

Crop Profile for Chickpea (Garbanzo bean) in Montana

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General Production Information

Chickpeas are a high-value crop that is well adapted to many of Montana's dryland cropping regions. Production problems in traditional growing regions have created good market opportunities for Montana chickpeas. In rotation with wheat, chickpeas can increase economic returns.

Chickpeas (*Cicer arietinum* L.) are an annual grain legume or "pulse" crop that originated in the Fertile Crescent of the Near East. Chickpeas were one of the first legumes cultivated by humans, dating to 7000-6000 BC. The term "pulse" originates from the Latin word *puls*, meaning "thick soup." Pulse crops like chickpeas, dry beans, dry peas, fababeans, lentils and lupine work with rhizobia bacteria to convert nitrogen from the atmosphere into nitrogen nodules on the plant roots.

Chickpeas are classified as "desi" or "kabuli" types based in part on seed size, color and the thickness and shape of the seed coat. Desi types produce smaller seeds, generally 100 or more seeds per ounce. The seeds have a thick, irregular-shaped seed coat which can range in color from light tan to black. Kabuli types, also called "garbanzo beans," produce larger seeds that have a paper thin seed coat and are graded into 58 or fewer seeds per ounce. The kabuli types produce seeds with colors that range from white to a pale cream colored tan.

World chickpea production is roughly three times that of lentils. Among pulse crops marketed as human food, world chickpea consumption is second only to dry beans. Turkey, Australia, Syria, Mexico, Argentina and Canada are major chickpea exporters.

About 90 percent of chickpeas - the majority of which are desi types - are consumed in India.

Historically, North American chickpea production was confined to California (8,000 to 20,000 acres) and the Pacific Northwest (20,000 acres). Recently, chickpea production has expanded into the Northern Great Plains regions of Canada and the United States. In Saskatchewan, chickpea production increased from 8,000 acres in 1995 to over 200,000 acres in 1998. In 1998, Montana produced about 4,000 acres and North Dakota about 3,300 acres, with yields averaging from 800 to 1,200 pounds per acre.

In the United States and Canada, most kabuli chickpeas are marketed as canned garbanzo beans for salads. Kabuli chickpeas are also marketed as dry garbanzo beans and ground flour for baking purposes.

Desi chickpeas require a specialized seed coat removal process if used for human food. The process, called decortication, involves adjusting the moisture level of the seeds to facilitate the mechanical removal of the thick seed coat. The seeds, which then resemble a small yellow pea, are processed into numerous East Asian ethnic food products. Canadian Select Grains, in Eston, Saskatchewan, which opened in 1998, is the first North American facility to decorticate desi chickpeas.

Nutritional and feed quality

Chickpeas have one of the highest nutritional compositions of any dry edible legume. Chickpeas' average nutritional content is 22 percent protein, 67 percent total carbohydrates, 47 percent starch, 5 percent fat, 8 percent crude fiber and 3.6 percent ash. The fat (lipid) fraction is high in unsaturated fatty acids, primarily linoleic and oleic acids.

Chickpea protein digestibility is the highest among the dry edible legumes. The content of the amino acid lysine is adequate, while the sulphur-containing amino acids, methionine and cystine, are the first limiting amino acids. Chickpeas are considered a cholesterol reducer due to their unsaturated fatty acid and fiber content. Chickpeas are unique in moderating the rise in plasma glucose after meals. Chickpeas are used to help control diabetes in eastern Asia. The chickpea mineral component is high in calcium, potassium, phosphorous, iron and magnesium. Chickpea calcium content is similar to that of pinto beans, about 100 to 200 mg/100g (compared to 35-70 mg/100g for dry peas and lentils). The only negative factor ascribed to chickpea consumption is more flatulence due to a higher concentration of non-reducing sugars than other dry edible legumes.

Chickpeas are also a good livestock feed. Feed values and feeding studies for kabuli and desi chickpeas have been compared to peas, barley, grain and soybeans. Chickpeas have higher oil content than other pulse crops and the feed value of chickpeas is similar to dry peas.

Production Regions

The bulk of chickpea production is centered around the northern [Montana](#) counties of Blaine, Choteau, Glacier, Hill, Liberty, Phillips, Pondera, Teton, and Toole. The northeastern Montana counties of Daniels, Dawson, Garfield, McCone, Richland, Roosevelt, Sheridan and Valley and Gallatin county in southwest Montana vie for second place.

Cultural Practices

Field history and selection

To select appropriate fields for chickpeas, consider previous herbicide use (see Table 1), weed spectrum and pressure, interval since last chickpea crop and proximity of other chickpea fields. These considerations are important to manage weeds and diseases and to minimize residual herbicide injury to the crop.

A field that has not had chickpeas for at least three years and is at least three miles from the previous year's fields is important to prevent *Ascochyta* blight. If *Ascochyta* blight was detected in a field, increase the isolation distance to at least three miles.

Many herbicides used in small grain production can carry over, resulting in chickpea injury and yield loss (See Table 1).

Table 1. Minimum Rotation Intervals

Herbicide	Labeled Rotation Restriction	Expected Time
Ally®	34 months *	3 years
Amber®	4 months *	3 years
Assert®	15 months *	
Canvas®	34 months *	3 years
Curtail®	18 months	
Finesse®	36 months *	3 years
Glean®	36 months *	3 years
Peak®	11-18 months	1.5 - 2 years
Stinger®	18 months	
Tordon®	*	Depends**

* Indicates a field bioassay is required. See the product label for specific guidelines

** Length of Tordon carryover depends on the application rate, application frequency, soil and environmental conditions following the application.

Rotational intervals depend on how long herbicides remain in the soil. Factors that affect herbicide persistence include pH, moisture and temperature. Because Montana has a dry climate and short

growing season, herbicides generally degrade slower than in warmer, moister areas. Sulfuron herbicides (Ally®, Amber®, Canvas®, Finesse®, Glean® and Peak®) persist longer in higher pH soils. When soil pH exceeds 7.5 to 7.9, Sulfuron herbicide residues may remain in the soil much longer than described on the label. Under such conditions, a field bioassay is required the year before seeding pulses.

Rotational benefits

Chickpeas, like other annual legumes in a rotation, offer several cropping advantages for the producer. Cereal crop yields often increase when planted after legumes due to the following considerations:

- Cereal disease and insect cycles have been disrupted
- Alternative herbicides to cereal crops can be used to clean up grassy weeds.
- Soil nitrogen supply is increased.

Varieties

To protect Montana's developing chickpea industry, only Ascochyta-resistant varieties can be recommended. The U.S. Department of Agriculture's Agricultural Research Service breeding program at Washington State University-Pullman has released three resistant kabuli varieties (Dwelley, Evans and Sanford) and a resistant desi variety (Myles). Sanford is higher yielding and Dwelley produces large seeds. Evans has a seed size midway between Dwelley and Sanford and has the advantage of maturing one week earlier than Sanford and Dwelley.

The Crop Development Center at the University of Saskatchewan, Saskatoon, has also released three resistant kabuli chickpea varieties (CDC Yuma, CDC Xena and CDC Chico). CDC Yuma and CDC Xena are similar to Sanford and Dwelley in seed size, respectively; however they mature earlier and have a higher yield potential. CDC Chico and B-90 (from Terramax of Qu'Appelle, Saskatchewan) are small-seeded kabuli types designed to enter the desi chickpea market without requiring decortication.

Seedbed preparation and fertilization

Chickpeas can be seeded into standing or tilled stubble and fallow. Minimize soil tillage to reduce moisture loss. This is especially important for the large-seeded kabuli chickpeas. Nutrient requirements of chickpeas have not been determined for Montana. Generally, fertility recommendations for peas and lentils are appropriate for chickpeas. It is expected that chickpeas will respond to phosphorous, sulfur, molybdenum, manganese and iron if these nutrients are noted to be deficient in soil test results. Nitrogen fertilizer application generally is unnecessary unless available soil nitrogen levels are less than 15 pounds per acre. Application of no more than 18 pounds per acre of additional nitrogen (which must not be applied directly with the seed) is recommended. While phosphorous can be safely applied in the seed-row, fertilizers should be applied in a band away from the seed.

Inoculation

Chickpeas must be inoculated with a specific Bradyrhizobium strain for Cicer species to ensure effective nodulation and nitrogen fixing. Inoculant is marketed in liquid and powder forms for seed inoculation or in granular form for soil inoculation. Powder and granular formulations can consist of clay or peat carriers. Rhizobium inoculant is sensitive to some fungicide seed treatments and fertilizers. Seed-applied inoculant must be applied to the seed just before planting. Large populations of this introduced rhizobia bacteria must survive in the harsh soil environment for 2-3 weeks to effectively form nodules on the roots of pulse crop seedlings. In dryland cropping regions such as Montana, granular inoculant is preferred since it is more reliable in dry seedbed conditions.

Seeding

To reduce soil-borne diseases, kabuli chickpea types should be planted after the soil temperature 2-3 inches deep is at least 50 degrees. Desi types can be planted when the soil reaches 40 degrees or above. Chickpeas can be planted with either air seeders or conventional drills as long as the openings can accommodate the large seed. You may need to modify air seeders to meter the large kabuli seed and remove seed counters to minimize seed damage.

Suggested seeding rates for desi types are 80-95 pounds per acre and 120-140 pounds per acre for the kabuli types. To insure adequate seed size at harvest, seeding rates should provide 3 (kabuli) to 4 (desi) plants per square foot. This will require 4-5 seeds per square foot for kabuli and 5-6 seeds per square foot for desi chickpeas. Seeding depth recommendations are 1 inch below moisture for desi and up to 2 inches below moisture for kabuli chickpeas. Kabuli chickpeas may be planted to a depth of 4 inches to use available soil moisture for germination. If the field requires rolling, the operation should be completed prior to seed emergence or after the plants are well emerged but before the 6-leaf growth stage. Avoid rolling during plant emergence.

Plant growth habit

Chickpea plants are erect with primary, secondary and tertiary branching, resembling a small bush. They flower profusely and have an indeterminate growth habit, continuing to flower and set pods as long as conditions are favorable. Pod set occurs on the primary and secondary branches, and on the main stem. The individual round pods generally contain one seed in kabuli types and often two seeds in desi types.

In Montana, desi chickpeas flower several days before kabuli types. In Montana trials, desi chickpea flowering dates were similar to Austrian winter peas and lentils and 2-8 days later than dry peas. Kabuli chickpeas generally matured two weeks after desi types. The chickpea's tap root gives it more drought tolerance than peas or lentils. Chickpeas also tolerate higher temperatures during flowering than peas. Chickpea resistance to early or late frost is similar to peas and lentils.

Plant height of the kabuli ranges from 14-22 inches and the desi types from 10-20 inches, with the lower seed pods 4-6 inches from the soil surface under dryland conditions in Montana.

Yield and quality

Montana research center trials with chickpeas have been successful. Yields and quality of Sanford and Dwelley chickpeas grown at Huntley for the 1993-1994 seasons are compared in Table 3. Sanford yields were significantly higher in 1993 while yields of Sanford and Dwelley were equal in 1994. Seed size was significantly higher for Dwelley in both years.

Harvesting

While seed size is a major factor in gross return per acre, seed color is the single most important factor in determining if your kabuli crop is marketable, and that is largely determined by harvest timing and methods.

If the seed coats are dark or discolored the crop will not be accepted by food processors. Harvesting decisions such as timing and harvesting methods are the major factors in harvesting seeds with the light yellowish-cream color demanded by the processor. Monitoring seed color is most important to determine proper harvest timing and management.

Producers can direct combine or swath the crop when the pods are straw yellow. The method of harvest often depends upon the weather. In some regions, the swathing/combining combination has the advantage because delayed harvests can result in darkening of the seed coat. The desiccant paraquat (Gramoxone Extra) is labeled as a harvest aid for chickpeas. However, caution is recommended when using a desiccant because it has reduced seed size and caused pod drop in some situations. Producers may wish to restrict application to green spots only.

Chickpeas can be harvested at 18 percent moisture. Combine speeds, cylinders, sieves and air must be adjusted to prevent seed breakage. Chickpea seeds have a characteristic small protruding beak-like structure which must not be damaged. Breakage of chickpeas can be minimized by use of conveyor belts or by keeping the standard augers as full as possible and operating at slower speeds. Chickpeas can be stored at 15 percent seed moisture. Production information and guides for chickpea growers have been published in the U.S. and more recently in Canada (See source list).

Marketing

Kabuli chickpea marketing depends first and foremost on producing seeds with the color and sizes acceptable to the processors. Seed remaining on top of 22/64, 20/64, or 18/64 round screens respectively are classified as jumbo (42-48 seeds per ounce), large (48-52 seeds per ounce), and medium (54-58 seeds per ounce). Desi chickpea grading does not fall under size or color

constraints.

Production levels must be sufficient to create an opportunity for local elevators and seed processors to both sell seed and to purchase and process the crop. The overall success in Montana will depend upon a group of producers providing an adequate volume of production to the buyers, and to an increased U.S. export potential of both kabuli and desi chickpeas.

Insect Pests

Chickpea stems, leaves and seed pods are covered with small hair-like glandular structures that secrete malic and oxalic acids which deter insect pests. Insect problems on chickpeas have been minimal and insecticide applications generally have not been necessary. Insect problems have been limited to possible virus transmission by aphids.

Diseases

Being a new crop in Montana, chickpea production has thus far been relatively free of yield limiting disease. [Ascochyta blight](#) is the most serious threat in Montana chickpea production. Plants infected with *Ascochyta* first show stem-tip wilting and die back. This may be followed by dark, sunken lesions that soon become a concentric ring. Eventually the infection ring girdles the plant and it dies above that point. Cool, moist conditions favor the disease. Splashing rain helps spread the pathogen, and pod infections lead to seed contamination. The pathogen survives in infected seed and residue. Since it is nearly impossible to certify that chickpea seed is pathogen free, seed should be purchased from a reputable supplier.

Montana producers must select only resistant varieties to limit the potential development of this disease in our state. See the section on variety selection for greater detail. High quality *Ascochyta*-resistant seed, coupled with a minimum four year rotation and several miles distance from field previously planted to chickpeas will help to minimize the potential for *Ascochyta* blight outbreaks.

When the soils are cold and moist after seeding, soil-borne fungi can produce damping off and seedling blights, harming stand establishment (*Pythium* and to a lesser extent *Fusarium*). Kabuli chickpeas are especially prone to seedling infections due to the large seed size and thin seed coat and must be treated with Apron® seed treatment to insure stand establishment. Captan® also is registered and gives a broad spectrum of activity, but it is not sufficiently active against *Pythium*. Also, Captan seed treatment cannot

be in contact with the seed for more than two hours or it adversely affects Rhizobium.

Weeds

Few herbicides are registered for managing weeds in chickpeas, especially broad-leafed weeds (see Table 2). Manage perennial broad-leaf weeds like field bindweed and Canada thistle the fall before seeding chickpeas. Likewise, manage annual broad-leaf weeds like kochia and Russian thistle in small grain or fallow in years before seeding chickpeas. Grass weeds are easier to manage in chickpeas, and rotating to pulse crops such as chickpeas may improve grass weed management in small grain. Weeds can also be managed with stale seedbed techniques, such as delaying seeding, allowing weeds to emerge, then destroying them with either tillage or non-selective herbicide. Generally the first flush is the largest, and the earliest emerging weeds are the most competitive since they have the most soil resources. These techniques are not fool-proof, since weeds emerge throughout the growing season and warm season annual weeds, such as green foxtail (pigeongrass), may be favored by delayed seeding.

When developing weed management plans for chickpeas, scout fields and record the type of weeds present, then refer to herbicide labels and select appropriate herbicides (See Tables 1 and 2).

Table 2. Labeled Herbicides for Chickpea

Herbicide	Application time	Rate	Weed Spectrum	Remarks
Roundup®(glyphosate)	PPI, PRE* SPOT	depends on formulation	Emerged grass and broadleaf weeds	Apply with ammonium sulfate
Fargo® (trilalate)	PPI	1.25 qt/A; 12.5-15 lb/A	Wild oats	Buckle® (Fargo + Treflan® is labeled for chickpeas
Prowl® (pendimethalin)	PPI	1.2 - 3.6 pt/A	Grass	Adjust rate to soil type
Treflan HFP® (trifluralin)	PPI	1.5 pintt/Acre; 7.5 lb/A	Grass and some broadleaf weeds	

Sonalan® (ethafluralin)	PPI	1.5 pint/Acre; 7.5 lb/A	Grass and some broadleaf weeds	
Dual II® and Dual Magnum (metolachlor)	PPI,PRE	2-3 pints /A and 1-2 pints/A	Grasses(not wild oat) and some broadleaf weeds	PPI improves activity
Pursuit W DG® (imazethapyr)	PPI, PRE	1.1 oz/Acre	grass and broadleaf weeds	No control of sulfate-resistant kochia
Assure II® (quizalofop)	POST (up to pod set) (grass 2-6")	8-10 fl oz/A	Grass weeds	Apply with crop oil concentrate at 1% volume/volume
Poast® (sethoxydim)	POST (grass 2-4")	0.5-1.5 pints/Acre	Grass weeds	Apply with crop oil concentrate at 2 pints/Acre
Select® (clethodim)	POST (grass 2-6")	6-8oz/Acre	Grass weeds	Apply with crop oil concentrate at 1% volume/volume

PPI = PrePlant Incorporated. PRE = Prior to crop emergence. POST = after crop emergence. SPOT = spot treatment

Contacts

Industry:

- Farmers Elevator, Division of Cenex-Harvest States, Circle, MT, 406-773-5758
- McIntosh Seeds, Havre, MT 59501, 1-800-228-1928
- Circle S Seeds, Three Forks, MT, 59752, 406-285-3269
- Columbia Grain, Inc., Three Forks, MT 59752, 406-285-3231, 1-800-879-3495
- Mike Greytak, Sec/Treasurer Mt. Pulse Growers, 2051 Andromeda Lane, Billings, MT 59105, 406-248-5495, fax 406-248-1606

- Gary Kiemele, Normont Specialty Seeds, 1712 41st Street S., Great Falls, MT 59405, 406-771-4737
- North Dakota Dry Pea and Lentil Assoc., 4023 State St, Bismarck, ND 58501, 701-222-0128
- George Brocke & Sons, Inc., Kendrick, ID 83537, 208-289-4231
- Columbia Grain International, 111 SW Columbia Street, Portland, OR 97201, 503-224-8624
- Continental Grain, PO Box 367, Lewiston, ID 83501, 208-746-0102
- Hinrich Trading Co, 2620 S. Grand Ave., Pullman, WA 99163, 509-332-8888
- Finora Co. Inc., 6312 Fiddlers Green Circle, Suite 250 N, Englewood, CO 80111, 303-290-8020
- Maviga, N.A., Inc., 421 W. Riverside, Suite 461, PO Box 21004, Spokane, WA 99201, 509-747-6000
- Mills Bro. International, 7066 S. 188th St., Kent, WA 98032, 206-575-3000
- Palouse Empire Marketing, 213 N. Main, Suite 1, Moscow, ID, 83843, 208-882-2055
- Prime Pro Ventures, Perry Gryde, Box 53, Frontier, SK, Canada, SON-OWO, 306-296-2233
- Canadian Select Grains, Gary Schweitzer, Box 222, Eston, SK, SO2-IAO Canada, 306-962-4751

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- A condensed electronic Crop FactSheet on *Cicer arietinum* by F. J. Muehlbauer and Abebe Tullu can be found at: <http://www.hort.purdue.edu/newcrop/cropfactsheets/Chickpea.html>
- [USA Dry Pea and Lentil Council.](#) <http://www.pea-lentil.com/Default.htm>