

Crop Profile for Lentils in Idaho

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General Production Information

- In 1998, Idaho produced 30% of the lentils in the U.S. and ranked second in U.S. production.
- 56,000 acres of lentils were harvested in Idaho, with an average yield of 1100 lbs per acre.
- Annual revenue from lentil production totaled \$7,084,000.
- Annual input cost of lentil production averaged \$220 per acre.

Production Regions

Approximately 90% of lentils produced in the U.S. are within a 90-mile radius of Moscow, Idaho and nearby Pullman, Washington. Lentil production is distributed throughout northern Idaho in Latah, Benewah, Lewis, Idaho and Nez Perce Counties. The highest concentration of production is in Latah and Benewah Counties.

General Cropping Practices

Lentils are a cool-season annual crop, classified as a grain legume or pulse. Lentils were introduced into northern Idaho during the 1930-s, and continue to be one of the most important pulse crops grown in the region. Lentil acreage fluctuates from year to year in response to variable export market demand and market price. Nearly 90% of the crop is exported, although domestic consumption is on the rise. Reliance on export market demands puts lentils at the risk of volatile market prices.

Lentils are important as a rotational crop, especially with the small cereal grains (wheat, barley), and as a cash crop. Lentils provide the means to break the disease and weed cycle in winter cereals, conserve soil moisture relative to other rotational crops, improve soil fertility by fixing nitrogen and increase yields in the following crops. Lentils, like other spring crops in rotation with winter cereals, limit soil erosion compared to summer fallow on land that is highly erodible.

Climate conditions accompanying lentil production in northern Idaho include mild, wet winters and springs, hot dry summer days, and cool summer nights. All lentils produced in northern Idaho are grown without irrigation, and receive 15 to 28 inches of annual precipitation.

Lentils emerge and perform well planted in a variety of seedbeds including direct seeding into grain residue. Lentils typically are grown following winter wheat or spring barley. Cereal stubble that is fall plowed or chiseled is cultivated for weed control then harrowed and rolled. Optimal seeding rates vary with the lentil variety and seed size, but typically range between 40-80 lbs/acre. Lentils are drilled in rows 6-7 inches apart.

Optimal planting dates range from mid-April when soil temperatures are above 40 degrees F to mid-May. In most years, delayed planting after April lowers quality and seed yield. Lentils are adapted to grow during the cool season when evapotranspiration is minimal. In most of the production region, they rely on stored soil moisture for a large part of their growth cycle. Lentils start flowering after a specific number of nodes are reached and continue until drought, or nitrogen deficiency ends flowering. Maturity is reached about 100 days after emergence.

Lentil harvest begins in mid-August, with the crop being swathed and then combined. Swathing before combining will dry down the weeds and the lentil crop in instances of uneven crop maturity or heavy weed infestation. Swathing improves moisture uniformity of the lentil seed and reduces the amount of seed discoloration by weed exudates. Timely harvest of lentils is critical to avoid post maturity disease, seed bleaching and seed shatter.

INTEGRATED PEST MANAGEMENT PRACTICES

Several different cultural practices are integrated into lentil production to help reduce pesticide input and to suppress pest populations to an economically acceptable level. Crop rotation is practiced by 92% of lentil growers to reduce the buildup of disease, insects, and weeds in the following crop. About 90% of growers consider crop rotation important in reducing the buildup of weed resistance to herbicides, and insect resistance to insecticides. Field scouting for insects and weeds, and the use of economic thresholds are practiced by nearly 100% of growers before applying a pesticide. When post emergent herbicides are applied, 91% growers will base the application on the level of weed infestation.

Insect Pests

Lygus bugs (*Lygus* spp.)

Lygus bugs are a major pest in lentil production. In northern Idaho, approximately 21 species of lygus bug have been identified on 70 species of plants. The most abundant species are *L. hesperus* and *L. elisus*. Hosts for these pests include weeds such as mustards and lambsquarters, and crops of alfalfa and clovers. Lygus bugs survive the winter protected in ground litter, crop residues and buildings. They may become a nuisance in households during warm winter days. Adults lay eggs in the spring and feed on various plants. Eggs hatch into nymphs in about 10 days and reach maturity in a month. It appears that only a single generation develops on lentils. Lygus bugs pierce tender leaves, stems, buds, petioles, and developing seeds.

Lygus bugs are considered to be the most serious insect pest of lentils because feeding adults damage the seed, causing Chalky spot syndrome. Seeds with chalky spot have pitted, crater-like depressions in the seed coat with or without a discolored chalky appearance. The spot causes an economic loss (market price) to the producer. Lentils with more than 3.5% chalky spot damage are graded Sample grade and their value is discounted. Yield reduction due to direct feeding and chalky spot typically ranges between 3-50%. If not treated, reductions in yield generally average about 30%.

Economic thresholds have been established for lygus bug control. When lentils are in bloom, and podding has begun, sweep nets are used to determine presence and quantity of adult lygus bugs. If netting captures 7-10 lygus bugs per 25 sweeps, an insecticide treatment is recommended.

Controls

Chemical control:

Dimethoate (Dimethoate 4EC, Dimethoate 4E, Dimethoate E267) -- Dimethoate is the most effective insecticide for lygus bug control. Applied by custom applicators to 70-90% of the lentil acreage at bloom stage of lentil development. Typically applied once per year at a rate of 0.43 lbs ai/acre. PHI is 14 days. Dimethoate provides 2-3 weeks of good lygus bug control. To avoid injury to pollinating bees, applications are usually made during the early morning hours when bees are not active.

Cultural control:

Cultural control programs for lygus bug are only partially effective because the target insect is supported by a variety of hosts. The continuity of plant hosts support lygus bugs throughout their life cycle. Disturbing habitat by disking near fencerows and mowing roadsides can potentially lower lygus bug numbers, but also will injure over-wintering populations of beneficial insects.

Wireworms (*Limonius* spp.)

Wireworms are widely present in the soils of northern Idaho, however, lindane used as a seed treatment has kept damage to a minimum. Wireworm larvae usually take several years to develop. They cause little damage the first year but feed heavily thereafter, cutting off and damaging roots. Wireworm larvae feed on germinating seeds or seedling plants and will thin or destroy lentil stands. Where wireworms are suspect, growers perform soil tests to determine their population levels. Usually the presence of three or more wireworms per square foot requires control measures. Wireworm density and injury to lentils are directly related to soil moisture. Wireworms are generally low in years of average or below average precipitation, and high and damaging in years of above average precipitation.

Controls

Chemical control:

Lindane (Lindane 40) -- Applied as a seed treatment to about 80% of sown seed, usually in combination with fungicides. Typically applied at a rate of 0.8 fl oz ai/cwt of seed.

APHIDS

Pea aphid (*Acyrtosiphon pisum*)

Cowpea aphid (*Aphis craccivora*)

Aphids are considered a very serious pest of lentils. They are able to multiply quickly so a moderate infestation can become a damaging population in less than a week. Aphids injure lentils mostly by direct feeding, but are also responsible for the transmission of viruses. Direct feeding by aphids includes sucking sap from leaves, stems, blossoms and pods. Plants heavily fed upon are stunted and produce fewer and smaller pods and seeds. Smaller plants may die from aphid feeding. Aphid predators such as the larvae of ladybugs are usually not present in high enough numbers, and typically lag behind in development of aphids. If not controlled, feeding by aphids can destroy from 25-50% of developing plants.

Controls

Chemical control:

Dimethoate (Dimethoate 4EC, Dimethoate 4E, Dimethoate E267) -- Applied by custom applicators to 70-90% of the lentil acreage at bloom stage of lentil development. Typically applied once per year at a rate of 0.43 lbs ai/acre. PHI is 14 days.

Biological control:

Natural predators are usually not present in significant numbers to reduce aphid populations below economically damaging levels.

Diseases

Seedling blight and foliar Ascochyta blight are the primary diseases of lentils grown in Idaho. They are considered a serious problem, and cause about 25-40% of the ARegular@ lentils to be treated with fungicides, and about 80% of the small brown lentils (Pardina lentil) to be treated each year. This amounts to about 60-80% of total lentil seed treated each year.

Ascochyta blight

Ascochyta blight is the most common foliar disease of lentils in the Northern Hemisphere. The fungus *Ascochyta fabae* f.sp. *lentis* causes the disease. Small brown lentils are especially susceptible to Ascochyta blight when cool, wet years cause luxuriant plant growth. The source of infection is from seed and crop residue remaining near the soil surface. The inoculum remains active in crop residue for 2-3 years, spreading rapidly by wind-driven rain and by contaminated equipment moving spores from field to field. Symptoms of infection are dark lesions along stems, leaves and pods. These lesions may girdle stems, causing upper portions of the plant to yellow, wilt and eventually die. When weather conditions favor ascochyta blight, production loss can be 10-50%, if left untreated.

Controls

Chemical control:

Thiabendazole (LSP) -- Applied as seed treatment to 20-40% of total acres, depending on year. Typically applied at the rate of 1.5 fl oz/100 cwt of seed. Control of Ascochyta blight in small brown lentils has been mainly through the use of thiabendazole as a seed treatment. Thiabendazole does not have a federal label in Idaho for lentils, but has been granted Section 18 status in the past. Without thiabendazole, the estimated production loss would range from 10 to 50%, depending upon weather conditions during the growing season.

Cultural control:

Sanitation practices for Ascochyta blight include having seed tested for Ascochyta blight, and planting clean seed. Since no resistant lentil varieties are available, the combination of planting disease free seed, and seed treatment has been successful in controlling most diseases of lentils and preventing the introduction of seedborne inoculum.

Root rot and seedling blights

The soil borne fungi *Fusarium*, *Rhizoctonia*, and *Pythium* cause root rot and seedling blights. These diseases are widespread in commercial lentil fields. Seedling blight from soil borne *Pythium* species reduces emergence and stands of lentils. Seed is infected shortly after planting, and infected seedlings fail to emerge.

Controls

Chemical control:

- **Mefenoxam (Apron XL) + fludioxonil (Maxim)** -- Averaged over several years, these two seed treatments are applied in combination to about 50-70% of lentil seed. Mefenoxam is applied at the rate of 0.08 fl oz/cwt of seed, and provides excellent control of *Pythium*, *Rhizoctonia*, and *Fusarium*. Fludioxonil is applied at a rate of 0.04 fl oz/100 lb of seed, and provides excellent control of seedling rots, seed decays, *Rhizoctonia*, and *Fusarium*.
- **Captan (Captan 400)** -- Captan is applied as a seed treatment to about 5-10% of the lentil seed at a rate of 1.5-2 fl oz/cwt of seed, usually as a supplement to mefenoxam and fludioxonil.

Cultural control:

Since soil borne diseases remain viable in the soil for several years, crop rotations with non-host crops will not eliminate the diseases. Cultivation of lentils no more frequently than every 3 years may reduce the severity of these diseases, but will not completely eliminate lentils from becoming re-infected.

Pea enation mosaic virus

Bean (pea) leaf roll virus

There are at least 27 different viruses that have been identified in lentils. Of these, pea enation mosaic virus (PEMV) and bean (pea) leaf roll virus (BLRV) are two major pathogens that can cause significant damage under favorable conditions. PEMV and BLRV survive from year to year in alternate crops such alfalfa, chickpea, clover, pea, vetch and some weed species. Only BLRV can be transmitted by seed. The principle vector is pea aphid and the green peach aphid, which can acquire the viruses after feeding on infected host plants. Flights of aphids in the spring and early summer from infected hosts spread the viruses to lentils. Symptoms of virus infection usually develop on the lentil plants in about 7 to 10 days. Symptoms of PEMV include mottling, crinkling at the top of the plant, stunting, and tissue outgrowth on pods and leaves. Pods may become distorted, and produce few or no marketable seeds. Symptoms of BLRV include chlorotic mottling in terminal foliage, which may become bright yellow in time. Stunting is frequent, and plants may die if infections occur early in the season.

The extent of damage caused by PEMV and BLRV varies from year to year and by geographical regions. Incidence of BLRV in the Pacific Northwest is not necessarily correlated with observable colonization of lentils by the pea aphid and the green peach aphid. Epidemics have occurred with only trace populations of aphids on lentils. Climatological and biological factors that trigger epidemics are not yet understood. In average years, damage is usually minimal, but about one in five years viral infections reach damaging levels and cause severe economic loss. In the 1983, PEMV and BLRV was epidemic in lentils and caused severe damage. In these instances, yields losses reached 50% in localized areas. Lentils damaged by diseases will be downgraded in market price if damaged or small in size.

Controls

Use of seed certified free of BLRV will lower the risk of introducing the virus into the field. Controlling aphids with systemic aphicides have been partially successful in reducing the field spread of viruses. Overwintering aphids feed on infected host crops and spread the virus to lentils before insecticides are applied for aphid control. Aphicides do, however, help stop the spread of secondary infection to lentils.

Resistant lentil varieties are being developed, but are not currently available for commercial release.

Weeds

Grass and broadleaf weeds are a very serious problem in lentil production. Typical troublesome weeds include wild oats, various mustards, nightshades, pigweed, common lambsquarters, prickly lettuce, pineapple weed, field pennycress and mayweed chamomile. Lentils are poor competitors against weeds and require an intensive weed control program. Weeds also contribute exudate at harvest that stains lentil seed. Stained seed is considered inferior in quality. Weeds also interfere mechanically with lentil harvest. Yield loss and reduced seed quality from weed competition, if left uncontrolled, would range between 50-100%.

Chemical desiccant use varies on a yearly basis, and depends on the extent of the weed infestation and the natural dry down of the lentil crop at maturity. Desiccant herbicides are important in years of warm wet, springs and cool, wet, summers that promote luxuriant plant growth. Under such conditions lentils will continue to flower and set pod and weeds will continue to grow as long as moisture is available. If growers must wait for natural dry down to occur under such high moisture conditions, they will risk, pod shattering, sprouting, seed coat slough, and seed bleaching. Weeds that remain luxuriant under available moisture will also mechanically impair the harvest of the crop. In years when weeds are less threatening, lentils are mechanically swathed or direct combined.

Controls

Chemical control:

- **Imazethapyr (Pursuit)** -- Most widely used herbicide to control broadleaf weeds. Applied to 75% or more of the lentil acres. Most often applied preplant incorporated in combination with triallate to control wild oats. Typically applied once per year at a rate of 0.047 lb ai/acre. PHI is 60 days.
- **Metribuzin (Sencor DF 75%)** -- Applied to about 30% of the acres once per year at a rate of 0.2 lb ai/acre PHI is 75 days. Metribuzin is the most common postemergent herbicide used to control mayweed and common lambsquarters.
- **Paraquat dichloride (Gramoxone Extra)** -- Use varies on a yearly basis. In years of little weed problems, no paraquat is used. In years of high weed infestation, paraquat is applied to 10-15% of the lentils in late season as a harvest-aid to desiccate lentils and weeds. Typically applied once per year at a rate of 0.31 lbs per acre. PHI is 7 days.
- **Glyphosate (Roundup Ultra, Roundup Ultra RT)** -- Applied to 5-10% of the acreage as a preharvest aid or a spot treatment to control escaped weeds such as Canada thistle, mayweed and grass weeds. Usually applied at a rate of 0.75 lb ai/acre once per year. PHI is 14 days. As a spot treatment, glyphosate is especially useful in the low, wet areas of fields to control persistent weeds. As a preharvest aid, its use is similar to the paraquat use as a desiccant. This is considered an important herbicide because it can be applied up to 14 days preharvest.

Cultural control:

Cultivation is performed before planting to remove weeds, but is not useful during the growing season because of the narrow row spacing.

GRASS WEEDS

Chemical control:

- **Triallate (Far-Go)** -- Applied to 75% of the lentil acres once per year at a rate of 1.25 lb ai/acre. Currently the most widely used herbicide for wild oat control. Future use will decline to about 50%, as an increasing number of growers substitute quizalofop (Assure II) for triallate. Frequently applied in combination with imazethapyr (Pursuit) for broadleaf control. Applied preplant incorporated to a depth of 1 to 2 inches.
- **Quizalofop P-ethyl (Assure II)** -- Applied postemergence to grass weeds to about 30% of the lentil acres. Typically applied once per year at a rate of 0.06 lb ai/acre. PHI is 60 days.

Growers not using a preplant application of triallate will apply quizalofop postemergence. Postemergent use of quizalofop has the advantage of controlling weeds on an as needed basis@.

Another benefit is that quizalofop exhibits little or no phytotoxicity. Use of quizalofop will increase to about 50% in the next few years.

Contacts

Prepared by:

Samuel J. Fuchs, Extension Support Scientist I

Ronda E. Hirnyck, Pesticide Program Coordinator

Department of Plant, Soil and Entomological Science, University of Idaho.

With Assistance From:

Dr. Maury Wiese, Professor of Plant Pathology

Dr. Stephen Guy, Extension Professor, Crop Management Specialist

Department of Plant, Soil and Entomological Science, University of Idaho.

Contact:

Ronda Hirnyck, Pesticide Program Coordinator

University of IdahoCBoise Center

800 Park Blvd., Suite 200

Boise, ID 83712

(208) 364-4046

rhirnyck@uidaho.edu

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