



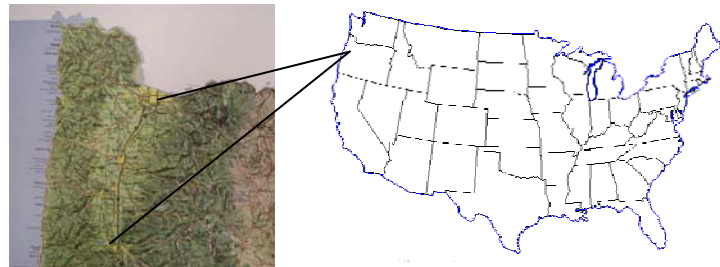
Extension Service

CLOVER SEED PRODUCTION IN OREGON

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The Willamette Valley of western Oregon is a premier seed production region, especially for clovers and cool-season grasses. Three things contribute to Oregon growers' ability to produce seed of the highest quality: expertise, climate, and infrastructure. The expertise comes from long experience. Many seed growers operate family farms that have been producing seed for four generations.



Willamette Valley of Oregon

What is unique about climate in the Willamette Valley is that it rarely rains in July and August, though total annual rainfall is more than 40 inches. This is an advantage for seed production. Seeds can be grown without irrigation, then dried in the field with little risk of being rained on.

In addition to over 32,000 acres of clover seed, over 480,000 acres of grass seed are also grown in the Willamette Valley. A large industry infrastructure has developed, including transportation for selling seed across the United States and internationally. Many seed companies, with state-of-the-art seed cleaning plants, are located in the area.

An important part of the seed industry infrastructure includes the Seed Certification program handled by Oregon State University. A blue Certified Seed tag guarantees that the seed is the genetically pure variety listed on the tag and that it has met high quality standards. A field in the certification program field is inspected at least once in the seedling stage and again each year prior to harvest. The seed must be sampled and tested through the OSU Seed Laboratory.

The clover seeds grown in Oregon are primarily red, crimson, arrowleaf, and white or Ladino. Red, crimson, and arrowleaf clover seed is grown mostly in the north valley (Washington, Yamhill, and Polk counties). White clover seed is grown in the south valley (Linn County). About 2,000 acres of red, crimson, and arrowleaf clovers for seed are grown under irrigation in other areas of Oregon.

Red Clover



Red Clover Seed Field



Red Clover Flowers

Red clover is a perennial. In the Willamette Valley, it is commonly planted in the spring, but may also be planted in August or September, especially if the grower can irrigate. In late May the plants start to bloom, but growers cut the fields for forage around this time. The purpose is to delay the bloom so that all the flowers come at the same time. Many growers sell the forage as green chop to dairies. Even if a

grower does not sell the forage, he will clip the field, because a uniform bloom is important for seed production. Seed is harvested in August and September.

Wild bumble bees are better pollinators of red clover than honey bees. Honey bees, with a shorter proboscis, can't reach the nectar in the long flowers of red clover, so they will go to other flowers if available. Since bumble bees nest in the ground, it is to a grower's advantage to leave some wild areas near the field for habitat. Honeybees can still help seed yield, and many growers contract with beekeepers to place hives in their fields. White, crimson, and arrowleaf clovers all require the honeybee hives for adequate pollination.

Aphids are a problem in red clover that usually requires treatment with insecticide once a season, before the bloom to avoid killing bees. Aphids may reduce seed yields, but a worse problem is created by the sticky honeydew aphids produce. Seeds covered with honeydew are difficult to harvest and clean.

A red clover stand usually lasts for only one or two seed crops. The reason is the clover root borer (*Hylastinus obscurus*). This beetle is the limiting factor in red clover production in the Willamette Valley. The adult lays eggs in the crown of the plant. The larvae mine out channels in the roots, which then become a site for infection with root rot fungus (*Fusarium solani*). Plants are weakened, and the seed yield drops in the second year. A third year of seed production is not economical. There is no control for clover root borer other than rotation.

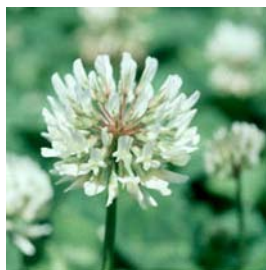
When June rainfall is lower than usual, the seed yield of red clover can be improved by irrigation at early flowering. Normally a healthy first-year stand with little root borer damage can produce a maximum yield with no irrigation.

Improved varieties of red clover yield less seed than the common type (Medium Red), so forage producers should expect seed of improved varieties to cost more. The right improved variety, however, can yield more forage and be more than worth the extra cost of seed.

White Clover



White Clover Seed Field



White Clover Flower

White clover is a perennial that spreads by stolons. Since the flowers are produced on the stolons, the trick to getting a good seed yield is reducing leaf growth so that the plants produce more stolons. This is the opposite of what a pasture producer tries to do. Seed growers plant in rows up to 20 inches wide to allow room for stolons to grow. They deliberately stress the plants by grazing them heavily with sheep after harvest in the fall and again for about a

month in the spring. Achieving the right amount of stress on the plants is a matter of trial and error. Each year is different, and each variety is different. For this reason, white clover is notorious for variable seed yields. Seed is harvested in August.

White clover seed in the south Willamette Valley is grown primarily for the soil quality benefit it provides to the grass seed crop following it. Some growers rotate a field out of white clover every two years, and some keep a stand for up to four years. To open the stand and make it last longer, some growers are experimenting with applying herbicide using a shrouded sprayer to re-make rows. This equipment has coulters on each side of the sprayed strips to slice the stolons and prevent herbicide uptake by the strip of clover the grower wants to leave. This can work well, but a drift of herbicide during the application will cause a lot of damage.

Crimson Clover



Crimson Clover Seed Field



Crimson Clover Flowers

The hills of the north Willamette Valley are beautiful in mid-May, when the crimson clover fields bloom scarlet red. Crimson clover is an annual, planted in late September or early October.

There is risk to having clover plants too small going into the winter because frost heaving on some soils can break the tiny roots and kill the stand. There is

also a risk to having them too big. Early-planted crimson clover with lush foliage is more susceptible to *Sclerotinia* crown rot and wilt (*Sclerotinia trifoliorum*), which can suddenly defoliate a field in the winter. A well-established stand can re-grow, but yield is lost.

Flowers open from the bottom of the flower head to the top. Growers hope for cool, cloudy days during the bloom period, so the flowers will open more slowly, giving bees plenty of time to visit each one. If the weather is hot and sunny, all the blooms open at once. Then not every flower gets pollinated, and the seed yield is lower.

Crimson clover is harvested in late June early July. As with the other clovers, it's swathed at night, when dew is on the plants, to reduce seed shatter. It's allowed to dry in the swath for about a week, then harvested with a combine using a belt pick-up header.



Combining Crimson Clover

Arrowleaf Clover



Arrowleaf Clover Seed Field



Arrowleaf Leaf



Arrowleaf Flower

Arrowleaf clover is an annual, similar to crimson clover in its requirements. Like crimson, it's planted in the fall but harvested later, in August and early September. Also like crimson, the flowers bloom from bottom to top, and the flower head will continue to grow taller and produce more seed as long as growing conditions are good.

Seed Cleaning



Cleaned Red Clover Seed

Seed cleaning is an art. Each seed lot from the field contains a different set of weed seeds and different amounts of dirt and damaged seed. An operator must know how to adjust the equipment to clean each lot perfectly, while losing a minimum of good seed.

The first piece of equipment in the cleaning process is the air-screen cleaner. It uses a set of sloped, vibrating screens to remove particles that are a different size from the clover seed. The top screen removes the larger particles by letting the clover seed fall through, and the lower screens sift out the smaller seeds and dirt. As the seed moves across the screens, air blows through to remove light dirt and chaff. This equipment can be high volume, with two or three sets of screens stacked above one another.



Air-Screen Seed Cleaner



Indent Cylinder Seed Cleaner

Another piece of equipment commonly used is the indent cylinder. Seed is fed through the center of the rotating cylinder, and centrifugal force pushes it into the round indents in the cylinder. Seeds, such as grass seeds, that don't fit the indent shape are separated out.

After good seed has been separated from poor seed and dirt by size and shape, it's further separated by weight, using the gravity deck. As the sloping platform vibrates and air blows through, the lighter poor seed moves to one side and the heavier good seed moves to other. At the front edge, seed falling off the different sides of the platform is separated.



Gravity Deck Seed Cleaner

Two pieces of equipment used only for clover are the velvet rolls and the magnetic cleaner. Velvet rolls remove weed seeds with rough surfaces. As the seed passes down the groove between two rollers rotating in opposite directions, the rough-edged seeds catch on the velvet and are lifted out, while the smooth clover seed slides through. The magnetic cleaner is used for special weed problems and cracked clover seed. The seed is wetted slightly and mixed with powdered iron. It then passes over a magnetic drum. The iron lodged in the cracks and on the sticky surfaces of weed seeds causes these seeds to stick to the drum and be removed.



Magnetic Seed Cleaner



Examining Cleaned Seed

Samples are examined at each stage of the cleaning process so that the equipment can be adjusted if necessary.

Minor Crop Issues

One of the biggest difficulties clover seed growers face is the fact that clovers are minor crops. Chemical companies are not willing to invest the money in research required to obtain pesticide registrations for minor crops because they don't see much potential profit. Growers therefore have limited options for pest control.

It is critical for a seed field to be kept free of weeds, because a weed could become a problem in a new area if its' seeds were planted with the crop seed. For this reason, keeping fields clean is a costly part of seed production. Growers use the full arsenal of registered herbicides, but they may also need to control weeds using hand labor.

Clover growers, through the Oregon Clover Commission, have negotiated with some chemical companies to support 24c or Special Local Needs (SLN) registrations, with the research funded by the growers themselves. There are several current SLN pesticide registrations in Oregon for clover grown for seed. Many of the labels specify that treated foliage and seed screenings cannot be fed to livestock. The Oregon Clover Commission is currently funding efficacy and residue trials for possible registration of more herbicides.