



AGRONOMIC CROP SCIENCE REPORT

Research

Extension

GROWING CRIMSON CLOVER FOR SEED PRODUCTION IN WESTERN OREGON

by Harold Youngberg and Hugh Hickerson ^{1/}

Crimson clover (*Trifolium incarnatum* L.) is native to southwestern Asia Minor and southeastern Europe. It was introduced to America in 1818. Crimson clover is a winter annual, planted in the fall and harvested for forage or seed the next season. Once established, reseeding varieties will produce forage crops in succeeding years without replanting. The primary use for crimson clover is as a hay or pasture crop in the southeastern and southern states.

Crimson clover is grown in Oregon primarily as a seed crop. In fact, Oregon is the major U.S. seed production area. Seed production has been recorded in Oregon since 1936, when 200 acres were grown for seed. Oregon seed acreage exceeded 10,000 acres annually from 1957-1971, with a maximum of 21,000 acres in 1960; but it declined during the early 1970's because of large carryovers and depressed prices. Recently, interest in crimson clover as a forage crop in the southeast has increased because of high nitrogen costs. This has created a greater demand for seed and caused prices to rise.

TABLE 1: CRIMSON CLOVER SEED IN OREGON

<u>YEAR</u>	<u>ACRES HARVESTED</u>	<u>AVERAGE YIELD (LBS)</u>	<u>PRODUCTION (1000 LBS)</u>	<u>PERCENT OF U.S.</u>
1965	10,000	480	4,800	58
1966	15,000	390	5,800	71
1967	14,000	450	6,300	80
1968	14,500	370	5,400	75
1969	16,000	380	6,100	76
1970	19,000	420	7,900	84
1971	10,500	275	2,900	76
1972	6,000	340	2,000	74
1973	5,700	400	2,300	85
1974	4,800	300	1,440	81

Based on Statistical Reporting Service data, USDA

^{1/} Extension Agronomist, Oregon State University; and Yamhill County Extension Agent, respectively.

U. S. crimson clover seed production has been below consumption since 1971 (see Table 2 below). The supply has not met the planting requirements, and this has caused an upturn in prices.

<u>Year</u>	<u>Production (1000 Lbs)</u>	<u>Supply (1000 Lbs)</u>	<u>Disappearance (1000 Lbs)</u>
1965	8,300	11,900	9,900
1966	8,200	10,200	9,700
1967	7,900	8,300	7,200
1968	7,200	8,300	6,500
1969	8,000	9,900	6,800
1970	9,400	12,300	6,500
1971	3,800	9,500	6,500
1972	2,700	5,400	4,700
1973	2,700	3,700	2,900
1974	1,800		

Based on Statistical Reporting Service data, USDA

PLANT DESCRIPTION

Crimson clover seeds germinate under favorable moisture conditions, producing seedlings that make rapid growth. In the fall, the plant develops a dense crown or rosette and a central taproot with fibrous roots attached. Under mild temperature conditions growth will continue throughout the winter. Leaves are composed of three leaflets, broad at the tip, narrow at the base, and densely covered with hair. In the spring, erect, hairy flower stems develop when the day length is over 12 hours. Stem growth is terminated by the formation of a pointed, conical flower head composed of 75-125 florets. The florets are a bright crimson color and open in succession from the bottom to the top of the head. For the most part, flowers are self-fertile but not self-pollinating. Bees in search of nectar, pollen, or both, bring about pollination. Fertilization occurs approximately 18 hours after pollination, at which time the corolla wilts. The seeds mature after 24 to 30 days, when the plant dies. Mature seeds shatter readily. Crimson clover seeds are yellow in color and are larger and rounder than red clover seeds. There are approximately 150,000 seeds per pound.

ADAPTATION

Crimson clover is well adapted to the climatic conditions of western Oregon. It grows vigorously on well-drained soils with medium-to-high fertility. It favors a neutral soil condition but tolerates medium acidity.

Crimson clover will not tolerate poor soil drainage. It is subject to winter injury from freezing and thawing of soil and should not be planted in areas subject to these conditions.

VARIETIES

Under southern conditions, crimson clover is planted for pasture use and allowed to mature seed. The seed then shatters and falls to the ground. Once moisture is available, common crimson clover seed germinates quickly. However, while there may be enough soil moisture to germinate the seedlings, often there is not sufficient moisture for continued growth. As a result, the seedlings die and the clover stand is lost. In 1935 the USDA and cooperating state experiment stations collected and tested a number of farm strains of crimson clover to determine their adaptation and reseeding characteristics. The desirable reseeding characteristic in crimson clover is associated with a moderately high percentage of hard seed, which germinate very gradually during the fall months. This gradual germination assures a stand even if one or more sets of seedlings is killed by dry weather after germination starts.

The hard seed content of reseeding crimson clover will vary some 30-75 percent. This range is apparently due to environmental conditions at the time of seed maturation. During harvest and processing, the seed is scarified so that the hard seed content may be as low as 5 percent when planted.

The Dixie variety is a composite of three strains with good forage production and reseeding ability. Dixie is the most widely used crimson clover in the southeastern region. Since its development, other strains with the same reseeding character have been found.

Chief plants are larger, and their leaves are a deeper green than those of other varieties. It is one of the latest-maturing clovers and produces larger plants and more growth during cold weather than the others. Its seed is slightly smaller than Dixie seed.

Frontier and Tibbee are from Italian strains. Both are soft-seeded and possess several desirable characteristics, including early maturity, superior seedling vigor, and large seed. Tibbee is the earliest-maturing reseeding crimson clover variety. It matures 7-10 days before early varieties such as Autauga and 14-18 days prior to late varieties such as Chief.

Several other reseeding crimson clover varieties have been developed. Most significant are Autauga, Auburn, and Talladega. The Auburn, Autauga, and Dixie varieties are similar in forage performance. Chief and Talladega are slightly later in maturity.

Table 3 shows seed yields of crimson clover varieties at Corvallis. Average seed yields of 424-721 pounds per acre have been recorded. Although Dixie is the most widely grown variety and continues to be popular, there is demand for Frontier, Chief, and Tibbee varieties.

TABLE 3
SEED YIELDS OF CRIMSON CLOVER VARIETIES
HYSLOP FARM, CORVALLIS, OREGON

<u>Variety</u>	<u>1960</u>	<u>1961</u>	<u>1963</u>	<u>1964</u>	<u>Average</u>	<u>Percent of Dixie</u>
Dixie	492	914	659	212	569	100
Autauga	455	935	641	182	553	97
Chief	670	759	631	169	557	98
Auburn	447	1168	823	448	721	127
Talladega	579	760	616	215	542	95
Frontier	-	-	659	190	424	75

From research by H. H. Rampton

SEED PRODUCTION

TIME OF PLANTING

Crimson clover must be planted sufficiently early in the fall to allow time for establishment before extremely cold weather. This is particularly important where the soil is subjected to heaving as the plants must be well-established or they will winter-kill. In western Oregon seeding in September or early October is necessary to produce stands vigorous enough to set a good seed crop.

SELECTION OF LAND

When growing certified seed, careful consideration should be given to field history. Fields selected for seed production should be uniform in slope and soil texture to assure even growth and maturity. They should have a low infestation of common weeds, as these either reduce seed yields or reduce profits due to additional seed cleaning requirements. Land with noxious weeds should never be used for seed production, and those with mustard, rape, or wild turnip should be avoided.

SEEDBED PREPARATION

A fine and firmly packed seedbed is essential for establishment of small-seeded legumes such as crimson clover. Following a fall cereal, the seedbed is commonly prepared by removing or burning all straw and residue, followed by a shallow tillage. Crimson clover is often planted following a spring crop such as barley. In this case, the soil is quite fine and firmly packed, and thorough removal of the straw provides an adequate seedbed.

SEEDING RATE

Seed growers use 10-15 pounds of seed per acre. A 5-8-pound rate is adequate when planted in a good seedbed. Seed should be placed from 1/8 to 1/4 inch deep and the soil compacted after seeding, particularly if the seedbed is dry.

INOCULATION

Crimson clover must be inoculated unless planted in soil where a properly modulated crimson clover was grown the previous year. It is desirable to plant just before a rain. Planting inoculated seed in warm, dry soil several weeks before moisture is available may result in death of the inoculating organism.

FERTILIZATION

Legumes respond to phosphorus, potassium, sulfur, and boron applications in western Oregon. Phosphorus and potassium soil requirements can best be determined by a soil test. Phosphorus is most effective when it is banded one inch to the side or below the seed at the time of seeding. When needed, potassium should be broadcast and worked in to the seedbed prior to seeding. As a general rule, in western Oregon 20-30 pounds of sulfur per acre should be applied annually, either as a component of the fertilizer materials or by a fall or early spring application of gypsum. Adequate boron is essential for maximum seed production. Application should be based on a soil test. Most soils in western Oregon are low in boron, and an application of 2 pounds per acre is recommended. It should be broadcast in the fall or early spring and should never be banded.

Crimson clover will respond to applications of lime when the pH is below 5.7. Application rates should be based on a soil test. Lime should be worked into the seedbed prior to planting or incorporated into the soil with the previous crop.

SPRING MOWING OR GRAZING

Both the rate of planting and mowing or grazing have influenced seed yields of Dixie crimson clover under western Oregon conditions. In non-mowed stands the five- and eight-pound-per-acre planting rates resulted in the best yields. Stands seeded at 12 pounds per acre and mowed to a height of 1-3/4 inches when plants reached a height of 8-9 inches showed consistent increases in yield in experiments at Corvallis. Earlier mowing had less influence on seed yields, while later mowing sharply reduced plant recovery and seed yields.

Plantings made at higher seeding rates grew most rapidly from the start and reached the mowing stage 17-22 days ahead of the low-rate-seeded stands. Small green floral heads were visible at all mowing dates. With the heavy planting rates both after-mowing recovery and seed maturity were the earliest. Stands that had been seeded at the low rates and then mowed were the latest to mature. Mowing delayed seed maturity by one to seven days.

Mowing resulted in shorter, stiffer stems that resisted lodging in the stands planted at rates less than 12 pounds per acre. The average date that plants reached mowing height varied according to the seeding rate. On the average, stands planted at the heavy seeding rates reached mowing height on April 1; stands planted at 12 pounds per acre reached mowing height on April 11; while stands planted at very light seeding rates reached mowing heights on April 20.

The effects of mowing or grazing that seemingly increase seed yields are: 1) shorter, stiffer stems that resist lodging; 2) better-filled heads because of reduced lodging and later flowering under conditions more favorable for pollination; 3) later maturity when drier harvesting conditions prevail; and 4) reduced bulk of plant material, which permits more efficient threshing.

Early spring mowing of crimson clover seed stands may not be desirable on all soils and perhaps not in all years. On droughty land, where soil moisture is depleted early in the season, and where the growth is seldom heavy enough to lodge, mowing is unlikely to be beneficial.

WEED CONTROL

Winter-growing annual grasses and broadleaves are serious weed problems in crimson clover. Fields being planted to crimson clover should be selected for freedom from these types of weeds because chemical controls are not completely effective. Weedy annual grasses and volunteer cereals can be controlled through the use of Protham-IPC (Chem-Hoe) at rates of four pounds per acre in 10-20 gallons of water. Applications should be made in the fall, preferably in December, after the clover has at least three to four true leaves. Pronamide (Kerb 50W) at rates of 0.75 to 1.5 pounds of active ingredient in 20-50 gallons of water per acre can also be

used for control of weedy annual grasses and volunteer cereals. Fields treated with Kerb cannot be grazed or harvested for forage within 120 days of treatment.

Where perennial grasses such as quackgrass or bentgrass are a serious problem, the field must be thoroughly cultivated so that rhizomes, roots, and other residue are cut up as finely as possible. Three pounds of EPTC (Eptam) should be incorporated two to three inches into the soil by discing in two directions.

Vetches, mustards, and other weedy annual broadleaved species can be controlled by MCPA amine at 1/8 pound in 10-20 gallons of water per acre. Radish and mustard should be sprayed in the rosette stage of growth, usually in December. Vetch should be sprayed in February or the first week in March before the crimson clover starts rapid spring growth. When both early weeds and vetch are in the same field, spray only once--before the early weeds develop flower stalks.

HARVEST

Crimson clover plants often remain green while the heads ripen and seed shatters. Harvesting usually consists of windrowing and allowing the crop to cure for several days before threshing with a combine. Studies have shown that the optimum time for windrowing crimson clover is when the seed moisture is at 35 percent. This is 7-10 days before the seed has matured sufficiently for safe storage. Several devices are available for measuring seed moisture, and they have proven to be helpful in timing the swathing of this crop.

The seed coat of crimson clover is thin and soft. If the combine is not properly set, the seed coat will be injured during harvest. Although not visible to the naked eye, seed coat injury will destroy the seed viability, which will cause a low seed-germination test.

Crimson clover is difficult to thresh completely in one run through the combine cylinder since much of the seed will not be removed from the hulls. The seed return should be worked to capacity to bring unhulled seed back to the cylinder for final threshing. When combining from the windrow, it is important that the windrows be small and uniform so that a continuous, even flow of material is fed into the machine. When the machine is not evenly fed, the cylinder will speed up for a few seconds when empty. When this happens, the seed coming back through the return to an empty cylinder will be damaged. In addition, running the cylinder empty for a few seconds without the straw as a cushion will break the seed coat.

Improper cylinder and concave adjustments are the greatest cause of injury to legume seed during harvest. It has been estimated that about 95 percent of seed damage is caused by excessively high cylinder speeds. It may be necessary to vary the cylinder speed daily as moisture conditions change. Adjustments must also be made for cylinder wear during the season.

The cylinder and beaters throw seed against sharp corners and hard surfaces within the machine. This also causes seed coat injury, but it can be corrected by covering bars or sheet metal parts with padding of rubber or canvas.

DISEASES AND PESTS

A fungus, Northern Anthracnose, *Kabatiella caulivora*, occasionally attacks crimson clover in western Oregon. The most noticeable symptom is drooping flower heads caused by damage to the flower stalk. Stems and leaves are also attacked, resulting in lesions or death of the infected plant parts. Development and spread of the disease is favored by cool, wet weather. The fungus overwinters on diseased crop residue and may be carried on or within the seed. Rotation and use of disease-free seed are recommended control measures.

Crimson clover seedlings may be attacked by the gray garden slug (*Deroceras reticulatum*). The slug damage may occur shortly after germination and emergence and before the grower is aware that slugs are present in the field. Fields should be checked regularly for presence of these pests.

CERTIFICATION

Since it is impossible to determine the variety of the crimson clover by its seed characteristics, it is important that the seed be certified to maintain its genetic identity. Seed growers should be aware of the field requirements and field standards for producing certified seed before planting seed fields. Certification requirements and application forms are available from county extension offices or from the Seed Certification Service, Farm Crops 102, Oregon State University, Corvallis, OR 97331.

The Oregon Foundation Seed Project, Agronomic Crop Science Department, Oregon State University, Corvallis, Oregon, can assist growers in obtaining stock seed (Foundation class) of improved varieties for certified seed production.

OREGON EXTENSION PUBLICATIONS FOR ADDITIONAL INFORMATION

- FG 3 *Liming Materials for Oregon*
- FG 30 *Fertilizer Guide: Crimson Clover, Vetch, Austrian Peas*
- FS 184 *Inoculating Alfalfa and Clover Seed*

These publications are available at county extension offices.

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