



Dryland Cropping Systems

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Chickpea Production Guide

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Chickpea Production Guide

History

Chickpea (*Cicer arietinum*) is an ancient crop that belongs to the legume family. It has been grown in Africa, the Middle East, and India for centuries and is eaten as a dry pulse or green vegetable. Most U.S. production is in California and the Pacific Northwest.

Uses

In the U.S., chickpeas commonly are used fresh in salads or in soup. Chickpeas are rich in protein, complex carbohydrates, and fiber, while low in fat and cholesterol. Chickpea is a potential rotational crop and fits well in wheat and barley cropping systems. It is an option for cereal farmers in eastern Oregon who are incorporating broadleaf crops into their rotations.

Description

In the Pacific Northwest, chickpea is a cool-season annual with a spreading growth habit. In this region, it traditionally is grown in the spring. Some varieties have compound leaves, also called fern type, and some have simple leaves, also called unifoliate. Compound leaves have from 8 to 20 leaflets.

Chickpea plants have root nodules that can fix most of the soil nitrogen needed for growth from atmospheric nitrogen. The nodules are formed by a symbiotic relationship with *Rhizobium* bacteria. Recent research shows that chickpea can fix more nitrogen than other pulse crops, thus enhancing soil fertility for subsequent crops.

The *Rhizobium* bacteria that are compatible for nodule formation on the roots of chickpea are different from those that nodulate peas and lentils. Inoculating chickpea seed with the correct inoculant is critical.

Chickpea has an effective rooting depth of up to 4 feet. As a later maturing plant, it uses more stored moisture from the 3- to 4-foot soil depth than do peas or lentils. Research conducted at Columbia Basin Agricultural Research Center in 1983 and 1984 (above-average rainfall years) showed peas, lentils, chickpeas, and fababeans using 9.3, 9.7, 9.8, and 10.7 inches of moisture, respectively, from planting to maturity.



Photo courtesy of University of Saskatchewan

Chickpea, like wheat, is self-pollinating. Its flowers come in a variety of colors and are borne in groups of two or three. The leaves, flowers, and pods are hairy.

The pods, borne at the top part of the plant, contain one or more seeds. Seeds have either rough or smooth surfaces and come in a variety of colors.

Varieties

There are two main commercial classes of seed: Kabuli and Desi. Kabuli have large, cream-colored, round seeds (about 800 seeds per pound). They are used for salads and vegetable mixes. Plants are 2 to 3 feet tall with

white flowers. Large, light-colored seeds that stay firm after canning are the most marketable types for domestic use.

The Desi types usually are shorter plants than Kabuli, have smaller leaves, and the seeds come in a variety of colors. They average about 1,500 seeds per pound. They are milled and used in a number of Indian, East Asian, and Ethiopian dishes.

Table 1 lists varieties adapted to the Pacific Northwest. Type and *Ascochyta* blight resistance are distinguishing factors. Varieties shown in Table 1 are spring types. Winter types from ICARDA, Syria, are being evaluated for adaptability to the Pacific Northwest.

Table 1. Characteristics of locally adapted chickpea varieties.

Variety	Reaction to blight ¹	Seed size ²	Seed color	Leaf type	Days to mature		
					Moscow, ID	Pendleton, OR†	Moro, OR†
<i>Kabuli types</i>							
Dwelley	R	large	cream	unifoliate	122	96	106
Sinaloa	S	large	cream	fern	—	90	100
Evans	R	large	cream	unifoliate	121	96	106
Sanford	R	large	cream	unifoliate	121	96	106
Sierra	R	large	cream	unifoliate	—	96	106
Surutato-77	S	large	cream	unifoliate	120	—	—
UC-5	S	large	cream	fern	124	—	—
UC-15	S	large	cream	fern	124	—	—
UC-27	S	large	cream	fern	124	—	—
Spanish White	S	large	cream	fern	125	—	—
CA99901604W	MR	large	cream	unifoliate	—	96	106
<i>Desi types</i>							
Myles	R	small	tan/spotted	fern	115	83	98
Sarah	MR	small	tan/spotted	fern	115	—	—

¹S=susceptible, MR=moderately resistant, R=resistant

Reaction of varieties to *Ascochyta* blight may vary with environmental conditions.

²Small=2,268–3,024 seeds/lb; large=756–1,134 seeds/lb

Source: Wiese, M.V., W.J. Kaiser, L.J. Smith, and F.J. Muehlbauer. 1995. *Ascochyta Blight of Chickpea*. University of Idaho College of Agriculture, CIS 886 (revised).

†Source: Machado, S., C. Humphreys, B. Tuck, and M. Corp. 2003. Columbia Basin Agricultural Research Center, Oregon State University, unpublished data.



Conditions for growth

Climate

Chickpea prefers cool weather. It yields best when daytime temperatures are 70 to 80°F and nighttime temperatures are 64 to 70°F. The crop is relatively drought resistant because of its deep taproot.

Varieties adapted to the Pacific Northwest take 84 to 125 days to mature. Rain or irrigation during the latter part of growth can delay maturity.

The crop does not yield well in regions where precipitation is over 30 inches per year.

Soil

Chickpea performs best on sandy or silt loam soils with good drainage. It is not suited to saline soils.

The crop does not tolerate wet soils. Avoid planting chickpea in low-lying areas of fields that are susceptible to flooding.

Cultural practices

Seed preparation

Chickpea seeds need to be inoculated at seeding with the proper *Rhizobium* strain. Research conducted at the Columbia Basin Agricultural Research Center in 2003 shows that inoculating the seed with the appropriate inoculant increases nodulation and yields. The *Rhizobium* that nodulates peas and lentils will not produce nodules on chickpea.

Inoculants come either in peat or granular form. Granular inoculant can be more effective than peat-based inoculant. The granular inoculant is metered through seed hoppers and placed in the seed row near the seed, preferably below the seed, at planting. Use 5 to 10 pounds of granules per acre.

Seeds must be treated with a fungicide mixture before planting, particularly when planting into cool soil. Studies near Genesee, Idaho, in 2003 show only a 10 percent plant establishment and 30 percent seed yield without seed treatment compared to a standard treatment.

Table 2 is a guide for fungicidal seed treatment of chickpea in Oregon. **Always read the current registration and product label information before use.**

Table 2. Guide for treating chickpea seed with fungicides.

Fungicide ¹	Trade name(s)	Ascochyta blight	Pythium component		Other components ²	
			Seed rot, damping off	Root rot	Seed rot	Damping off, seedling blight
Captan	Captan	—	x ³	—	x	x
Fludioxonil	Maxim	—	—	—	X	X
Mefenoxam	Allegiance	—	—	—	X	X
Metalaxyl	Apron	—	—	—	X	X
Thiabendazole	TBZ; LSP	X ⁴	—	—	—	—

¹Always follow the product label. Maximum protection can be achieved by mixing two or three fungicides to control diseases in each of the five columns in the table.

²Currently, there are no effective chemical controls for the root-disease complex on older seedlings and mature plants, including all components of *Aphanomyces* root rot.

³Control is anticipated to be stronger by products designated with “X” compared to products designated with “x.”

⁴For preventing transmission of the pathogen on the seed. Will not protect against postemergent infections.



Illustration courtesy of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), www.icrisat.org/text/coolstuff/crops/gcrops5.html#top

Mefenoxam- and metalaxyl-based fungicides are more effective than captan-based fungicides for controlling seed rots and seedling diseases, and they also have less potential for reducing nodulation. Granular forms of *Rhizobium* inoculant usually are less affected by fungicide treatment than liquid or peat formulations. Increase the rate of inoculant on fungicide-treated seed to compensate for toxicity of certain fungicides to *Rhizobium* bacteria.

For best results, buy good-quality, certified seed with germination percentage over 85 percent.

Seedbed preparation

Chickpea seeds are larger than peas or lentils, so they are less sensitive to seed placement than some other crops. However, they still need a firm, moist seedbed.

A conventional tillage system using primary tillage to bury previous crop residue followed by secondary tillage to incorporate herbicides is an effective strategy for creating a desirable seedbed. In direct-seed systems, where previous crop residue is left on the soil

surface, proper residue management and drill selection are essential for obtaining adequate stand establishment. Hoe-type no-till drills work best when the residue is baled and removed or when the residue is chopped into small pieces and spread uniformly. If using disc-type drills, uniformly spread crop residue to avoid leaving thick mats of residue that are difficult to penetrate.

Seeding date

Planting the crop early in the spring is particularly advantageous in eastern Oregon, where limited late-season moisture has a strong negative impact on seed yield. A laboratory germination study in combination with field trials in Oregon showed germination beginning at 41°F or higher.

As the crop requires a long growing season to mature and is frost tolerant, it can be planted in March or early April in eastern Oregon. In Idaho, growers traditionally seed in May when soil temperatures reach 45°F or warmer. These practices are successful under the higher rainfall and cooler temperatures found in Idaho production areas.

In all areas, later plantings result in reduced yields and in problems with crop drying before harvest. Grain quality may be reduced in some varieties by late planting.

Method and rate of seeding

Seeding rates vary because of the variation in seed size. Seeding rates range from three to four seeds/sq ft. This is equivalent to 80 to 95 pounds per acre for the Desi types and 150 to 200 pounds per acre for the Kabuli types. Higher seeding rates (four to five seeds/sq ft) can produce higher grain yields but may not be economically feasible.

Recent research indicates that there are no differences in grain yield at 6- or 12-inch row spacing at test sites in Moro and Pendleton, Oregon. These locations receive about 11 and 16 inches of annual precipitation, respectively.

Plant the seed at a depth of 1.5 to 2.5 inches. Packing the soil after seeding improves seed-to-soil contact and seed



Table 3. Phosphorus fertilizer rates for chickpea based on a soil test.

NaOAc	Soil test P (ppm) (0 to 12 inches) ¹		Application rate (lb/acre) ²	
	Bray 1	NaHCO ₃	P ₂ O ₅	P
0 to 2	0 to 20	0 to 8	60	26
2 to 3	20 to 30	8 to 10	40	18
3 to 4	30 to 40	10 to 14	20	9
over 4	over 40	over 14	0	0

¹There are three different procedures to determine soil test P: sodium acetate (NaOAc), Bray 1 method, or sodium bicarbonate (NaHCO₃). Do not use the sodium bicarbonate method on soils with pH values less than 6.2. Use the column indicated by your soil test report.

²P₂O₅ x 0.44 = P, or P x 2.29 = P₂O₅.

Table 4. Potassium fertilizer rates for chickpea based on a soil test.

Soil test K (ppm) ¹	K ₂ O application rate (lb/acre) ²
0 to 50	80
50 to 75	60
more than 75	0

¹Sodium acetate-extractable K in the 0- to 12-inch depth

²K₂O x 0.83 = K, or K x 1.20 = K₂O

Table 5. Sulfur fertilizer rates for chickpea based on a soil test.

Soil test S (0 to 12 inches)		S application rate (lb/acre)
(ppm SO ₄ -S)	(ppm S)	
0 to 10	0 to 4	20
over 10	over 4	0

Source of Tables 3, 4, and 5: Robert L. Mahler. *Northern Idaho Fertilizer Guide*. University of Idaho, College of Agriculture. Cooperative Extension System, Agricultural Experiment Station. CIS 826 (revised).

germination rate. Packing also reduces header losses by leveling the soil surface and allowing the combine header to be lowered closer to the ground.

Fertilizer and lime

Research on the fertility needs of chickpeas was conducted at the Columbia Basin Agricultural Research Center in 2002 and 2003. The limited amount of information generated indicates that chickpeas are minimally responsive to fertilization with nitrogen (N), phosphorus (P), sulfur (S), or zinc (Zn) under the conditions of the trials.

Nitrogen requirements for chickpea are not well defined, because the crop can fix

its own nitrogen from the air. Nitrogen fertilization seldom increases yield or quality unless soil test values in the top foot of soil are very low. Some growers add 15 to 30 pounds of N prior to planting or at planting to enhance seedling development. High N fertility can inhibit nodulation and crop nitrogen fixation. Suggested fertilizer sources include ammonium sulfate (21-0-0-24) to supply both N and S and ammonium phosphate-sulfate (16-20-0-14) to supply N, P, and S.

Chickpea, like other pulse crops, requires phosphorus, potassium (K), and micronutrients for growth. Tables 3, 4, and 5 are fertilizer guides developed by the University of Idaho

and Washington State University for growers in the Palouse region of northern Idaho and eastern Washington. Eastern Oregon growers can use this information to make decisions on fertilizer applications.

Fertilizer can be broadcast, banded, or drilled with seed. Broadcast applications of P may need to be at a slightly higher rate than banded applications, as P has little soil mobility. Do not let fertilizer contact seed, especially if the fertilizer contains nitrogen or potassium. Chickpea is sensitive to the salts in nitrogen and potassium fertilizers. If you need to make large applications, apply fertilizers before or during seedbed preparation to avoid salt effects.

Chickpea plants need adequate amounts of sulfur to help them fix atmospheric nitrogen. Do not use elemental forms of sulfur. Elemental sulfur must be converted to sulfate-sulfur by soil bacteria before plants can take up the sulfur. Using the sulfate form, such as ammonium sulfate or ammonium phosphate-sulfate, allows plants to readily take up sulfate without the need for bacterial conversion of elemental sulfur to sulfate. The use of elemental sulfur also increases soil acidity (lowers soil pH).

Make boron and molybdenum applications as needed, based on soil tests or personal experience. Use 1 to 2 pounds of boron per acre if soil tests show boron levels below 0.5 ppm. Always broadcast boron (never band it), because it is toxic if placed too near the seed. In northern Idaho, growers add an ounce of molybdenum per acre if soil pH is less than 5.7. Molybdenum typically is applied as a seed treatment.

Consider liming soil to a pH of 6.0 if pH falls below 5.3. Low soil pH leads to reduced yields.

Weed management

Field selection and preparation:

Chickpea is not competitive with weeds. Weed problems have proven to be a major constraint to successful chickpea production, so weed management measures must be planned and implemented carefully.

Perhaps one of the most important considerations is an assessment of the history of weed infestations on a field before planting chickpea. Avoid fields containing large weed seed reserves in the soil due to recent or past weed problems, particularly if broadleaf weeds have been the problem. Planting chickpeas in a field with a history of broadleaf weed problems such as Russian thistle, prickly lettuce, various mustard species, common lambsquarters, various nightshade species, and/or mayweed chamomile (dog fennel) most likely will result in unmanageable weed problems in the chickpea crop.

Weed problems also can be reduced by distributing previous crop residues as evenly as possible to prevent interception of preplant herbicides and to encourage uniform, vigorous emergence of chickpea plants. Also, a preplant or preemergence application of glyphosate can help control seedling weeds and volunteer cereals that emerge just prior to chickpea germination. Appropriate glyphosate application timing prior to crop emergence is important to prevent crop injury.

Grass weed control: A number of selective herbicides are available to control grass weeds such as downy brome, wild oat, jointed goatgrass, and volunteer cereals. The availability of registered herbicide products for selective grass weed management is one of the benefits of growing chickpea in a dryland crop rotation.

An application of sethoxydim (Poast) or quizalofop (Assure II) can be made to actively growing grass weeds at an appropriate stage of weed and crop growth as specified on the herbicide label. These herbicides are foliar active, so the herbicide must contact growing weed plant tissue. If the chickpea crop canopy prevents herbicides from contacting seedling grass foliage, herbicides are less effective. Specific recommendations for application rates and timing can be obtained on the product labels and from the *PNW Weed Management Handbook* (pnwpest.org/pnw/weeds?15W_LEGL06.dat).

Broadleaf weed control: Several preplant or preemergence herbicides are available for



general weed control in chickpea including trifluralin (Treflan) and pendimethalin (Prowl), both of which require soil incorporation. Preplant-incorporated herbicides can provide effective control of many broadleaf and grass weeds, but the need for soil incorporation limits herbicide options in direct-seeded chickpea. Imazethapyr (Pursuit) and other herbicides are registered for use preemergence or preplant incorporated for general weed control. See the *PNW Weed Management Handbook* for a complete list of currently registered products for chickpea.

Broadleaf weeds, including Russian thistle and prickly lettuce, have proven to be particularly troublesome in direct-seeded chickpea. General weed control in noncrop areas around field perimeters and along fencerows can be helpful at eliminating seed sources for these problem weeds. Metribuzin (Sencor) applied as one component of a preemergence herbicide program can be partially effective against these weeds if infestations are not severe. If weeds are present at time of harvest, a desiccation treatment of paraquat (Gramoxone) is registered for use as a harvest aid.

Foliar diseases

Ascochyta blight: The fungus *Ascochyta rabiei*, also known as *Didymella rabiei* or *Phoma rabiei*, causes lesions to occur on all above-ground parts of the chickpea plant. Ascochyta blight is the foliar disease having the greatest potential to destroy chickpea crops. Symptoms include yellowing of infected plant parts and elongated, sunken, dark lesions on stems, leaves, and pods. The lesions weaken leaf stems and branches, causing them to drop off the plant. The pathogen is spread on seed and by rain splash, wind, infested residue, and volunteer plants. Cool, wet weather enhances infection and spreads the disease epidemic.

Ascochyta blight is controlled by a combination of genetic resistance and crop husbandry. Planting certified, disease-free seed of resistant varieties is critical to preventing and controlling the spread of Ascochyta blight. Chickpea should be planted only once

in 3 to 5 years on the same field. Before planting, treat seed with a fungicide such as thiabendazole (TBZ or LSP). Monitor the crop and, if necessary, apply a foliar fungicide such as pyraclostrobin (Headline) or chlorothalonil (Bravo).

If a crop shows symptoms of Ascochyta blight, it is very important to destroy all infested residue after harvest and to kill all volunteer plants. Infested residue can allow spores of the pathogen to be released for up to 3 years. Inversion tillage that buries all residue is effective for breaking the disease cycle.

Recently, the available Ascochyta blight-resistant varieties have been showing more symptoms of the disease as new pathotypes occur. Other resistant varieties are being developed, but the current resistant varieties still reduce disease severity and are valuable for disease control. All chickpea crops should be closely monitored for Ascochyta blight symptoms, especially when cool, moist, and rainy weather has occurred in the previous few weeks.

Bacterial blight: The bacterium *Pseudomonas syringae* causes small, water-soaked lesions on leaves, pods, and stems. The lesions grow together and turn brown. Lesions may completely girdle stems or individual leaves, causing wilting and dying of the entire stem or leaf above the lesion. Damage can be extensive during very moist weather. Plant certified, disease-free seed to minimize bacterial blight.

Fusarium wilt: *Fusarium oxysporum* is a soil-borne fungus that causes leaves to yellow and plants to become stunted. Roots look normal, but plants wilt and die. Affected plants often are scattered across the field rather than occurring in patches. Cutting the stem diagonally with a knife reveals yellow, orange-brown, or reddish streaks in the vascular tissue. Fusarium wilt is controlled by long rotations (4 to 5 years between chickpea crops) and, if available, by planting varieties with genetic resistance.

Phoma blight: The fungus *Phoma medicaginis* causes foot rot and black stem

lesions, often below the soil surface. Plant certified, disease-free seed to minimize Phoma blight.

Sclerotinia stem rot (or white mold):

The fungus *Sclerotinia sclerotiorum* causes white fungal growth on older individual plants, particularly when the spring is cool and wet. The disease seldom causes economic damage to chickpea in areas with low summer rainfall unless the crop is irrigated. Sclerotinia stem rot can be controlled by planting chickpea after one or more cereal crops rather than immediately following another broadleaf crop. If Sclerotinia stem rot occurs, all residue should be buried after harvest.

Viruses: Viruses that infect green pea may infect chickpea. Viruses that cause distinct symptoms on green pea, allowing the disease to be identified visually, generally are indistinct and more difficult or impossible to identify visually on chickpea. Aphids transmit viruses that infect chickpea.

The most important viral diseases in Oregon are stunt (bean leaf roll virus) and yellowing (pea enation mosaic virus). Other diseases include mosaic (alfalfa mosaic virus), necrosis (pea streak virus), and an unnamed disease caused by red clover vein mosaic.

Viruses that are “persistent” in the aphid host cause stunt and yellowing. These viruses persist inside the aphid and require active feeding intervals to be effectively transmitted into new plants. The virus can be transmitted into new plants over repeated feeding periods. Bean leaf roll virus causes a yellowing or reddening of the leaf margin, upward curling of the leaf margin, stunting, and phloem discoloration. Pea enation mosaic virus causes yellowing of foliage and twisting of the seed pod.

Viruses that are “nonpersistent” in the aphid cause mosaic, necrosis, and the disease by red clover mosaic virus. These viruses adhere to the outside of the aphid stylet and may be transmitted when the aphid stylet probes a cell on the chickpea plant. Transmission of the virus does not require active feeding by the aphid. Alfalfa mosaic virus causes very indistinct symptoms, including

yellowing, stunting, and plant death. Pea streak virus also causes yellowing of foliage, wilting of the terminal tip, phloem discoloration, and plant death, particularly when seedlings are infected. Red clover vein mosaic virus causes mosaic symptoms, yellowing and bronzing of leaves, distortion of leaves, severe stunting, and proliferation of axillary buds (rosetting). Yield loss can be 100 percent if red clover vein mosaic virus infects chickpea at the prebloom stage.

Minimizing the level of crop infestation by virus-carrying aphids can control virus diseases.

Root diseases

Seedling damping-off and root-disease complex: Soil-borne fungal pathogens generally act together to cause complex diseases rather than a single disease. Two to five pathogens commonly are identified in the chickpea root-rot complex. Each pathogen may cause seed rot, seedling damping-off, or root rot. Components of the complex may include the following pathogens and diseases: *Aphanomyces euteiches* (Aphanomyces root rot), *Fusarium solani* (black root rot), *Rhizoctonia solani* (wet root rot), *Pythium* species (Pythium damping-off and root rot), and *Thielaviopsis basicola* (black streak root rot).

The complex may reduce emergence and root branching and elongation, and may cause light- to dark-colored lesions on the root surface. Lesions may be either dry or wet and either sunken or superficial. Economic damage is greatest when the root-disease complex is combined with drought, impediments to deep rooting, or other stress factors.

Kabuli-type chickpea varieties have a very thin seed coat that lacks the phenolic compounds that resist infection by soil fungi. Kabuli chickpea, therefore, is particularly susceptible to infection by soil-borne pathogenic fungi. Desi chickpea has a thick seed coat containing phenolic mold inhibitors, causing it to be more resistant to seedling infection.

Damage from the root-disease complex can be minimized but not controlled. The



root-disease complex is best managed by treating seed with a mixture of fungicides (Table 2), by creating seedbed conditions that favor rapid seed germination and seedling emergence, and by planting Kabuli and Desi chickpeas at soil temperatures above 50°F and 45°F, respectively. Chickpea is most prone to damage when planted into soils with pH values below 6.5, into poorly drained sites, or into fields immediately following another pulse crop.

Plant-parasitic nematodes: *Pratylenchus thornei* and *P. neglectus* (lesion nematodes) are present in many nonirrigated fields and may reduce root branching and elongation of chickpea. The lesions they create destroy the outer layers of tissue, causing roots to be narrower. Lesion nematodes may occur in complexes with root-rotting fungi, making diagnosis difficult. Lesion nematodes attack a wide variety of crop species and are difficult to manage with crop rotations. If necessary, crops such as safflower and flax can be used to reduce lesion nematode populations before planting susceptible crops.

Disease control

Use a combination of control measures to limit development of foliar and root diseases. These practices include the following.

- Plant certified, disease-free seed.
- Plant varieties with genetic resistance, if available.
- Treat seeds with a mixture of protective fungicides.
- Use long rotations with chickpea crops separated by 4 or 5 years.
- Do not plant chickpea immediately after another pulse crop.
- Avoid planting chickpea in fields that are poorly drained or acidic (pH < 6.5).
- Assure good fertility for seedling establishment, and try to avoid mixing fertilizer with the seed in the drill box.
- Monitor the crop and apply a fungicide to the foliage, if necessary, to control *Ascochyta* blight.
- Bury all plant residue that exhibited symptoms of *Ascochyta* blight.

Insects

The leaves, stems, and pods of chickpea plants are heavily pubescent (hairy), and the glandular hairs secrete acids that are objectionable to insects. This natural protective mechanism is effective in controlling some insect pests of chickpea.

Cutworms, cabbage loopers, and armyworms cause damage in some years and require insecticide treatment.

See the *PNW Insect Management Handbook* for registered insecticides to control these pests.

Harvesting and storage

Seed color is of utmost importance to buyers. They prefer a light yellowish-cream color as opposed to greenish or brown seeds, so monitor seed color carefully.

Harvesting can be accomplished by either direct combining the crop or swath before combining, depending on uniformity of maturity. Swath when most of the plants are yellow and pods appear nearly matured. To reduce seed loss, swath at night or at dawn when plants are slightly damp. When the vines, pods, and seeds in the windrow have dried down to about 13 percent moisture content, the crop is ready to combine.

Adjust screen sizes and concave clearance when combining to accommodate larger seeds. Adjust cylinder and fan speeds to obtain undamaged seeds and best separation, starting at the lowest speed and increasing speed as necessary. Chickpeas are prone to shatter and header harvesting losses. Using sickle sections equipped with double-density knife guards can substantially reduce losses. Attachments that extend knife finger length and headers equipped with air-reels also have been shown to reduce seed loss. Harvesting losses of less than 100 lb/acre, equivalent to about two seeds/sq ft, are achievable with proper equipment selection.

Store seeds at a moisture content of 10 to 12 percent to prevent disease and insect outbreaks.

Yield potential and markets

Table 6 presents yield data from Moro and Pendleton, Oregon, and Moscow, Idaho.

Grain yields are influenced by the cropping system primarily due to influences on soil moisture. Grain yields generally are lower under a recrop situation than after fallow.

In recent years, the price of chickpeas has declined along with declining pea prices. Market outlook shows potential if properly developed. India, Pakistan, Spain, and Algeria are major importing countries. Others include Italy, Iran, Lebanon, and Libya. Spain and Italy purchase premium-quality Kabuli types, while India and Pakistan demand both Kabuli and Desi types.

Table 6. Grain yields for chickpea varieties in Oregon and Idaho.

Variety/selection	Type ¹	Pendleton, OR ²		Moro, OR ³		Moscow, ID		Overall
		2002	2003	2002	2003	2002	2003	2-year average
lb/acre								
Dwelley	K	302	848	588	923	2,070	1,181	985
Evans	K	400	766	588	923	1,870	1,250	966
Myles	D	1,011	1,060	880	840	2,180	1,437	1,235
Sanford	K	388	863	648	830	1,750	1,287	961
Sierra	K	401	867	656	745	2,420	1,389	1,080
Spanish White	K	—	—	—	—	2,050	1,381	1,716
UC 27	K	—	—	—	—	2,520	1,476	1,998
CA99901604W	K	539	694	703	730	—	1,401	813

¹Type: K=Kabuli, D=Desi

²Recrop situation

³Fallow situation

Source: Machado, S.C. Humphreys, B. Tuck, and M. Corp. 2003. Columbia Basin Agricultural Research Center, Oregon State University, unpublished data. Also, Guy, S. and Y. Wu. 2003. University of Idaho.



For more information

OSU Extension publications

Pacific Northwest Insect Management Handbook (revised annually). \$35

Pacific Northwest Plant Disease Management Handbook (revised annually). \$35

Pacific Northwest Weed Management Handbook (revised annually). \$35

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These publications are available online at eesc.oregonstate.edu, or contact one of the following county offices of the OSU Extension Service: Baker, Clackamas, Crook, Gilliam, Jefferson, Josephine, Klamath, Linn, Malheur, Marion, Morrow, Sherman, Umatilla, Union, Wallowa, Wasco, Yamhill

World Wide Web

OSU chickpea research information is available at the OSU Dryland Cropping systems Web site at www.cerealcentral.com. Detailed chickpea research results are available there.

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