Bulletin No. 664

Dry Pea, Lentil and Chickpea Production in Northern Idaho

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Contents

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Dry Pea, Lentil and Chickpea Production in Northern Idaho

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Recommendations

- Select well-drained fields with soil pH above 5.4.
- Use drainage control measures in waterlogged fields if long-term economic benefits are realized.
- In fields with pH below 5.4, add lime to attain a pH between 5.6 and 6.0.
- Do not plant grain legumes in fields with severe weed, disease and insect problems unless appropriate control measures are available and used.
- Use cultural and pesticide control measures in a timely manner for weeds, diseases and insects.
- Avoid soil compaction during and after seedbed preparation.
- Plant adapted varieties that produce marketable seed.
- Plant high-quality disease-free seed.
- Plant early at recommended rates and depths.
- Apply adequate fertilizer for optimum yields.

Diseases, the pea leaf weevil and drought have reduced pea seed yields in recent years. These factors, accompanied by periodically depressed pea prices, have contributed to lower profits and reduced acreage of peas and increased interest in lentils and chickpeas.

Peas, lentils and chickpeas can offer a number of advantages to cereal producers. Among these are:

1. Reduced incidence of cereal diseases because legumes are not hosts for cereal pathogens.
2. Reduced fertilizer costs since legumes do not need nitrogen (N) and generally do need smaller amounts of other nutrients than cereals. Winter peas used as a green manure crop can fix 80 to 100 pounds of N per acre from the atmosphere (see University of Idaho CIS 652, *Austrian Winter Peas — A Green Manure Crop for Idaho*).
3. Reduced winter annual grass weed problems in cereals.
4. Reduced cereal surpluses and increased market flexibility.

The purpose of this bulletin is to provide growers with current management practices for winter peas, spring peas, lentils and chickpeas. Integration of good management practices can improve yield and quality of these legumes by reducing production problems.

Seedbed Preparation

Spring peas, lentils and chickpeas do best when planted in a seedbed with a minimum of straw residue on the soil surface (Fig. 1). Work the soil when it is moist enough to prevent large clod formation but dry enough to prevent compaction and crusting. Avoid overworking the soil and creating a thick layer of finely pulverized material. If the soil surface has a thick layer of finely pulverized soil, roll it before or after planting. This will improve contact of

Fig. 1. A properly prepared seedbed provides a good environment for seed germination, aids uniform herbicide application and helps ensure good yields.

soil with seed and will improve uniformity and speed of germination. Soils with a high clay content or soils worked too wet are susceptible to crusting if rolled.

Winter peas require a seedbed similar to spring legumes, but where erosion is a problem, the seedbed should have more straw and larger clods on the soil surface. However, heavy straw and large clods prevent good seed placement and reduce herbicide effectiveness. Heavy straw residue also decreases seedling vigor of peas. Decreased vigor may be caused either by increased disease incidence or by toxins released from the straw.

Do not use a roller where erosion is a problem. Most medium-sized clods will disintegrate over the winter and will not be a problem at harvest.

Inoculation

Inoculation of spring peas, winter peas and lentils is not generally needed in fields that previously have raised well-nodulated peas and lentils. The seed should be inoculated with the proper Rhizobia before planting if neither peas nor lentils have been raised in a field for 10 years. The same Rhizobia is effective on both peas and lentils. Chickpeas require a special Rhizobium strain, and the seed must be inoculated with this Rhizobium bacteria before seeding.

Metalaxyl is not harmful to Rhizobium and is a good choice for seed treatment of chickpeas if Pythium is the primary seed and root rot organism (see disease section). Captan seed treatment is detrimental to the survival of Rhizobium, and prolonged exposure of Rhizobium inoculant to Captan must be avoided. Captan-treated chickpea seed should be inoculated with twice the recommended rate of peat-based inoculum just before seeding. Granular inoculum metered through small seed hoppers and placed in the soil near the seed, preferably below the seed, is more effective than coating the seed with a peat-based inoculum. It is also more expensive.

Dates of Seeding

Seed spring peas and lentils as early as possible in the spring at approximately the same time as spring wheat and barley (Fig. 2). In northern Idaho and eastern Washington, soil temperatures at planting depth should be 40°F or above. Delayed seeding often reduces both the quality and seed yield of dry peas.

Plant chickpeas when soil temperatures are 45°F or warmer at planting depth. Planting in soils cooler than 45°F will reduce stands and seedling vigor.

Seed winter peas between September 10 and 15. Early seeding increases winter survival (Fig. 3) and results in better protection against the pea leaf weevil in the spring because plants are larger and more vigorous (see insect section). Early-seeded peas also flower earlier in the spring and avoid some of the hot weather and lack of moisture that limits flowering and seed production in the late-seeded peas.

Rates of Seeding and Row Spacing

Seeding rates vary with legume species and variety. Rates given in Table 1 assume that seed planted has germination percentages above 85 percent and that seedbed preparation and seeding dates are optimum for good seed germination and plant establishment.

Seeding rates of fall-planted winter peas should be 75 pounds per acre for long-vined Melrose and Common win-

Fig. 2. Early seeding of spring peas usually avoids hot weather and produces higher yields than late-seeded peas.

ter peas and 100 to 120 pounds per acre for the short-vined Glacier winter pea. Increase seeding rates 1 pound per acre for each day that seeding is delayed after September 15. Seeding rates should be 90 to 100 pounds per acre for Common and Melrose if seedbeds are cloddy or have heavy straw residue on the soil surface. Glacier should be seeded at 130 to 150 pounds per acre in cloddy or trashy seedbeds.

Chickpeas should be seeded at rates to establish 2 to 3 seedlings per foot of row depending on variety (Table 1). Medium and small seed (900 to 1,100 seeds per pound, respectively) of the large-seeded UC-5 or other "Kabuli" type chickpeas can be used to establish acceptable

Table 1. Seeding rates for peas, lentils and chickpeas grown for seed production under dryland conditions in the Northwest.

Variety	Seeding rate
	(lb/acre)
Spring peas	
Small sieve Alaska, Tracer	125-150
Regular Alaska, Latah, Alaska 81 and Columbian	150-175
Winter peas	
Common or Melrose	
Fall-planted	75
Spring-planted	120
Glacier	
Fall-planted	100-120
Lentils	
Chilean 78, Red Chief, Emerald and Brewer	60
Laird	80
Eston	40
Chickpeas[1]	
Aztec	60
Lyons	80
UC-5	120

[1]See plant population requirements in Rates of Seeding and Row Spacing section.

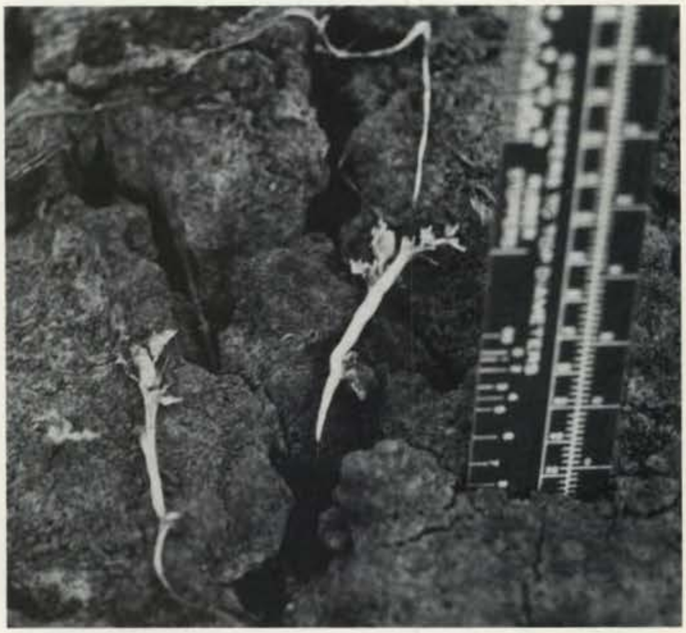

Fig. 3. Late-seeded winter peas are more susceptible to frost heaving and pea leaf weevil damage than early-seeded peas.

stands and yields. Using smaller seed will reduce the seeding costs by reducing the pounds per acre planted. Smaller seed of the same seed lot should not be used for more than two generations as size of the harvested seed also may become smaller.

Peas, lentils and especially chickpeas should be planted in rows 6 or 7 inches apart. Seed yields will be improved, weed control better and maturity earlier than if rows are spaced wider than 7 inches. In our trials, seed size of chickpeas was either slightly increased or not affected by 6- to 7-inch row spacings because fewer seeds were set per pod on plants grown at the narrower row spacings.

Fertilization

Well-nodulated legumes require no nitrogen (N) fertilizer. Peas grown on soils with less than 20 pounds of available N sometimes benefit from 20 to 30 pounds of N applied at the time of seeding. Legumes grown on soils with more than 20 pounds of residual N generally show no response to nitrogen fertilizer. Base the N fertilizer decision on soil test values.

Apply phosphorus (P) to spring peas grown in soils deficient in P, as shown by soil test (Table 2). Broadcast application to the soil surface and incorporation before planting or banding at planting time are both acceptable methods of P application. Banded application of P below the seed generally has given the best yield responses (see University of Idaho CIS 448, *North Idaho Fertilizer Guide: Peas and Lentils*).

Unlike P, potassium (K) is not generally a limiting factor for pea production in most areas. Apply K fertilizer on sandy soils or on soils with low levels of K (Table 2).

Apply sulfur (S) at rates of 15 to 20 pounds per acre annually in soils that show less than 20 pounds residual S per acre. Excessive S can be detrimental to winter peas and lentils because it increases vegetative growth. Increased vegetative growth uses more soil water, may increase incidence of Sclerotinia (white mold) and may ultimately reduce seed yield.

Peas, lentils and chickpeas grown in soils deficient in molybdenum will benefit from molybdenum seed treatment. Molybdenum fertilizer can be toxic and should not be applied unless a definite need has been established. Apply 0.5 ounces sodium molybdate to seed for each acre planted (see University of Idaho CIS 589, *Essential Plant Micronutrients: Molybdenum in Idaho*).

Peas and lentils grown in northern Idaho respond to boron (B) applications (see University of Idaho CIS 608, *Essential Plant Micronutrients: Boron in Idaho*). Boron need can be determined by a soil test. Soils testing less than 0.5 ppm B should receive 1 to 2 pounds of B per acre. Boron can be toxic if application rates are excessive or if B is concentrated too close to the seedling. Boron fertilizer should always be broadcast, never banded.

Soil pH levels below 5.6 will reduce seed yield of both peas and lentils. Between 40 and 50 percent of the agricultural soils in northern Idaho have pH values that low or lower. At soil pH of 5.4 and lower, seed yields of both peas and lentils can be depressed at least 15 percent. Lime should be applied in sufficient amounts to raise soil pH above 5.6 but below 6.0. Response of chickpeas to low soil pH has not been tested, but responses similar to those of peas and lentils are expected. For further information concerning liming or effects of low soil pH on grain legume production, contact the Department of Plant, Soil and Entomological Sciences at the University of Idaho. Consult University of Idaho CIS 448 for further information on fertilizer requirements of these legumes.

Table 2. Guide for phosphorus and potassium fertilization of peas and lentils grown for seed production under dryland conditions in the Northwest.

Soil test sodium acetate extraction	Apply this amount (lb/acre) P_2O_5	K_2O
0- 2 ppm	60	
2- 4 ppm	40	
Over 4 ppm	None	
0-50 ppm		80
50-75 ppm		60
75+ ppm		None

Weed Control

Weed control in peas, lentils and chickpeas is essential for maximum seed yield and seed quality. Wild oat, common lambsquarters, pigweed, mayweed chamomile, nightshades and various mustards are common weed problems in peas. Many herbicides registered for use on spring peas are ineffective for use in winter peas because the weeds either are not present at time of application or are too large for effective control. Tables 3, 4 and 5 are guides for control of annual weeds in peas, lentils and chickpeas. Perennial weed infestations cannot be satisfactorily dealt with in these crops, so apply controls before planting or in rotational crops. Be sure to read and heed the label before applying any herbicide.

Insects of Dry Peas and Lentils

Two insect pests, the pea leaf weevil and pea weevil, are major problems for dry pea production. The pea aphid also attacks peas but is not a pest every year. Lentils are not bothered by either weevil, but the pea aphid and the cowpea aphid commonly attack this crop in northern Idaho and eastern Washington. Lentil seed and sometimes peas can have chalky spot damage caused by sucking bugs such as lygus or stink bugs. Chickpeas grown in the Northwest have not experienced insect problems requiring treatment.

Pea Leaf Weevil

Adult pea leaf weevils (Fig. 4) overwinter in alfalfa and other sheltered locations containing perennial legumes. Adults sometimes are found in winter pea fields during the fall, but they do not cause economic damage. The adult weevil migrates to pea fields during late April and early May. The insect is a heavy feeder and causes severely scalloped edges on leaves and growing points of peas. If the adult weevil population is large enough to affect growth, spraying is necessary to prevent loss of stand and reduced yields (Table 6). See University of Idaho CIS 227, *The Pea Leaf Weevil*, for more details. The adult weevil lays eggs on the soil near the base of pea plants. As the eggs hatch, the larvae burrow into the root zone where they feed on the nodules. They then change to adults and emerge from the soil to repeat the cycle the next year.

Pea Weevil

Adult pea weevils (Fig. 5) overwinter in fence rows, in timbered areas adjacent to fields and in other places that provide protection from the weather. Adults become active before pea blossoming and fly considerable distances to find peas. Adults feed on pollen. This causes no direct damage to the pea crop but does stimulate the ovaries of the female pea weevils to produce eggs. Approximately 6 days after the insects arrive in a field in bloom, they are capable of laying orange-colored viable eggs on pea pods. As they hatch, the larvae eat through the pods and into the developing pea seed. After 5 or 6 weeks, the larvae pupate and the adults eventually emerge from a circular hole cut in the dry pea. If you find two or more

Table 3. Herbicides for weed control in peas grown for seed production under dryland conditions in the Northwest. This table is only to suggest possibilities; follow label directions when using herbicides.[1]

Herbicide	Rate (active ingredient/acre)	Comments (follow label directions strictly)
Weed problem: Annual broadleaf and grass weeds		
trifluralin (Treflan)	.5 to .75 lb	Apply preplant and incorporate thoroughly with rototiller or by discing and cross-discing. Injury to winter wheat, oats and other grass crops planted after peas may occur if conditions are unfavorable for trifluralin decomposition. Apply low rate on sandy and silt soils and higher rate on clay soils. Can be tank-mixed with Far-Go for wild oat control. See label for crop rotation.
ethalfluralin (Sonalan)	.57 to .75 lb	Preplant incorporate thoroughly into top 2 to 3 inches. Don't allow grazing or feeding of peas from treated soil.
glyphosate (Roundup)	.25 to 5 lb	Apply before crop emerges. Kills most emerged weeds. Do not use crop for 8 weeks after application.
metolachlor (Dual 8E)	1.5 to 2.5 lb	Apply during (behind planter) or after planting in 10 or more gallons of water per acre. May be applied by aircraft. Significant control of nightshade; weak on lambsquarters; good on pigweed.
paraquat (Paraquat or Gramoxone)	.5 to 1 lb	Broadcast spray before crop emergence; add surfactant. Kills all emerged foliage.
Weed problem: Annual broadleaf		
bentazon (Basagran)	.75 to 1 lb	Postemergence use after peas have 3 pairs of leaves; suppresses wild mustard, smartweed, hairy nightshade, Canada thistle, purslane. Don't add oil. Poor control if temperatures are below 80°F day and 60°F night.
MCPB (Thistrol, (Can-trol)	.5 lb	Rate is expressed as acid equivalent per acre. Apply when crop has 6 to 12 nodes but 3 nodes before flowering. Suppresses Canada thistle. Do not spray peas if they are stressed for moisture or when temperatures are over 90°F. Do not apply both MCPA and MCPB to the same crop of peas. Injury will result. Don't feed or graze treated crop.
MCPA sodium salt (several manufacturers)	.125 to .375 lb	Rate is expressed as acid equivalent per acre. Apply after 3 nodes develop but at least 3 nodes before the first pea blossom. Do not apply if peas are stressed by lack of moisture or when temperatures are above 90°F. Do not apply both MCPA and MCPB to the same crop of peas. Injury will result. Don't feed or graze treated crop.
metribuzin (Lexone, Sencor)	.25 to .375 lb	Apply after planting but before germination of the crop. Plant peas at least 2 inches deep. Cross-harrow if soil is dry, but not if rain follows application. Avoid coarse-textured soils or stressed crops. Metribuzin has caused some crop stunting and yield reduction, especially on eroded clay knobs and in stressed crops or unusually sensitive varieties. Don't use on soils with less than 1.5% organic matter. Poor control of volunteer grain, nightshade, wild oat.
Weed problem: Wild oats		
propham, IPC (ChemHoe)	4 lb	Apply before planting. Incorporate immediately into top 4 to 6 inches of soil. Plant as soon as possible: not later than 1 to 2 days after application. Does not control wild oat seedlings germinating from deep seed.
triallate (Far-Go)	1.25 lb	Apply before or after planting. Before planting: Incorporate into the top 2 inches of soil and plant. With heavy or trashy soil, incorporate with culti-harrow, duckfoot or spring-tooth cultivations at right angles. Don't use disc implement to incorporate triallate. Can be tank-mixed with Treflan for broadleaf weed control. After planting: Plant crop seed 2 to 3 inches deep, apply chemical and immediately incorporate with a harrowing and cross-harrowing. Do not graze.
diallate (Avadex)	1.25 lb	Apply before or after planting and incorporate according to label directions.
barban (Carbyne, Barban)	.375 lb	Apply when wild oats are in 2-leaf stage 4 to 9 days after emergence. Don't apply after peas reach 6-leaf stage or more than 10 days after crop emerges. See label for grazing or feeding restrictions. Apply in 5 to 10 gallons water per acre with at least 45 psi.
diclofop methyl (Hoelon)	.75 to 1 lb	Use 2⅔ pints on wild oats with 3 to 4 leaves. Don't use if wild oats have more than 4 leaves. Use at least 10 gallons per acre of water and 40 psi; stay 100 feet from surface waters, don't tank mix. Control is not obvious for several days. Don't apply more than once per growing season. Don't graze or feed treated crop.

[1]Trade names in parentheses are provided as examples. No endorsement or criticism of these or other products is implied.

weevils in 25, 180-degree sweeps with an insect net, spray to prevent excessive injury to dry peas (Table 6). Apply an insecticide approximately 6 days after first blooms appear, which will usually be just after pods start to form. (For more details, see University of Idaho CIS 475, *Pea Weevil and Its Control*.) The insecticides prevent the female from laying eggs.

Aphids

Pea aphids and cowpea aphids (Fig. 6) occasionally become numerous and cause injury by sucking the sap from growing plants, which causes foliage and blossoms to wilt and shrivel, and by transmitting a variety of virus diseases. The pea aphid is a large, pale-green insect that feeds on peas and lentils. The cowpea aphid is a smaller, dark blue-gray insect that feeds only on lentils in the Northwest. Aphid infestations that threaten peas or lentils can be controlled with insecticides (Table 6). (For more details, see University of Idaho CIS 748, *Aphids on Peas and Lentils and Their Control*.)

Lygus Bugs

Lentils and occasionally dry peas have a chronic seed quality problem known as chalky spot. Seeds with chalky spot have pitted, crater-like depressions in the seed coat with or without a discolored chalky appearance. Lygus bugs (Fig. 7) and stink bugs feeding on developing pods and seeds of lentils have been identified as the cause of chalky spot.

Seed or grain with chalky spot on more than 3.5 percent of the seeds is down-graded by grain inspection to "sample grade" and the seed market value is discounted. Damaged seeds cannot be separated from otherwise good seed. The damaged seeds are smaller, deteriorate faster in storage, have poor germination and produce abnormal seedlings.

To prevent chalky spot, monitor individual lentil fields for plant development. When the field is in bloom and podding has started, determine numbers of adult lygus bugs. Use a 15-inch sweep net and 180-degree upward sweep, and sample in at least three places in each field

Table 4. Guide for weed control in lentils grown for seed production under dryland conditions in northern Idaho.

Herbicide	Rate (active ingredient/acre)	Guides on use (Read and follow label)
Weed problem: Wild oats		
diallate (Avadex)	1.5 lb	Apply preplant or postplant; incorporate according to directions.
triallate (Far-Go)	1.25 lb	Apply preplant or postplant; incorporate according to directions. Do not graze.
barban EC (Carbyne)	.375 lb	Apply when oats are in 2- to 3-leaf stage and lentils have fewer than 4 leaves. See label for grazing or feeding restrictions.
diclofop methyl (Hoelon)	.75 to 1 lb	Use 2⅔ pints on wild oats with 2 to 4 leaves. Don't use if wild oats have more than 4 leaves. Use at least 10 gpa and 40 psi. Stay 100 feet from surface waters. Don't tank mix. Apply only once per season. Apply to lentils before bloom. Don't graze or feed. Registered for Idaho and Washington only. Control is not obvious for several days.
Weed problem: Annual grasses, broadleaf		
propham, IPC (Chemhoe)	4 lb	Apply and incorporate preplant; seed lentils within 2 days of application for control of shallow germinating annual grasses.
glyphosate (Roundup)	.25 to 5 lb	Apply before crop emerges, kills most emerged weeds. Don't harvest or feed for 8 weeks after application.
Weed problem: Annual grasses and broadleaf weeds		
Sencor 75DF Lexone 75DF	.24 to .375 lb	Apply after seeding but before germination. Incorporate if soil is very dry. Don't use on coarse-textured soil, clay knobs, poorly covered subsoils, soils with less than 1.5% organic matter or on seedings less than 2 inches deep.
metribuzin	.125 to .187 lb	Apply when weeds are less than 6 inches tall. Don't use on coarse-textured soil, clay knobs, poorly covered subsoils, soils with less than 1.5% organic matter or stressed lentils. Often causes lentils to turn chlorotic (light green). Use the lower rate under moist conditions.

[1]Trade names in parentheses are provided as examples. No endorsement or criticism of these or other products is implied.

Table 5. Guide for weed control in chickpeas in northern Idaho.

Herbicide	Rate (active ingredient/acre)	Guides on use (Read and follow label)
Weed problem: Annual grasses, broadleaf		
metolachlor (Dual 8E)	1.5 to 3 lb	Preplant incorporate 1 to 2 inches deep not over 2 weeks before planting or apply preemergence to crop and weeds. Weak on lambsquarters; provides some nightshade control

Fig. 4. Adult pea leaf weevil on pea leaf.

Fig. 5. Adult pea weevil on pea blossom.

Fig. 6. Green pea aphids on peas.

Fig. 7. Adult lygus bugs on flower.

any time from mid-morning to early evening. Consider insecticide treatment if you capture an average of 7 to 10 adult lygus bugs per 25 sweeps. If the field is weed-free or has a history of chalky spot, the risk of lygus bug injury may be higher. Based on a higher risk, you may wish to consider insecticide treatment at a lower average number of adult lygus bugs.

A second insecticide application for lygus bugs should not be necessary most years. However, until details for control are known, a grower may choose to continue sampling for lygus bugs in lentil fields during mid- to late July and early August. Sample with a sweep net in at least three areas of the field during hot afternoons and watch for lygus bug nymphs. The stage of insect development and the development and maturity of the pods will influence the potential for lygus bug-caused chalky spot. Consider a late-season insecticide treatment when you collect 15 or more lygus bug nymphs and adults per 25 sweeps, and most of the pods are green and in the flat to full pod stages. If most of the pods are lemon-colored and maturing rapidly, insecticide treatment will not be worthwhile. However, if the field has high numbers of green pods and harvest is likely to be delayed because of weather or shortage of equipment, use a late-season insecticide treatment to prevent the occurrence of excessive amounts of chalky spot.

Loopers

Loopers can be a minor problem in lentils and peas. Check with your county Extension agricultural agent or fieldman for control recommendations.

Diseases

Seed Rot and Seedling Blight

Seed rot and seedling blight caused by soil-borne fungi can reduce emergence and stands of peas, lentils and chickpeas throughout Idaho. Species of Pythium are the principal cause of seed rot, but *Fusarium solani* and *Rhizictonia solani* also can cause this problem. Seed is infected shortly after planting, and seedlings fail to emerge. Wrinkle-seeded peas and chickpeas appear more vulnerable to seed rot than round-seeded peas or lentils. The pigmentation found in the seed coats of Austrian winter peas is effective in inhibiting seed rot, provided seedcoats are not damaged and remain intact.

Proper use of a seed treatment fungicide can provide cost-effective protection from seed rotting fungi and can help establish vigorous stands. Table 7 lists the major seed treatments available for use on peas, lentils and chickpeas. Protectants such as captan and thiram provide good control of most seed-rotting fungi. Metalaxyl provides excellent control of Pythium species but should be used in

Table 6. Guide for insect control in peas and lentils produced under dryland conditions in northern Idaho.

Insecticide and crop	Rate (active ingredient/acre)	Pre-harvest interval	Guides for use (Read and follow label)
PEAS			
Pea leaf weevil			
Imidan	1 lb	7 10 hay	Spray when growth is held back and damage is evident on growing points.
methoxychlor	1.5 lb	7	
Penncap-M	0.5 lb	10 15 hay	
Pydrin	0.2 lb	21	Do not graze or feed.
Pea weevil			
methoxychlor	1.5 lb	7	Dry peas: Spray when an average of 2 or more weevils are found per 25 180 degree sweeps.
Penncap-M	0.5 lb	10	
Sevin	1.5 lb	3	
parathion	0.5 lb	10 15 forage	
Pydrin	0.1 to 0.2 lb	21	Do not graze or feed.
malathion ULV	0.58 lb	14	
malathion	1.25 lb	3 7 forage	
Imidan	1 lb	7 10 hay	
Pea aphid			
Penncap-M	0.5 lb	10 15 hay	Parathion and Phosdrin are toxic materials and their application is not recommended in the more populated areas where fields are close to dwellings or farm buildings. Graze or feed only if stationary viner is used.
parathion	0.5 lb	10 15 hay	
malathion	1.25 lb	3 7 feed	
dimethoate	.17 lb	0 21	
Phosdrin	0.25 to 0.5 lb	1	
Di-Syston	1 to 2.5 lb	50	Do not graze or feed.
diazinon	0.375 to 0.5 lb	0 4 hay	
Pydrin	0.1 to 0.2 lb	21	Do not graze or feed.
LENTILS			
Lygus bug			
dimethoate	0.5 lb	14	Do not graze or feed.
Penncap-M	0.5 lb	15	Do not graze or feed.
Aphid			
dimethoate	0.25 to .5 lb	14	Do not graze or feed.
Penncap-M	0.5 lb	15	Do not graze or feed.
malathion	1 lb	3	
Western yellowstriped armyworm			
methomyl	0.45 to .9 lb	25	Do not graze or feed.
Dipel worm killer	1.0 to 1.5 lb product		

combination with other fungicides where other species of seed-rotting fungi also are known to reduce stands. Always consult the label to be sure the seed treatment chemical is registered for use on your crop.

Root Rot Complex

Root rot in peas can be caused by several fungi, but is caused primarily by *Fusarium solani* f. sp. *pisi*, and several species of Pythium. Two other fungi, *Aphanomyces euticheS* f. sp. *pisi* and *Thielaviopsis basicola*, are major root rot pathogens of peas in other regions of the United States and do exist in many soils of Idaho. All of these pathogens are soil-borne and can survive in soil for years in the absence of peas or alternate host crops. While not truly seed-borne, these fungi are spread in the residue and dust of contaminated seed lots.

General symptoms of root rots are stunted, nonvigorous plants often yellowing from the base upward and reduced pod numbers. Identification requires early inspection of the roots for any discoloration or decay. Advanced root rot is often the result of more than one pathogen, making exact identification of the initial pathogen difficult.

Because of their longevity in the soil, rotations with nonhost crops are not likely to reduce the soil inoculum level of these pathogens. Avoiding soil compaction (Fig. 8), using resistant varieties (Table 8) and appropriate seed treatment should minimize the impact of root rot on crop quality and yield.

Pythium species, in addition to causing seed rot and damping-off of preemergent seedlings, can cause root rot by attacking root tips and developing lateral roots. The damage caused by Pythium is characterized by watery soft rot, tan to light brown in color, along with ''pruning'' of the root tips. This pathogen is favored by wet soils and soil temperatures between 65 and 75ºF. The systemic action of metalaxyl used as a seed treatment (Table 7) has been effective in providing additional protection from root rot caused by Pythium. Protectants such as Captan have little or no effect on this form of the disease.

Fusarium root rot is favored by warm, dry soil conditions, excessive compaction, soil acidity ($pH < 6.2$), and low soil fertility. Initial infection usually occurs in the seedpiece regions where the cotyledons are attached to the stem, progressing both up to the soil line and down into the root system. Symptoms include a brownish red discoloration of the seedpiece section of the stem and a discoloration of the vascular tissue in the roots appearing as reddish streaks. The discoloration of infected tissue darkens with age. Rotations without peas for 4 or 5 years reduce the severity of Fusarium root rot.

Common root rot caused by *Aphanomyces euticheS* is considered the most destructive disease of peas in the upper Midwest and northeastern regions of the United States. Like Pythium, this pathogen is favored by cool, wet soils

Fig. 8. Soil compaction caused by plow and wheel traffic restricts root growth of peas, making peas more susceptible to root rot and moisture stress.

Table 7. Guide for seed treatment fungicides in peas, lentils and chickpeas in Idaho. (Always refer to the product label.)

Fungicide	Crop[1]	Rates (ai/cwt)	*Pythium spp.* Seed rot	*Pythium spp.* Damping off	*Pythium spp.* Root rot	*Fusarium solani* Seed rot	*Fusarium solani* Damping off	*Fusarium solani* Root rot	*Rhizoctonia* Seedling blight	*Ascochyta* blight
Benomyl	CP	5.0 oz								X[2]
Captan	P, L	0.8 to 1.3 oz	X[3]	X		X	X		X	
	CP	1.0 to 1.5 oz	X	X		X	X		X	
Metalaxyl	P,L,CP	0.25 to 0.50 oz	X	X	X					
PCNB +	P	0.50 to 1.00 oz +								
Terrazole	P	0.125 to 0.25 oz	X	X		X	X		X	
Thiabendazole (TBZ) Mertect LSP	CP	14 fl oz[4]								X[2]
Thiram	P	1.5 oz	X	X		X	X		X	

[1]P, L and CP indicate registration for use on peas, lentils and chickpeas, respectively.

[2]For control of seed-borne *Ascochyta rabiei* only. Will not protect from any postemergent foliar infections.

[3]Indicates activity of fungicides on pathogens for listed crops.

[4]Rate is 14 fl oz of product.

and is often associated with poorly drained areas. Infection usually occurs shortly after emergence, but plants can be infected at any growth stage. Infected roots show straw- or mustard-colored lesions in the cortex tissue between vascular strands. Pulling plants from the soil usually strips the remaining cortex from the affected roots, leaving only strands of the vascular tissue. Aphanomyces is known to exist in some soils of northern Idaho. It can persist at unsafe levels for at least 8 years without the production of peas. Beans and alfalfa are alternate hosts. No resistant varieties or effective chemicals exist for control of this disease. Because the disease persists in the soil, fields moderately to heavily infested with Aphanomyces should not be planted to peas.

Thielaviopsis or black root rot is a severe pea disease in the northeastern United States and occurs in pea-producing areas throughout Idaho. Less is known of the importance of this pathogen in the pea root rot complex than the other root rot fungi. Thielaviopsis attacks both the taproot and lateral roots, causing charcoal black lesions in the infected regions of the root. Greenhouse studies indicate Thielaviopsis is pathogenic to chickpeas, but its importance as a disease under field conditions is not understood. The only control measure now is to avoid fields with a known history of severe Thielaviopsis root rot.

Ascochyta Foot Rot

This fungus (*Phoma medicaginis* var. *pinodella*) overwinters in the soil in infected plant debris. It also can be seed-borne, but little evidence of seed-borne infection has been found in the Northwest.

Symptoms of this disease are purple spots on the surface of leaves and stems. On leaves these spots often enlarge and turn black or brown. On the stems the lesions can vary from purple to black in color and may be several inches long. Infected stems may die. Pods may become infected, resulting in diminished quality of processing peas and allowing seed-borne dissemination of Ascochyta in dry peas.

No fungicides are registered for control of this fungus. To control Ascochyta culturally, grow peas on a minimum of 3- to 4-year rotations, completely bury all pea refuse during cultivation, and use resistant varieties as they become available.

Sclerotinia White Mold

This fungus survives for many years in the soil in small, black, hard bodies called sclerotia. It has many alternate hosts including beans, rape, alfalfa, lentils and potatoes. The organism sporulates in the early summer and may infect plants by field contact or by spores. The fungus invades pea tissue where it contacts the soil or dead plant material and may spread an inch or two from the site of infection. Heavy, dense stands, especially when accompanied by free moisture or high humidities, favor development of the disease.

Symptoms include infected leaves and stems that turn brown and appear water-soaked. Tissue above lesions wilts and turns brown and eventually dies prematurely in hot weather. A white moldy growth may be evident on plant tissue in later stages. Sclerotia are formed in stems and serve as an overwintering structure.

Chemical control of Sclerotinia in peas is not yet possible. Excessive seeding rates may enhance the development and spread of this disease. Glacier winter peas show some tolerance to Sclerotinia because this variety has an upright growth habit, but no varieties have resistance to the disease. Some experimental lines have shown tolerance to Sclerotinia under greenhouse conditions.

Fusarium Wilt

Two races of Fusarium wilt (*F. oxysporum*) are prevalent in the dry pea growing areas of eastern Washington and northern Idaho. Race 1 attacks peas in about the sixth node but before bloom. It causes a brick red discoloration and plugs the conducting tissues in the stem or root. Infected plants wilt and die, usually before bloom. Nearly all dry pea varieties grown in the area are resistant to Race 1 (Table 8). Race 2 of the wilt fungus attacks peas just after bloom and causes similar vascular discoloration. Infected plants wilt and die. Race 2 only attacks occasional plants in a stand and does not cause an economic loss.

Ascochyta Blight of Chickpeas

Caused by the fungus *Ascochyta rabiei*, Ascochyta blight is the principal foliar disease of chickpeas in northern Idaho and eastern Washington. Symptoms are elliptical-shaped lesions occurring on the stems, leaves and pods. These lesions have concentric whorls of dark fruiting bodies called pycnidia. The lesions often girdle entire stems, causing upper portions of the plant to yellow, wilt and eventually die. Infection and spread is favored by wet weather occurring at moderate (65 to 75°F) air temperatures. Wind-driven rains or contaminated equipment and clothing can move spores from field to field. Chickpea fields infected with Ascochyta blight exhibit yellow areas that increase in size during cool, wet weather. Infected plants often recover with the onset of warmer, drier weather but will mature later and yield less than noninfected plants.

Ascochyta blight is spread through either infected crop residue or by infected seed. The use of certified, disease-free seed treated with either benomyl or thiabendazole (Table 7) should minimize the seed-borne spread of this disease. *Ascochyta rabiei* is short-lived in the soil if crop residues are adequately incorporated. Infected residue remaining on or near the soil surface can provide a source of inoculum for at least 2 to 3 years. Limiting the production of chickpeas to once in 4 years and tillage that incorporates chickpea residue should minimize the recurrence of Ascochyta blight. Delaying seeding dates will reduce the impact of this disease but also can reduce potential crop yield.

Variety Choice

Spring Peas

Four improved varieties of spring peas are currently available to Palouse growers (Table 8). Recent market expansions of the larger dark green cotyledon peas in the Indian market require most growers to produce either Columbian or Alaska 81. Other markets still accept regular Alaska. Production of a high-quality crop should bear equal importance with final seed yield. Latah is still the preferred yellow pea and Tracer the preferred variety of small sieve Alaska. Umatilla is a new variety of yellow pea developed by the Agriculture Research Service at Pullman, Washington. It has improved seed quality and slightly higher yields but has not been adequately tested in northern Idaho.

Winter Peas

The old Common and Melrose winter peas continue to be preferred by growers who wish minimal inputs into their winter pea crop and who will use some or all of the crop as green manure to satisfy set-aside requirements. Growers willing to provide more intensive management have achieved consistently higher seed yields with the semi-dwarf variety Glacier (Table 8). Glacier requires higher planting rates, earlier seeding and better weed control practices than Melrose or Common, as well as more careful monitoring for pea leaf weevil damage in the spring. Glacier performs better in production areas that have consistent losses to Sclerotinia white mold and Fusarium wilt, race 1.

Table 8. Varieties of spring peas, winter peas, lentils and chickpeas for production in northern Idaho.

Variety	Seed color	Attributes
Spring peas		
Alaska 81	Green	Darker green cotyledons and more bleach resistant than regular Alaska or Garfield. This variety is resistant to Fusarium wilt, race 1, and tolerant to Fusarium root rot.
Columbia	Green	Very dark green cotyledons and highly resistant to bleach. This variety also is resistant to Fusarium wilt, race 1.
Tracer	Green	Small sieve, tall, weakly upright vine, better yield and more tolerance to bleaching than other small sieve strains. Resistant to Fusarium wilt, race 1, and tolerant to root rot.
Latah	Yellow	Larger, more uniform seeded than Common First and Best; resistant to Fusarium wilt, race 1, and tolerant to root rot. Vine heights and maturity similar to First and Best. Yield slightly better than First and Best.
Umatilla	Yellow	Slightly higher yielding and better seed quality than Latah. Not extensively tested in northern Idaho.
Winter peas		
Common	Yellow	Old land variety composed of a mixture of genotypes. Susceptible to Fusarium wilt, race 1, powdery mildew and the pea leaf weevil. Some tolerance to Ascochyta. Seed yields generally lower than Melrose.
Melrose	Yellow	Seed size similar to Common but more tolerant to Ascochyta and the pea leaf weevil, more winter hardy. Susceptible to Fusarium wilt, race 1. Yield approximately 10% better than Common.
Glacier	Yellow	Semi dwarf variety of winter peas that is resistant to Fusarium wilt, race 1, and tolerant to white mold. Susceptible to the pea leaf weevil. Yield approximately 25% higher than Melrose or Common with proper cultural practices.
Lentils		
Chilean 78	Yellow	Intermediate-sized seed with yellow cotyledons and light brown to black seed coat coloration. Sold on the market as a "green" lentil.
Brewer	Yellow	Slightly larger seeded and higher yielding than Chilean 78 lentils. Similar in seed appearance and potential market.
Emerald	Green	Green seed coats with green cotyledons. Seeds are slightly larger than Chilean 78. Markets not yet fully developed.
Red Chief	Red	Similar in seed size and seed coat color to Chilean 78 lentils. Seed yield and pest resistance are similar to Chilean.
Laird	Yellow	Large-seeded lentil with green seedcoat similar in appearance to Chilean 78. In the higher rainfall areas, yields have been equivalent to Chilean 78.
Eston	Yellow	Small-seeded lentil developed in Canada. This green lentil is sold to specialty markets.
Indian Head	Yellow	Small black-seeded variety used as a green manure crop in Canada.
Chickpeas		
UC-5	Kabuli	Large-seeded, white seed-coated variety developed in California. Standard of U.S. chickpea trade.
Suratato	Kabuli	Slightly larger-seeded type with a unifoliate leaf. Better quality than UC-5 but lower yielding.
Lyons	Small Kabuli	Smaller-seeded than UC-5 but higher yielding and earlier maturing than any other existing variety.
Aztec	Desi	Small-seeded, brown seed coat variety sold to specialty markets. Lower yielding and earlier maturing than UC-5.
Tammany	Kabuli	Similar to Suratato in seed size and plant morphology. Yields less than UC-5.
Garnet	Desi	Similar to Aztec.

Lentils

Chilean 78 is a selection of the original Chilean land race of lentils that has more uniform seed shape and is free of false lentils (Table 8). Brewer is an improvement of Chilean 78, while the Canadian varieties, Laird and Eston, represent the largest and smallest seed sizes, respectively, of current lentil varieties. These green lentils have tan seed coats and yellow cotyledons and represent our largest lentil market. Care must be taken in warehousing and marketing both Laird and Eston because of seed size and market. While these varieties demand premiums in certain markets, they cannot be commingled with the Chilean 78 and Brewer varieties.

Red Chief and Emerald represent seed cotyledon types that are exported to smaller markets. The decorticated red cotyledon lentil, Red Chief, and the green cotyledon lentil, Emerald, have good potential to expand domestic markets.

Indian Head is a small-seeded, black seed-coated lentil used as a green manure crop in the extremely dry areas of the Canadian provinces. Its production as a seed or green manure crop in the Palouse region has not been adequately tested.

Chickpeas

Growers need to be careful to select varieties that have both proven markets and proven adaptation (Table 8). Seed lots of these varieties should have been field-inspected and seed-assayed to ensure they are free of *Ascochyta rabiei*. UC-5 has been the most successful variety, but seed lots free of Ascochyta are not currently available. If sufficient markets develop, the Lyons variety will offer the greatest utility to Palouse growers.

Aztec has the smallest seed of adapted varieties. Aztec seeds have brown seedcoats and are sold to domestic ethnic markets. Production of Aztec for export is currently not economically feasible. The two chickpea varieties released by the Agriculture Research Service at Pullman, Washington (Tammany and Garnet) may have some use if disease-free seed can be produced.

Guide for Successful Grain Legume Production

Producing optimum yields of grain legumes with minimum input costs requires integration of the practices recommended in this bulletin. Omitting one or more important practices can reduce yields and increase production costs.

Successful production begins with selection of both the crop species and the specific variety adapted to the environmental stresses of the production area. Weed, insect and disease stresses and marketing will influence variety selection.

Field selection is equally important for profitable grain legume production. Fields that are waterlogged during the growing season, that have soil pH below 5.4 or that are known to be heavily infested with a weed, insect or disease problem should not be planted to grain legumes unless appropriate control measures are used. Drainage systems in waterlogged fields, liming in fields with soil pH below 5.4 and use of appropriate pesticides in fields with severe pest problems may make grain legume production possible in those fields. However, the grower needs to determine if long-term economic benefits to the whole rotation can be realized from such practices.

Careful seedbed preparation and planting practices prevent many difficulties associated with grain legume production. This ensures that grain legumes are produced under more favorable environmental conditions which reduce the impact of pests and save input costs. Planting early, avoiding soil compaction and using good seed of high vigor and germination are especially important for optimum production.

Proper timing of all production operations is probably the most crucial element. Plan ahead for grain legume production by developing a production guideline and schedule of operations before planting the crop. You can find further information on production practices for grain legumes in the references at the end of this bulletin, by contacting the authors and from local Extension agricultural agents.

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