**

- **Chickpea seedlings are tolerant of frost. Desi chickpea seed can germinate in soil as cold as 5°C, but seedling vigour is greater if soil temperatures are at least 7°C.**

- **Kabuli chickpea seed is more sensitive to cold soils and should not be seeded into excessively wet soil or into soil with temperatures below 12°C at the**

Figure 8.5.4 *Dwellely Chickpea*



Figure 8.5.5 *Myles Chickpea*

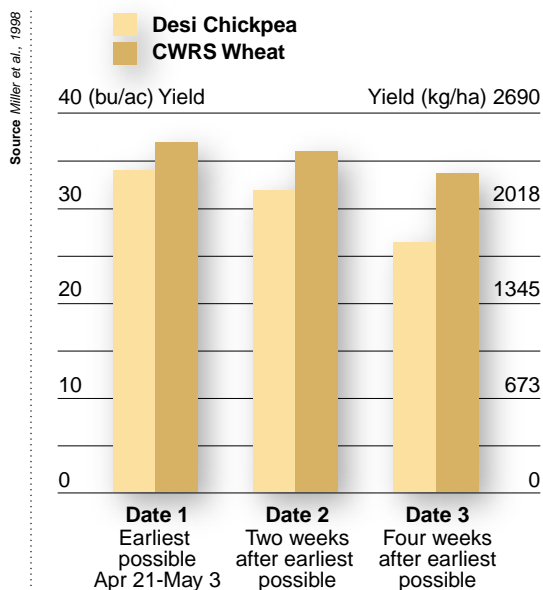


Figure 8.5.6 *Sanford Chickpea*



8.8 Chickpea

Figure 8.6 Influence of seeding date on yield of desi chickpea at Swift Current (1994, 96, 97).



placement depth.

- **Apron FL seed treatment is very effective against seed rot, permitting early seeding of kabuli types to help offset the later maturity of currently available kabuli chickpea varieties.**

- **If the seed is treated, it should be planted immediately after inoculation, as seed treatments can be toxic to the inoculant. The longer the inoculant is in contact with the seed treatment, the less effective it will be.**

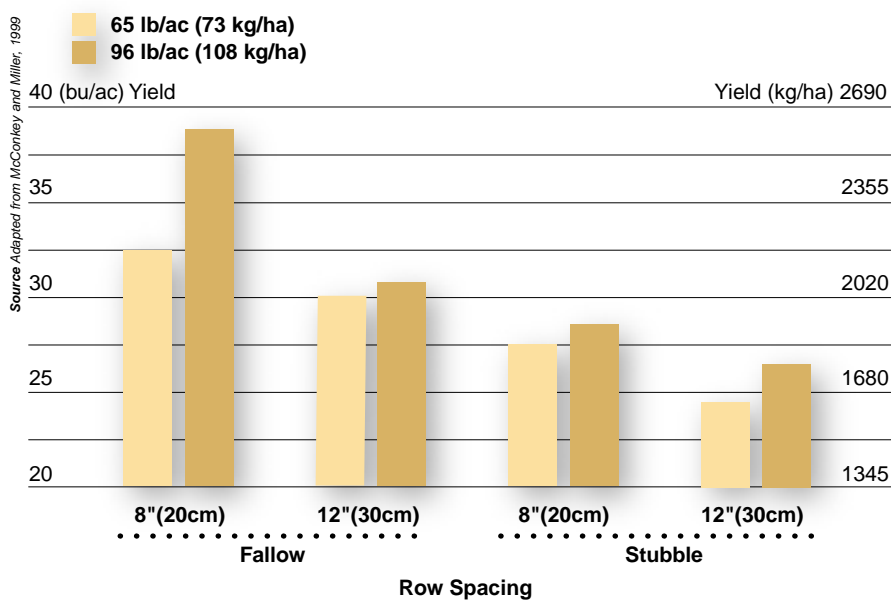
Later seeding reduces plant growth, the duration of flowering, seed set, seed size, and, ultimately, yield. However, crop developmental stages become more compressed with later seeding with little effect on yield unless maturity is delayed enough that the immature seeds are killed by frost. In the Brown soil zone with desi chickpea, no advantage was found for a late April vs. early May seeding date, either in terms of maturity or yield.

Chickpea seeds, especially kabuli types, are relatively large and must take up their own weight of water during germination, so seeding into moisture is important. A seeding depth of 1.5 to 2.5 inches (4.0 to 6.4 cm) is usually the best and deeper seeding reduces seedling emergence. The seeder must be tested to ensure that it is capable of uniformly distributing these large seeds without plugging or chipping or damaging the seed.

Target seedling populations are 4 plants/ft² (44 seeds/m²). Seeding rates depend on the size of the seed used, but target rates of 80 to 95 lb/ac (90 – 105 kg/ha) are recommended for desi chickpea and 120 to 140 lb/ac (135 – 155 kg/ha) for kabuli chickpea. Seeding rates should be adjusted to reflect seed germination and seed size. Narrow row spacing and even seed distribution are beneficial for even canopy growth and maturity. Thin stands generally increase weed problems and delay crop maturity. The effect of seeding rate and row spacing on seed yield of desi chickpea is demonstrated in Figure 8.7.

In this study, narrow row spacing, on either fallow or stubble, provided higher yields than wider rows. Narrow rows facilitate canopy closure and quicker root exploitation and use of interrow soil moisture and nutrients. Lower seeding rates resulted in slightly lower yields with-

Figure 8.7 Influence of seeding rate and row spacing on desi chickpea yield in the Brown soil zone.



in most row spacings, suggesting that seeding rates might be reduced and seed cost savings realized without the loss of significant yield. Experienced producers favour recommended seeding rates to encourage rapid and complete canopy closure as a weed control strategy and to prevent delayed and irregular maturity.

In-Crop Considerations

Weeds

Although chickpea plants are quite short, pods are generally formed several inches above the soil surface.

• **Post emergent rolling is not required and may damage the plants and spread disease.**

Chickpea plants are not strong competitors with weeds. Weeds often emerge through the short, open chickpea canopy. Chickpea is able to maintain yield in the presence of weeds better than dry bean, but they are less competitive than pea or lentil. Yield losses from weed competition may be as high as 100%.

Mechanical weed control in the chickpea crop is not recommended. Post-emergent harrowing can cause severe crop injury because the stems are stiff and woody at an early age and harrowing also spreads disease.

Sencor (metribuzin) is registered for control of some broadleaf weeds in chickpea. Application should take place in the 1 – 3 above ground node stage of the crop when plants are a maximum of 2.5 inches (6.25 cm) in height. Some leaf scorch may be evident after application, but plants will recover quickly with no permanent damage. Late applications of Sencor result in leaf burn and some stand thinning as more leaf material is present and

damage is intensified with a longer recovery period. Poast Ultra and Select are registered for volunteer cereal and grassy weed control. Select should be applied prior to the 9-node stage. Yield losses may be high if spraying is delayed beyond the first 2 – 3 weeks after emergence.

Research trials have been conducted to test both fall and spring pre-plant incorporated applications of Edge on chickpea. Fall applications of double the recommended rate have not caused damage nor the recommended spring rate of application. However, twice the recommended rate in spring does cause chickpea injury. **Presently, Edge is not registered for use in chickpea.**

Minor use registration of Edge as a pre-emergent may be possible in the future. A number of products used for broadleaf weed control in other pulses (such as Basagran, Pursuit, 2,4-DB, MCPA) have caused severe injury to chickpea plants in test plots. Low rates of Pursuit/Odyssey have resulted in delayed maturity.

The chickpea canopy is generally shorter than most weeds by mid-season. A non-selective herbicide applied with a wick applicator above the crop canopy may provide some weed control without crop damage, but yield loss will already have occurred by this point.

Insects

Insect damage is unlikely in Saskatchewan, although aphids can cause problems in other regions of the world because they may carry viral diseases. Aphids are usually not of concern in the Brown and Dark Brown soil zones. Grasshoppers are the main insect threat, but in general, they prefer to feed on cereal crops rather than on pulse crops. Grasshopper damage

8.10 Chickpea

Source Cheyl L. Armstrong



Figure 8.8 *Ascochyta* blight on chickpea.

Source Sheau-Fang Hwang



Figure 8.9 Root rot of chickpea.

may occur at the early seedling stage in some fields, in some years. It is advisable to check fields in areas expected to have high grasshopper populations. The glandular hairs on chickpea leaves, pods, and stems contain malic acid, which further deters insect attack.

Crop damage has been observed, particularly by pocket gophers, but with rabbits, antelope and deer as well.

Disease

Chickpea is susceptible to an extremely aggressive type of ascochyta blight, differing from the ascochyta blight of pea and lentil and causing greater damage.

- **At present, chickpea production in Saskatchewan is limited by ascochyta blight. This seedborne fungus can wipe out the entire crop if susceptible varieties are planted.**

- **During 1999 scientists at Agriculture and Agri-Food Canada in Saskatoon confirmed the presence in Saskatchewan of the sexual stage of the fungus (ascospores). The spores of this stage can be spread by wind over several miles (kilometres), greatly enhancing disease spread.**

- **Although current varieties are resistant to ascochyta blight, all can suffer economic loss from the disease. Apparently, ascochyta resistance diminishes as plants senesce and start maturing.**

The symptoms include tan to brown lesions on stems, leaves and pods. Dark fruiting bodies, called pycnidia, are formed in the lesions. The lesions may girdle entire stems, causing them to break over and die (Figure 8.8). Frequent showers and cool weather from flowering onward favour infection. Infected plants of susceptible varieties will die in 3 to 4 weeks. If weather then turns warm and dry, less severely infected

plants may survive, but these will be delayed in maturity. Most disease is seedborne so the use of disease-free seed is critical. It can also survive for several years on infected crop residues in the soil. A rotation where chickpea is not cropped more than once in 4 years is recommended. To reduce the risk of disease spread, chickpea should not be planted adjacent to the residue of a chickpea crop infected with ascochyta blight.

- **Ascochyta susceptible varieties of chickpeas should not be grown.**

- **Bravo 500 foliar fungicide is registered for control of ascochyta blight in chickpea. Bravo 500 is a contact fungicide and protects healthy plant tissue from the spread of spores. It cannot prevent the development of the disease on already infected leaves or stems.**

- Initial application of Bravo 500 should be made at early flowering. A number of applications, not more than 3, may be needed to slow the spread of this disease in years with prolonged wet periods.

Seedling blights are common in other regions of the world, where they are commonly combated with fungicide seed treatments. In drier areas, seedling blight build-up is unlikely.

- **Irrigation is not suitable for chickpea production in Saskatchewan because of delayed maturity and disease problems.**

Kabuli chickpea is susceptible to seed and root rots (Figures 8.9), particularly on wet, poorly drained soils. Apron FL is registered as a seed treatment for control of seed rot, root rot and seedling blight in chickpea. Applying a registered seed treatment protects seeds from seed rots and reduces the potential of initial root rot. However, seed treat-

ments will not protect plants from root rot later in their development.

Chickpea is also susceptible to *Botrytis* (grey mold), both as a seedling and in later stages of development (Figure 8.10). Prolonged wet weather during pod fill may result in a systemic infection whereby the seeds become covered with a white fungal growth.

Sclerotinia can be damaging to chickpea in wet years, particularly if a heavy canopy exists. *Sclerotinia* symptoms include wilted plants, shredded stems, cottony growth protruding from infected stems and pods, premature ripening, development of small, misshapen seed and yield loss (Figure 8.11). To reduce the risk of *sclerotinia* infection chickpea should not follow lentil, pea, canola, mustard, dry bean, sunflower or hemp in rotation.

Harvest

Chickpea plants are relatively short, but the pods are held several inches (cm) above the ground and do not shatter readily. This substantially reduces the difficulty of harvest. Chickpea can be direct combined, or swathed and combined. To improve the ease of harvesting, chickpea can be planted into tall cereal stubble (16"+, 40 cm). The plant increases in height due to reduced light intensity during early seedling development. This results in increased pod height.

• **No desiccants are registered for use in chickpea. Use of unregistered products as desiccants can prevent market place acceptance.**

• **The Pest Management Regulatory Agency of Health Canada has developed a sampling program to monitor potential desiccant misuse.**

Chickpea can be swathed as early as 30% seed moisture without loss of yield or seed size, but best

results usually occur if the crop is left until a majority of the pods are straw yellow. Swathing too early will result in an excess of green immature seeds, which will remain green in the swath and result in downgrading. Due to its indeterminate plant growth, pod size differences will occur at harvest. Although chickpea pods resist shattering, delaying harvest beyond maturity can result in breaking of the pod stem and the pods dropping from the plant and/or, depending on conditions, seed discolouration and cracking. Seed cracking is especially problematic at seed moisture contents of less than 13%.

Swathing should occur while plants are slightly damp to facilitate forming the swath and minimize losses. The swath can be combined when the vines, pods, and seeds are nearly dry (at 18% moisture). Approximately 0.5% immature green seed is allowed before deductions are implemented. Air or pick-up reels on the combine are generally better than bat reels for reducing harvest losses.

As the chickpea plants produce relatively small amounts of stem, stalk and leaf, they are well suited to straight combining. Pods and seed often mature before leaves and stems. The stage of the crop should be closely monitored as delayed harvesting increases the



Figure 8.10 *Botrytis* infection on a chickpea plant.



Figure 8.11 *Sclerotinia* infection on a chickpea plant.



Table 8.3 Suggested harvester settings for chickpea.

Reel speed	Same as the ground speed (slow)
Table auger clearance	High
Concave speed*	250 – 600 rpm
Rotor speed**	700 – 900 rpm
Concave clearance	10 – 30 mm, depending upon desi or kabuli types
Fan speed	High
Top sieve	20 – 25 mm
Bottom sieve	2 – 16 mm

* Keep speed to a minimum without significantly reducing the harvesting capacity.

** Rotary machines only.

8.12 Chickpea

Table 8.4 Primary and export grade determinants for kabuli chickpea.

Grade name	Colour	Damage (%)	Cracked seed coats including splits (%)	Green (%)	Foreign material (%)
No. 1 CW	Good natural colour	0.5	1.0	0.5	0.1
No. 2 CW	Fair	1.0	2.0	1.0	0.2
No. 3 CW	Poor	2.0	3.0	2.0	0.2
Grade, if No. 3 specs not met	Chickpeas, Sample CW, Account Colour	Chickpeas, Sample CW, Account Damaged	Chickpeas, Sample CW, Account Cracked Seed Coats and Splits	Chickpeas, Sample CW, Account Green	Chickpeas, Sample CW, Accounts Foreign Material

Source: Canadian Grain Commission Official Grain Grading Guide August, 1999



chances of weathered seed, which makes the seed unacceptable to most processors and consumers. If environmental conditions have caused delayed or uneven maturity, it may be beneficial to harvest and bin separately the low, immature areas of the field.

The chickpea seedling root projects from the seed so rough handling can easily reduce grade or germination, especially for kabuli types. All harvesting and handling procedures

should be done with the objective of minimizing seed damage. Because the plant has an upright nature vine lifters are usually not required, if straight cut. Cylinder speeds and ground speeds should be reduced and combine cylinder settings adjusted to accommodate this large, fragile seed. Experienced producers often use cylinder speeds of approximately 450 rpm, cylinder speeds should be reduced when harvesting drier seed. If pods are not properly threshing, cylinder or rotor speeds may have to be increased. Air flow can be increased and sieves can be opened to reduce harvest losses. Watch for unthreshed pods going over the sieves.

Harvest settings will vary depending on equipment and harvest conditions but those outlined in Table 8.3 offer a reference point. Harvest a small area using these settings, assess the sample for purity and cracking, and adjust the settings as necessary.

Large, uniform, undamaged, light-coloured seeds are favoured by the kabuli chickpea market. Tan coloured, uniform-sized seed is preferred in the desi chickpea market. Any dark brown, green or black seeds will reduce the value of the seed.

Seed should be stored at 15% moisture or less. Seed moisture testing metre conversion charts for various kabuli chickpea are available from Saskatchewan Agriculture and Food Rural Service Centres. Aeration can be used to cool and dry the seed. Seed moisture should be tested frequently with a moisture meter. Ensure that chickpea seed is dried throughout. The large seed can often test dry, but still be moist at its center. A soft internal center can result in spoilage and quality loss.

Grading

The Canadian Grain Commission has developed the standards for kabuli and desi chickpea grades (Tables 8.4 and 8.5).

Table 8.5. Primary and export grade determinants for desi chickpea.

Grade name	Damage (%)	Cracked seed coats including splits (%)	Green (%)	Foreign material (%)
No. 1 CW	1.0	1.0	1.0	0.1
No. 2 CW	2.0	2.0	2.0	0.2
No. 3 CW	3.0	2.0	3.0	0.2
Grade, if No. 3 specs not met	Chickpeas, Sample CW, Account Damaged	Chickpeas, Sample CW, Account Cracked Seed Coats and Splits	Chickpeas, Sample CW, Account Green	Chickpeas, Sample CW, Account Foreign Material