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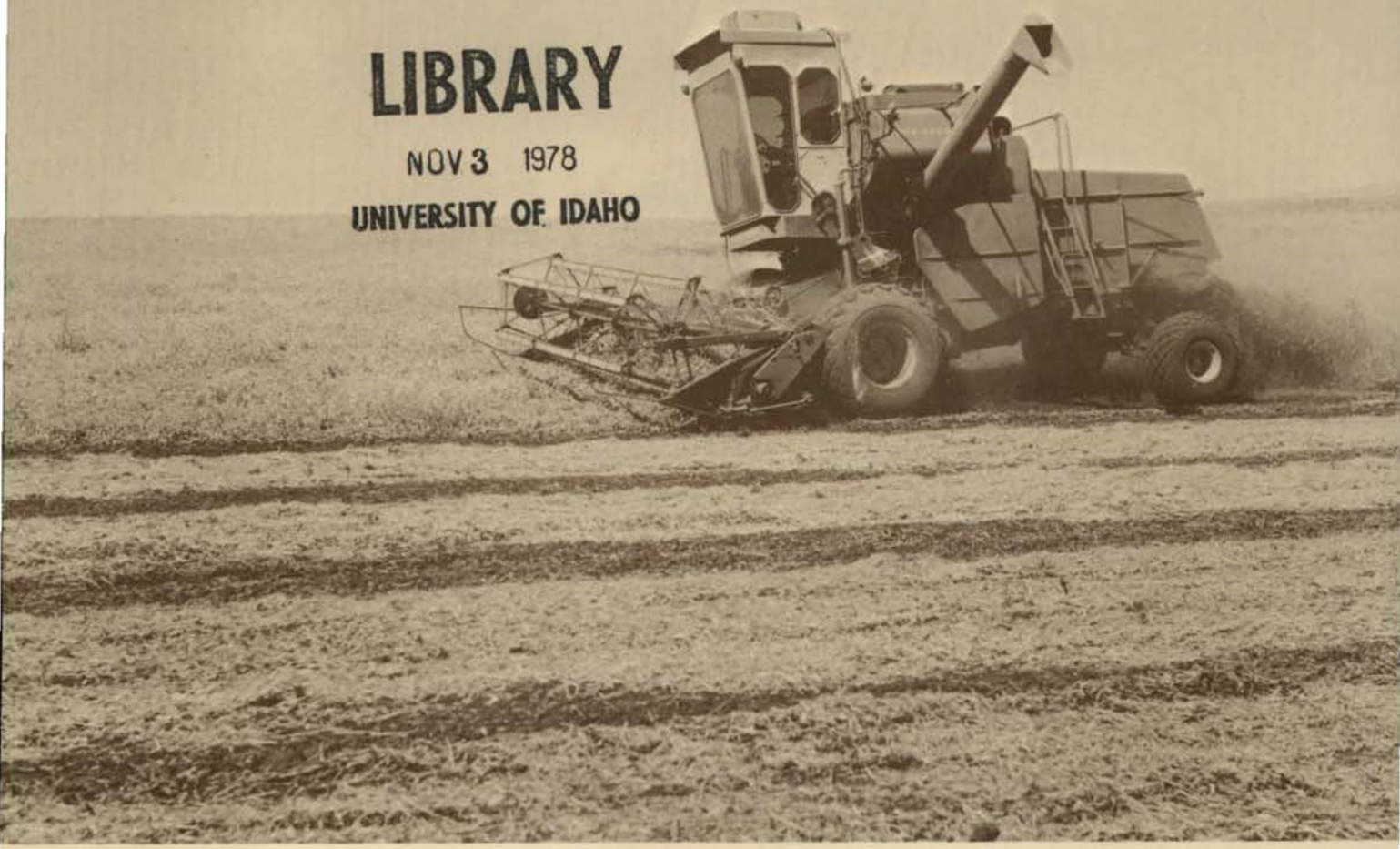

Dry Pea and Lentil Production In the Pacific Northwest

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Dry Pea and Lentil Production In the Pacific Northwest

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Spring peas, winter peas and lentils offer a number of advantages to cereal producers. Among these are:

1. Crop rotations with legumes reduce cereal diseases because legumes are not hosts for cereal pathogens.
2. Legumes require less fertilizer than cereals.
3. Winter peas as a green manure crop provide up to 80 pounds of nitrogen per acre and add organic matter to soils.
4. Legumes in the rotation improve control of grassy weeds.
5. Legumes in the crop rotation help broaden market possibilities.

Problems with diseases, the pea leaf weevil and drought have reduced seed yields in recent years. These factors accompanied by periodically depressed pea prices have contributed to lower profits and reduced acreage of peas.

The purpose of this bulletin is to provide growers with current management practices for the production of peas and lentils. These practices can improve yield and quality of peas and lentils by reducing disease, insect and other environmental problems.

Seedbed Preparation

Spring peas and lentils do best when planted in a seedbed with a minimum of straw residue on the soil surface. Work the soil when 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 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 peas. Because of erosion problems, leave more straw and larger clods on the soil surface. Where erosion is a problem, do not use a roller. Heavy straw and large clods prevent good seed placement and heavy straw residue on the soil surface also appears to decrease seedling vigor of peas. This may be caused by an increase of pea diseases or by toxins released from the straw. Most medium-sized clods will disintegrate over the winter and will not be a problem at harvest.

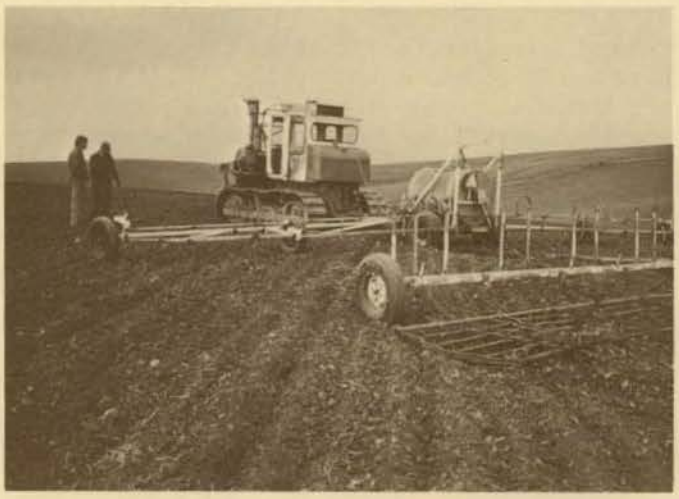


Fig. 1. A good seedbed for peas and lentils has relatively little straw on the soil surface and few clods.

Planting Practices

Rates of seeding depend on variety of pea or lentil planted, seedbed preparation and moisture availability (Table 1).

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. In northern Idaho and eastern Washington, plant peas as early as March 25 at the lower elevations and May 1 at the higher elevations. Delayed seeding often reduces both the quality and seed yield of dry peas. Seed lentils about the same time as or even slightly earlier than peas.

Seed winter peas between September 10 and 15. Early seeding increases winter survival and results in better protection against the pea leaf weevil in the spring because plants are larger and more vigorous. Early-seeded peas also flower earlier in the spring and avoid some of the hot weather that limits flowering and seed production in late-seeded peas. Delay seeding if a suitable seedbed cannot be prepared because of lack of moisture. For each day that seeding is delayed after September 15, increase the seeding rate 1 pound per acre. Seeding rates should be 90 to 100 pounds per acre if seedbeds are cloddy or have heavy straw residue on the soil surface.

Fertilization

Spring peas require less nitrogen fertilizer than cereals. Peas grown on soils deficient in nitrogen sometimes benefit from 20 to 30 pounds of N applied at the time of seeding. Peas grown on soils with moderate to high levels of residual nitrogen generally show no response to nitrogen fertilization. Base the N fertilizer decision on soil test values.

Apply phosphorus to spring peas grown in soils deficient in phosphorus, as shown by soil test (Table 2). Banded application of phosphorus below the seed has generally given the best yield responses.

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

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

Weed Control

Weed control in peas and lentils is essential for maximum seed yield and seed quality. Wild oats, lambsquarter, pigweed and various mustards are common weed problems in peas. Herbicides registered for use on spring peas are generally ineffective on winter peas because the weeds either are not present at time of application or are too large for effective control. Tables 3 and 4 are guides for weed control in peas and lentils. Be sure to read and heed the label before applying any herbicide.

Fig. 2. Early seeding in a well-prepared seedbed produces best yields and quality of peas and lentils. Both crops do well in the Palouse region.

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

Variety	Seeding rate[1] (lb./acre)
Spring Peas	
Small sieve Alaska	125-150
Regular Alaska	150-175
Garfield	150-175
Tracer	125-150
Latah	150-175
First and Best	150-175
Winter Peas	
Fenn or Common — Fall-planted	75
— Spring-planted	120
Lentils	
Common	60

[1]If seedbed is rough or large amounts of straw residue are present, increase seeding rate. If precipitation and soil moisture are lower than normal, decrease seeding rate.

Table 2. Guide for fertilization of peas and lentils grown for seed production under dryland[1] conditions in the Pacific 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

[1]Under irrigation more P and K can be applied.

[2]Potassium values are estimates based on experience. No correlation values are available.

Table 3. Guide for weed control in peas grown for seed production under dryland conditions in the Pacific Northwest.

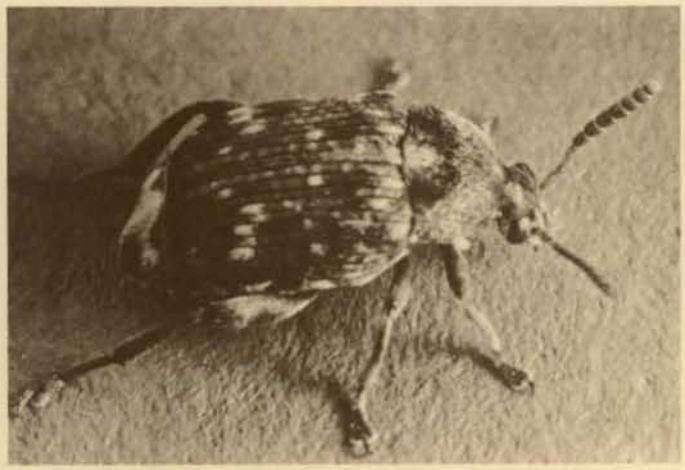
ALWAYS REFER TO THE LABEL

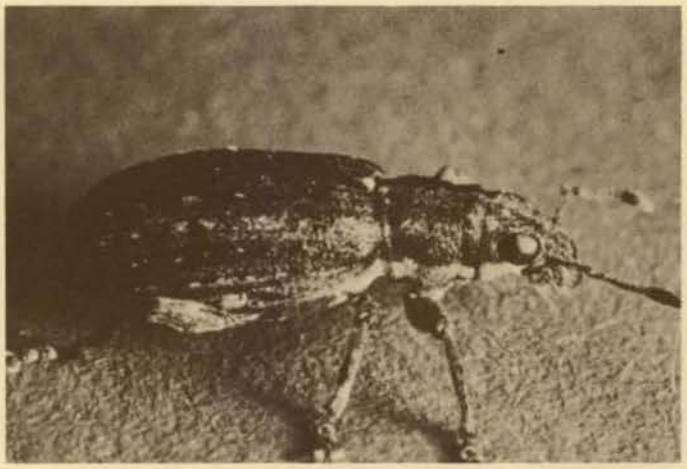
Herbicide	Rate (active ingredient/acre)	Guides on use (Read and follow the label)
Weed problem: Annual broadleaf and grass weeds		
Treflan (trifluralin)	½ to ¾ lb. (1 to 1½ pt.)	Apply preplant and incorporate thoroughly with rototiller or by discing and cross-discing. Injury to winter wheat, oats and other grass crops planted after peas may occur if conditions are unfavorable for decomposition. Apply low rate on sandy and silt soils and higher rate on clay soils.
Cobex (dinitramine)	1/3 to ½ lb. (1 1/3 to 2 pt.)	Apply preplant and within 24 hours incorporate thoroughly in top 1½ to 2 inches of soil. Gives good nightshade control. Use low rate on sandy soils and high rates on clay soils.
Weed problem: Annual broadleaf		
Premerge 3 (dinoseb alkanol amine salt)	Preplant: 6 to 9 lb. 2 to 3 gal. Postmergence: ¾ to 2¼ lb. (1 to 3 qt.)	Apply in 30 gal. of water per acre as a broadcast spray after planting but before emergence of the crop. Apply in 30 gal. of water per acre as a broadcast spray or 5 to 10 gal. of water per acre by aircraft. Apply before bloom when peas are 2 to 8 inches tall and weeds are small. Check label for temperature and moisture requirements. Some foliage burn of peas may occur but plants will recover within a few days. Do not graze or feed for 6 weeks.
Dow Selective or Sinox W (dinoseb or DNBR) (ammonium salt)	½ to ¾ lb. (2 to 3 qt.)	Apply when peas are 4 to 8 inches tall, before pea flower buds appear. Follow label precautions as to hardening off of plants. Do not apply within 6 weeks of harvest. Do not graze or feed treated forage to livestock within 6 weeks after spraying.
MCPB	½ lb. (2 pt.)	Apply when crop has 6 to 12 nodes but 3 nodes before flowering. Do not spray peas if they are stressed for moisture or when temperatures are over 90°F. DO NOT GRAZE OR FEED FORAGE FROM TREATED FIELDS.
MCPA sodium salt	⅛ to ⅜ lb. (½ to 1½ pt.) (2 lb./gal.)	Apply after 3 nodes develop but at least three nodes before the first pea blossom. Do not graze or feed treated fields. 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.
Weed Problem: Wild Oats		
ChemHoe (propham IPC)	4 lb. (4 qt.)	Apply before planting. Incorporate immediately into top 3 to 6 inches of soil. Plant as soon as possible: not later than 1 to 2 days after application.
Avadex BW (triallate) (dry peas only)	1¼ lb. (1¼ qt.)	Apply before or after planting. BEFORE PLANTING: Incorporate into the top 2 inches of soil and plant. With heavy or trashy soil, incorporate with 2 light discings or spring tooth cultivations at right angles. For light or easily worked soils, incorporate with 2 harrowings at right angles. AFTER PLANTING: Plant crop seed 2 to 3 inches deep, apply chemical and immediately incorporate with a harrowing and cross-harrowing.
Avadex (diallate)	1¼ lb. (1¼ qt.)	Apply before or after planting and incorporate the same as for Avadex BW.
Carbyne (barban)	⅜ lb. (3 pt.)	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. DO NOT GRAZE. Do not apply in more than 5 gal. water per acre.

Table 4. Guide for weed control in lentils grown for seed production under dryland conditions in the Pacific Northwest. (Always refer to the label.)

Herbicide	Rate (active ingredient/acre)	Guides on use (Read and follow label)
Weed Problem: Wild Oats		
Avadex (diallate)	1 to 1½ (1 to 1½ qt.)	Apply preplant; incorporate into top 2 inches of soil.
Avadex BW (triallate)	1¼ lb. (1¼ qt.)	Apply preplant; incorporate into top 2 inches of soil.
Carbyne (barban)	⅜ lb. (3 pt.)	Apply when oats are in 2 to 3 leaf stage and lentils have fewer than 4 leaves. Do not graze.

Herbicide	Rate (active ingredient/acre)	Guides on use (Read and follow label)
Weed Problem: Annual grasses, broadleaf, wild oats		
Chemhoe (propham IPC)	4 lb. (4 qt.)	Apply preplant; seed lentils within 2 days of application.
Weed Problem: Annual grasses, broadleaf		
Premerge-3 (dinoseb alkanol amine salt)	2¼ to 3 lb. (3 to 4 qt.)	Apply as soon as possible; at least 5 days before emergence of lentils. Seedbed free of clods and trash.





Figs. 3 and 4. The two major insect pests of peas are the pea weevil (left) and the pea leaf weevil (right).

Insects of Dry Peas and Lentils

Two insect pests, the pea leaf weevil and pea weevil, are major problems in dry pea production. The pea aphid also attacks peas but is only an occasional pest. Lentils are not bothered by either weevil, but pea aphid and the cowpea aphid commonly attack this crop in northern Idaho and eastern Washington.

The adult **pea leaf weevil** overwinters in alfalfa and other sheltered locations containing perennial legumes. Some adult weevils also are found in winter pea fields during the fall but they do not cause economic damage. The weevil migrates to pea fields between April 25 and May 19. The insect is a heavy feeder and causes severely scalloped edges on leaves and growing points of peas. If enough adult weevils are present to prevent growth of peas, spraying is necessary to prevent loss of stand and reduced yields (Table 5). When feeding on peas the adult weevil lays eggs on the soil near the base of the plants. As the eggs hatch, the larvae burrow into the root zone where they feed on the nodules of the pea plant until the plants mature. They then change to an adult weevil and emerge from the soil to repeat the cycle the next year.

The **pea weevil** overwinters in fence rows, in timbered areas adjacent to fields and in other places that provide protection from the weather. Adults become active just before pea blossoming and fly considerable distances to find peas. Adults feed on pea pollen which causes no direct damage to the pea crop but does stimulate the ovaries of the female pea weevils to produce viable eggs. Approximately 6 days after the insects arrive in a field in bloom, they are capable of laying viable eggs. The orange-colored eggs are laid on pea pods. As they hatch, the larvae eat through the pod 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 weevils in 25 180-degree sweeps with an insect net, spray to prevent excessive injury to dry peas (Table 5). Apply the chemicals approximately 6 days after first blooms appear which will usually be just after pods start to form. The insecticides prevent the female from laying eggs.

Pea aphids and **cowpea aphids** occasionally become very numerous and cause injury by sucking the sap from growing plants, causing 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 which feeds only on lentils in our area. If aphid infestations on peas or lentils are severe enough to cause the plants to wilt, you can control them with insecticides (Table 5).

Table 5. Guide for insect control in peas for seed and forage production under dryland conditions in the Pacific Northwest. (Always refer to the label.)

Insecticide	Rate active ingredient/ acre	Interval between last application and harvest	Guides for use (Read and follow label)
Pea Leaf Weevil			
Imidan	1 lb.	7 days	Spray when pea growth
Methoxychlor	1½ lb.	7 days	is held back and dam-
Penncap-M	½ lb.	10 days	age is evident to grow- ing points
Pea Weevil			
Imidan	1 lb.	7 days	Dry peas: Spray when
Methoxy- chlor	1¼ to 1½ lb.	7 days	an average of two or more weevils are found
Penncap-M	½ lb.	10 days	per 25 180° sweeps with
Parathion	½ lb.	10 days	a net.
Parathion	½ lb.	15 days	(pea forage)
Malathion	1¼ lb.	3 days	
		7 days	(pea forage)
Malathion ULV	8 oz.	14 days	(pea forage)
Pea Aphid			
Penncap-M	½ lb.		Parathion is a hazard-
Parathion	½ lb.		ous material and its
Malathion	1¼ lb.		application is not rec- ommended in the more populated areas where fields are close to dwell- ings or farm buildings.

Malathion at 1.25 pounds per acre is the only registered chemical for controlling pea aphid and cowpea aphid in lentils. The same chemical also controls loopers, a minor problem in lentils. No insecticide is now registered for control of another minor insect pest on lentils, the western yellow-striped armyworm.

Pea Diseases

Root rot, Ascochyta and Sclerotinia (white mold) appear to be the most economically important diseases of peas in northern Idaho, eastern Washington and eastern Oregon. No economically feasible chemical control for these diseases is available. To reduce severity of these diseases, plant the most disease-resistant varieties available, use high-germinating certified seed, use adequate seed treatment fungicides and use cultural practices that maintain good soil fertility and tilth.

Root Rot Complex

The root rot complex of this area is caused primarily by the fungi *Fusarium solani* f. sp. *pisi* and *Pythium ultimum*. These pathogens are soilborne and can survive in soil for long periods even though no peas are grown.

If plants in a problem field are stunted, if the leaves are yellow from the base upward or if the plants appear unhealthy, suspect root rot. To identify which organism, dig the plants and recover as much of the root system as possible. Carefully wash the soil off the root and examine the root for decay.

Pythium can cause a seed rot, pre- and post-emergence damping off and a root rot by attacking the root tips and lateral roots. Plants attacked by *Pythium* generally have a watersoaked appearance. This pathogen is more active when soil conditions are wet. *Fusarium,* favored by warm, dry soil conditions, usually attacks the lower part of the stem where the seed is attached and invades both up to the soil line and down into the root zone. *Fusarium* symptoms are a brownish red discoloration at the seed attachment area, and deep red color on the conducting tissues of the root.

Fig. 5. Thin, darkened roots of common Alaska peas (left) are symptoms of root rot infection. New Garfield variety (right) is tolerant to root rot. Note extensive development and light color of roots.

Ascochyta

This fungus overwinters in the soil in infected plant debris. It also can be seedborne but little evidence of seedborne infection has been found in the Pacific Northwest. Spores originating from the overwintering fungus are discharged in the spring and are disseminated by wind and rain. In northern areas, a second sporulation may occur in June. Wind may spread these spores one-fourth mile or more. High moisture conditions over a relatively large temperature range are conducive to the spread of this disease.

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 may be purple to black in color and several inches long. Infected stems may die. Pods may become infected, resulting in diminished quality of processing peas and allowing seedborne dissemination of Ascochyta in dry peas.

Control of this fungus by fungicide application is not possible at this time. To control culturally, grow peas on a minimum of 3- to 4-year rotations. Completely bury all pea refuse during cultivation. Use resistant varieties as they become available.

Sclerotinia

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 and lentils. The organism sporulates in the early summer and may infect plants by direct 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 — Infected leaves and stems turn brown and appear water-soaked. Tissue above lesions wilts and turns brown and eventually dries 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.

Control in peas is not possible by fungicide application at the present time. Planting at excessive rates may enhance the development and spread of this disease. No existing varieties have resistance to Sclerotinia but experimental lines have shown some tolerance under greenhouse conditions.

Fusarium Wilt

Two races of Fusarium Wilt are prevalent in the dry pea growing areas of eastern Washington and northern Idaho. Fusarium Wilt caused by *F. oxysporum,* 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. Race 2 of wilt fungus attacks peas just after bloom and causes similar vascular discoloration. Infected plants wilt and die. Race 1 may attack up to 100% of a pea stand, but race 2 only attacks occasional plants in a stand and does not cause an economic loss.

Control — Use varieties resistant to race 1.

Variety Choice

Spring pea growers can choose from several varieties; winter pea and lentil growers have fewer choices (Table 6). For information concerning freezing and processing types, contact local commercial companies and extension agents.

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Table 6. Varieties of spring peas, winter peas and lentils for seed production in the Pacific Northwest.

Variety	Seed Color	Attributes
Spring Peas		
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.
Garfield	Green	Larger seeded, taller than Alaska. Resistant to Fusarium wilt, race 1, and tolerant to root rot; equal to Alaska in resistance to powdery mildew, bleaching and mechanical damage. One week later than Alaska.
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.
Winter Peas		
Fenn	Yellow	Seed larger and more uniform than Common Austrian winter peas; some tolerance to Ascochyta; no resistance to root rot and Sclerotinia; vine length and maturity similar to Common; yield about 5% better than Common.
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 Fenn or Melrose.
Melrose	Yellow	Seed size similar to Fenn but more tolerant to Ascochyta and the pea leaf weevil, more winter hardy. Susceptible to Fusarium wilt, race 1, and powdery mildew. Yield approximately 14% better than Common. (Certified seed available in 1980.)
Lentils		
Common	Yellow	Mostly large-seeded and indeterminate. Referred to as the "Chilean" lentil. It is a mixture of seed sizes, mostly large, and seed coloration, light brown to black. Resistant to Fusarium wilt, race 1, and tolerant to root rot.