

Seed Production of Arrowleaf Clover in Western Oregon

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INTRODUCTION

Arrowleaf clover (*Trifolium vesiculosum* Savi) was introduced from Italy in 1956 and was first grown in the United States at the Southern Regional Plant Introduction Station, Experiment, Georgia. The crop is finding increasing use as a naturally reseeding, long-season, winter annual forage legume in the southeastern states.

The first planting in Oregon was made in October 1963 at the Oregon Agricultural Experiment Station, Corvallis. The performance of this planting indicated that arrowleaf clover was a potential seed crop for western Oregon but showed little promise for forage.

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Seed production investigations at the Oregon Agricultural Experiment Station are cooperative with the Plant Science Research Division, Agricultural Research Service, U. S. Department of Agriculture.

Three named varieties of arrowleaf clover are available in the United States: (1) 'Amclo,' an early type released by the Georgia Agricultural Experiment Stations and the Soil Conservation Service; (2) 'Yuchi,' a midseason type released by the Auburn (Alabama) University Agricultural Experiment Station; and (3) 'Meechee,' a late type released by the Mississippi State University Agricultural Experiment Station and the Soil Conservation Service.

Seed of arrowleaf clover is produced in western Oregon on a relatively small but gradually expanding acreage. As demand for seed increases in the southeastern states, the market potential for Oregon-grown seed will increase.

Description

Seedlings of arrowleaf clover are slower in development than crimson clover and have much less winter vigor. Spring recovery is three or four weeks later than crimson clover but with warm weather plant development is rapid. Stems are smooth,

hollow, profusely branched, and hard at maturity. The leaves are trifoliate with leaflets that are smooth, wider near the base than in the middle, sometimes becoming 3 inches long and 1 1/2 inches wide. The leaflet bears a distinct white V-mark which resembles an arrowhead. Mature plants are 2 to 5 feet tall with the later varieties usually being the tallest. The Arnco variety may begin flowering about the first week in May. Seed heads may attain 3 inches in length and 1 1/2 inches in diameter. The newly opened flowers are white, changing later to pink-purple and finally to buff or brown color.

The seeds are rough coated, yellow to brown colored, about twice the size of white clover seeds, and number approximately 360,000 to 400,000 per pound. Mature seeds are commonly found in the lower portion of the head while the tip is still in blossom. The inflated calyx bears the seed pod. The calyx tips form fine, sharp spines which may be irritating to the skin and eyes of persons threshing and cleaning the seed. Newly harvested seed has about 15 percent germination and 80 percent hard seeds. Scarification is necessary for acceptable germination.

Adaptation

Arrowleaf clover is adapted to about the same climatic conditions in western Oregon as crimson clover. Arrowleaf clover needs well-drained soil and higher soil fertility than crimson clover and is less tolerant of soil acidity. River bottom soils and fertile uplands usually produce good growth. On unfavorable soils arrowleaf clover plants do not recover well in the spring, appear to be lacking in healthy nodulation, and produce little forage or seed.

SEED PRODUCTION

Precautions

Because of arrowleaf clover's pronounced hard-seeded character, seed growers can expect considerable volunteering in succeeding years. Volunteer plants can be removed readily with herbicide sprays from cereal and grass seed fields but not from other clovers or crops such as strawberries which occupy the land over winter.

Location of fields in relation to pollination

Bumblebees are excellent pollinators of arrowleaf clover in western Oregon. Their favored nesting places are in waste or wooded areas and non-

irrigated permanent pastures where field mice build their nests. Arrowleaf clover seed fields located near such areas are likely to be visited by many bumblebees and to set seed heavily.

Research workers in the southeastern states recommend using one colony of honey bees per acre when native bees are inadequate for good pollination. In Oregon, however, honey bees have not usually been good pollinators of arrowleaf clover.

Time of planting

Arrowleaf clover seeds will germinate at relatively low temperatures. Nevertheless, experimental results in western Oregon have shown that early seeding, in late September or early October, will generally result in better stands, more plant vigor, and better seed yields than later seeding.

Seeding rate

Experimental data on seeding rate in western Oregon are inconclusive. Investigations in the southeastern states show that 5 to 8 pounds of scarified seed per acre is adequate. This amount of scarified seed seems to be satisfactory in Oregon. Avoid deep planting. Shallow seeding about one-fourth inch deep is best.

Inoculation

Arrowleaf clover seed should be inoculated before planting, but planting in dry soil may result in death of the inoculation organism. A specific inoculant for arrowleaf clover is available. However, crimson clover cultures have been used with good results in western Oregon.

Spring mowing or pasturing

Good stands of arrowleaf clover, especially the later maturing varieties such as Yuchi and Meechee, often grow tall, branch profusely, lodge, and mature in a tangled mass which is extremely difficult to windrow. Usually this condition can be prevented by pasturing or mowing to a 2-inch stubble in the spring. The time to mow is when the plants reach a maximum height of 8 to 9 inches. Pasturing should cease when the clover plants in a protected corner or quadrat reach the 8 to 9 inch growth stage. The resulting regrowth will usually be shorter with less lodging and little or no reduction in seed yield.

On porous, droughty soils where tall, vigorous growth does not occur, mowing or pasturing in the spring may cause severe reduction in seed yields.

Because spring recovery of arrowleaf clover is late and growth is rapid after recovery begins, the pasture period on seed stands is likely to be short.

Weed control

Winter-growing annual weeds are serious competitors of arrowleaf clover. Rattail fescue, annual ryegrass, annual bluegrass (*Poa annua*), filaree, mustard, radish, hairy vetch, and common chickweed are some of the most troublesome in western Oregon. Other problem weeds are dogfennel, French pink, dock, sheep sorrel, and perennial grasses such as quackgrass, bentgrass, and creeping velvetgrass. Dodder is a serious problem in the southeast and could become so in western Oregon. Seeds of dodder and arrowleaf clover are about the same size and texture and are difficult to separate. Patches of dodder should be removed by cutting or flaming before seed is formed. Dodder-free seed stock should be sown.

For control of perennial underground spreading grasses such as quackgrass, use a preplant spray treatment with S-ethyl dipropylthiocarbamate ('EPTC') at 4 pounds per acre just before the final disk-and-harrow operation. Disk in thoroughly to a depth of 3 inches immediately after application and plant.¹ Because EPTC may cause plant distortion and retard seedling development, seed early.

Although other herbicides are not registered for use on arrowleaf clover in Oregon, some are registered for use on crimson clover seed crops. Experimental evidence and grower experience indicate that the two crops respond similarly to isopropyl carbanilate ('propham,' formerly called 'IPC'), and to [(4-chloro-O-tolyl)oxy] acetic acid 'MCPA'.² Forage from treated fields should not be grazed or otherwise used for livestock.

For control of winter-growing weedy annual grasses, crimson clover seed growers spray treat with propham at 4 pounds per acre in December or early January after the clover seedlings have developed three or more trifoliate leaves and be-

fore the grass seedlings have stooled profusely. For control of winter-growing broadleaf annuals, crimson clover growers treat with MCPA spray at one-fourth pound per acre when such weeds as mustard and radish are in the rosette stage. This is usually in December or early January. Hairy vetch is best controlled with later treatment between February 15 and March 15. When both mustard and hairy vetch contaminate the field, apply spray when the mustard flower stalk begins to show. Clover should not be sprayed with MCPA twice in one season.

No satisfactory treatments have been developed for controlling well-established seedlings of dogfennel, French pink, dock, or sheep sorrel in arrowleaf clover.

Irrigation

Experimental work has not been done in Oregon on the effects of irrigation on seed yields of arrowleaf clover. However, early fall irrigation is often necessary for early establishment of seedlings. Some seed growers apply one or two summer irrigations to spring-mowed fields to stimulate blossom production and seed development.

Harvesting the seed crop

The Amclo (early) variety usually matures its seed crop about the first week in August. The Yuchi (midseason) variety is usually ready to harvest about one week later and the Meechee (late) variety about two weeks later. Harvesting too early (before the seeds in the upper portions of the heads are filled) may result in a considerable amount of shriveled seed.

Harvesting usually consists of windrowing, curing for several days in the windrow, and then threshing with the combine. Because arrowleaf clover stems often remain green when the heads are ripe, rank-growing, intertwined stands of the Yuchi and Meechee varieties may be difficult to windrow. Spring mowing or pasturing as previously described will help to prevent excessive plant growth.

When difficulty is encountered in windrowing rank stands, seed may be harvested by direct combining if the crop is preconditioned with a suitable desiccant. Chemical drying has not been tried on seed fields of arrowleaf clover in Oregon but the warm, dry conditions that usually prevail in August are favorable for desiccant action. Seed growers in Alabama have successfully used the amine or ammonium salt of 2-sec-butyl-4,6-dini-

¹ All agricultural chemicals recommended for use in this report have been registered by the U. S. Department of Agriculture. They should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act.

² This is a report on the current status of research involving use of certain chemicals that require registration under the Federal Insecticide, Fungicide, and Rodenticide Act. It does not recommend the use of such chemicals on arrowleaf clover, nor does it imply that the uses discussed have been registered. All uses of these chemicals must be registered by the appropriate state and federal agencies before they can be recommended.

trophenol (DNPB) at 3 pints in 10 gallons of diesel oil per acre applied by air. Also useful is 6,7-dihydrodipyridio (1,2-a:2',1'-c) pyrazinedium ion (diquat) at 2 pints in 10 gallons of water per acre applied by air. Combining should take place about 3 to 10 days after application of the desiccant.

Seed of arrowleaf clover does not thresh readily. The individual florets cling tenaciously to the tough rachis of the head, which does not usually break up in threshing. Seeds are protected by the inflated calyx and will remain in the head if not dislodged in the threshing cylinder. If the combine is not properly adjusted, these heads will be carried over the straw rack and the chaffer and out of the machine.

Average seed yields in western Oregon have not been determined but under good cultural con-

ditions and with adequate pollinators, yields of 600 pounds per acre are not uncommon. Some fields have exceeded 1,000 pounds of seed per acre.

Diseases and insects

The only disease known to attack arrowleaf clover in Oregon is crown rot or stem rot (*Sclerotinia trifoliorum*). The more dense and rank-growing stands are most likely to be affected by this disease.

Arrowleaf clover seedlings may be consumed by the grey garden slug (*Deroceras reticulatum* (Muller)). These pests are controlled with pelleted metaldehyde-arsenic bait.

Although several insects attack legume crops in western Oregon, none have seriously injured arrowleaf clover seed fields.