Pasture Management for Control of Tansy Ragwort

The right combination of plant species, fertility, and grazing is essential in good pasture management. Weed control also is important. Because of the toxic properties of the weed tansy ragwort, pasture management for its control is of extreme importance. The toxins in this weed can kill domestic livestock, although sheep are tolerant to large dosages.

Tansy ragwort is estimated to occur on 3¼ million acres in western Oregon, where 2 out of every 5 acres of pasture are infested. More than 112,000 acres of pasture in western Washington contain ragwort. Tansy ragwort has been reported in Idaho and is considered a serious potential weed problem that has not yet reached a level of economic importance. Most ragwort is on forested and clearcut lands. The plant spreads by seed, and grows and reproduces rapidly when pastures are not well managed. Livestock producers, part-time producers, and horse owners need to learn to control tansy ragwort to stay in production.

Plant growth

Tansy ragwort *(Senecio jacobaea)* was first reported in Oregon in 1922 after introduction into the United States from Europe. It is found in drier regions of Europe, Asia, and Siberia, where it can survive temperatures of –20°F or lower. Tansy ragwort has spread across western Oregon and Washington. Plants can withstand large variations in soil moisture conditions and will tolerate the hot, dry summers of eastern Oregon and Washington, where it has been found in numerous locations. It is believed to be capable of establishing itself throughout the Pacific Northwest. Tansy ragwort can become established rapidly in forest clearcuts and can develop in irrigated, nonirrigated, and woodland pastures. It occasionally occurs in annually tilled cropland. The heaviest infestations now occur in the coast range.

Tansy ragwort has conspicuous, daisy-like golden flowers, which appear over an extended period. The rosette has irregular, lobed leaves, 5 to 9 inches long,

Tansy ragwort leaves and the blade region near the tip are deeply lobed. Leaf color varies from light to dark green.

In the pasture complex, livestock often cannot separate the rosette stage of tansy ragwort from desirable forage.

PNW 210 Reprinted August 1984

A Pacific Northwest Cooperative Extension Publication

attached directly to the main stalk. Plant color is variable, ranging from light to dark green.

Tansy ragwort is a biennial, but can develop as a short-lived perennial. Seeds can germinate in the fall or spring. The vegetative stage is a low, dense, rosette. Plants that emerge early in the fall and develop a rosette before winter usually bloom during the following summer, produce seeds, and die. Plants that emerge late in the fall or in the spring are more likely to remain vegetative during the summer and bloom during the second summer. If the plant is cut or broken before it blossoms, it may regrow and flower during the third year.

Seed is the primary method of ragwort dispersal. It is spread by wind, water, and animals, including humans. Transportation of contaminated hay and straw from western Oregon and Washington by hunters is a major cause of movement east of the Cascade Mountains. A single plant may produce 150 thousand seeds, which can remain viable in the soil for 3 years or longer. Most seeds do not move more than a few feet from the parent plant.

Toxic properties

Livestock normally will not graze tansy ragwort if more desirable forage is available. Small plants, growing in intimate association with grasses and clovers or plants that may occur in hay, cannot be excluded selectively. Second-year plants are not grazed by horses and cattle until all other preferred forage has been removed.

Tansy ragwort contains at least six pyrrolizidine alkaloids. Concentration of alkaloids is greatest in flowers, then leaves, roots, and stems, and averages about 0.18 percent of the dry weight. The alkaloids themselves are not toxic. In the presence of certain liver enzymes, however, pyrrolizidine alkaloids are converted to pyrroles. When enough conversion to pyrrole has occurred, the liver ceases to function normally and the animal dies. The liver damage is cumulative with time and dose.

Cattle and horses are affected seriously; goats may suffer poisoning; sheep are generally not poisoned by tansy ragwort. Experiments show that dry tansy ragwort (weighing 2 percent of a weaned calf's body weight) fed over a 15- to 30-day period is enough to kill the animal. The toxic effect persists even when animals are removed from tansy ragwort after exposure. In the experiments this amounted to only 7 percent of the daily food intake. Ragwort fed to goats at 1 percent of their body weight for 25 days, during lactation (for a total of 125 percent of the goat's body weight), caused abortions and subsequent death of the does. It is unlikely an animal could graze that much on its own, since it represents about one-third of normal daily needs. Pyrrolizidine alkaloids have been found in milk from cows and goats fed a diet containing tansy ragwort. Susceptibility to tansy ragwort poisoning varies greatly among individual animals. Livestock in poor body condition are most rapidly affected because of pre-existing liver conditions.

Sheep are not easily poisoned by tansy ragwort. Ragwort is not rejected by sheep as it is by cattle and horses. Sheep may graze green ragwort plants preferentially in summer when other plants are dry. The leaves of tansy ragwort contain in excess of 10 percent crude protein and flowers contain 14.5 percent. In experiments, sheep have eaten more than twice their body weight in tansy ragwort and demonstrated no evidence of toxicity. Cattle are poisoned after ingesting 2 to 8 percent of their body weight. Younger animals are most sensitive. Sheep apparently do not convert pyrrolizidine alkaloids to pyrroles in their livers. It is not known whether sheep reconvert pyrrolizidine alkaloids into new molecules in the rumen or whether they don't have the liver enzymes to convert them into the toxic form. The OSU School of Veterinary Medicine offers blood enzyme tests for cattle, horses, and sheep. The tests can determine relative levels of toxin accumulation.

Costs of no control

Everything has a price tag. Inadequate pasture management is no exception. Losses from reduced performance of unthrifty animals and dead animals are real, as is competition by tansy ragwort for space, moisture, and nutrients. Dense populations of ragwort may reduce forage yields by 50 percent or more. The "cost" of anxiety when family horses are involved cannot be measured.

Cultural management

In a poorly managed, ragwort-infested pasture, the potential for damage to cattle is high.

Cattle will graze tansy ragwort in poorly managed pastures where other forage is limited.

The incidence of tansy ragwort is lower on well-managed pastures. The following practices are suggested to keep plants from setting viable seeds and to help achieve and maintain high forage productivity.

- Plant improved, high-yielding pasture species. Pastures with subclover or white clover and perennial grasses produce three to five times more forage, of higher quality, than native or annual grass pastures. Vigorous plants also provide more competition to tansy ragwort.
- Fertilize according to soil needs. Clovers require phosphorus and sulfur primarily; grass needs nitrogen. Clover can provide nitrogen through nitrogen fixation, but phosphorus, sulfur, and several other nutrients must be provided through chemical fertilizers or manure. Test soil to determine phosphorus needs. Consult OSU Fertilizer Guides 1, 2, and 63 or WSU Fertilizer Guides 1, 16, and 20. Instructions and sampling containers are available at county Extension offices.
- Maintain a dense stand. Tansy ragwort seed can germinate and establish in "holes" or "broken" spots in the stand more easily than in dense growth. Establish a good stand in the beginning. For example, tansy ragwort is seldom found in tall fescue growing in highway rights-of-way.
- Graze uniformly. Good grazing programs stimulate good plants to be more competitive and promote a higher proportion of clover. Subdivide pastures with fences and move stock from unit to unit in a planned sequence to avoid overgrazing.
- Avoid winter grazing by cattle and horses and grazing during irrigation. Large animals open "holes" in a good grass-clover pasture when soils are wet. Some winter use of excess grass growth by sheep or light cattle allows more light to reach the lower-growing clover and stimulates tillering of grass.
- Maintain a balance between grass and clover species. A proper forage mixture extends seasonal production, increases total productivity, and extends duration of competition to invading ragwort plants.

If tansy ragwort is already a problem in pasture, consider the reasons it became a problem. It is possible that some management practices promoted establishment. If preferential grazing is initiated too early in the life of the pasture stand, the soil disturbance may cause ragwort to develop from seed. Grazing either after new plants were firmly established or when everything was green should have minimized the invasion.

Continuous sheep grazing will remove tansy ragwort and keep it out. Observations suggest that the control occurs by keeping the plants from going to seed. Constant grazing may keep a plant vegetative and allow a second-year plant to develop into the third year. If not grazed, third-year plants will flower before they die. If sheep are removed and a seed source is present, tansy ragwort will reinfest the area. Mixed grazing by cattle and sheep results in more uniform forage utilization. Sheep can be used as a "preconditioning" agent ahead of cattle. Graze sheep from May to early June at an intensity that forces them to consume all tansy ragwort plants. This prevents ragwort plants from setting seed. Intense grazing for 2 to 3 years in sequence will reduce tansy ragwort populations so that cattle could be grazed safely during the growing season. Remove cattle if young tansy ragwort is being eaten.

Mowing is not effective in reducing tansy ragwort populations. Theoretically, mowing should keep plants from blooming if clipping is properly timed. In practice, this is virtually impossible to achieve.

Hand pulling and digging can be an effective tool in keeping second-year plants from setting seed. If plants start to bloom some viable seed can be produced. Hand labor requires persistence and intensive effort and is most applicable to spot infestations or small acreages. Unless the entire root system is removed, however, regrowth frequently occurs from segments left in the soil.

Chemical control

Tansy ragwort was controlled in test plots using 2,4-D applied at the rosette stage.

Effective and economical control of tansy ragwort has been accomplished with 2,4-D. Application is made during the early spring (April) or midfall, after rains have initiated new growth. Use amine, low-volatile ester (LVE), or emulsifiable acid forms of 2,4-D when ragwort is small or in the rosette stage. Apply 2 pounds acid equivalent per acre. If the 2,4-D formulation is 4 pounds-per-gallon use 2 quarts per acre in 20 gallons or more water. When applications are correctly timed, 2,4-D amine without wetting agent at 2 pounds per acre has given good to excellent ragwort control with minimum clover injury. Fall applications cause less clover injury than spring treatments.

If tansy ragwort is more mature and has a large rosette or the flowering stalk has elongated, use dicamba (Banvel) or dicamba + 2,4-D. Apply 1 pound active (1 quart) of dicamba or 0.5 to 1 pound dicamba plus 2 pounds (2 quarts) of 2,4-D per acre. Apply in 20 or more gallons of water.

After plants have bolted and developed a seedstalk, control with 2,4-D is less effective. The addition of dicamba results in increased control of mature plants and is effective in stopping the development of seeds in the flower. For best results from spot treatment, wet plants until spray begins to drip. Make application on a warm sunny day. Spray when no rain is expected for a minimum of 6 hours. After treatment, plants die slowly.

Always follow label instructions of the product being used. Read the label carefully for grazing restrictions before applying any herbicide. *Note:* Application of 2,4-D may injure clovers. Dicamba will kill clovers.

Biological control

Larvae of the cinnabar moth can reduce tansy ragwort populations to low levels in areas where other controls are not practical or economical.

The adult cinnabar moth is normally seen from April to July.

Insects are considered primary bio-control agents, but proper use of sheep grazing is also a form of biological control. Plant diseases may play an important role in the future, but presently there are no specific diseases used to control tansy ragwort.

The cinnabar moth, *Tyria jacobaeae,* was introduced into the Pacific Northwest in 1960 and is now widespread throughout the ragwort-infested areas west of the Cascade mountains. Cinnabar larvae feed on the foliage and flowers of ragwort, and in large numbers can totally defoliate the plant. Although the insect is widespread, not all areas have colonies. The following will aid in collection and successful establishment of cinnabar larvae from established colonies to new sites. The larvae should be nearing maturity, at which time they will be about 1 inch in length. Mature larvae are usually available from late June through July. An easy method to collect larvae from ragwort is by simply tapping the flowerheads into a large grocery bag, since the larvae readily fall when disturbed. Some ragwort foliage and stems should be placed in the bag as a source of food while in transit, and the bag should be kept shaded and cool until the larvae are released.

The new release site should have ample ragwort to support the larvae; however extensive stands are not necessary. Dump the larvae on flower clusters at the new site, but do not disperse them too widely. Do not be concerned if they fall to the ground. They will relocate tansy ragwort plants rapidly. In a dense stand of ragwort, 1,000 larvae could be released on an area of 200 square feet. The site should be well drained and should not be subject to winter flooding, since the insect overwinters as a pupa (cocoon) in litter on the soil and will drown on wet or soggy sites. The

The adult flea beetle is a new addition in biological control of tansy ragwort.

site should not be heavily grazed, as livestock trampling can destroy overwintering pupae. The cinnabar moth can be used where grazing occurs, but a protected site within the grazed area, such as a fence row or brush patch, should be chosen to protect the initial larval release. If larvae are not available for collection, consult your Extension agent or county weed control supervisor, as most counties are actively involved in the cinnabar moth program.

Even the severe defoliation by cinnabar larvae often does not kill ragwort. During late August and September, after the cinnabar larvae have formed pupae, rag-

wort will produce some regrowth and secondary flowering. Although cinnabar defoliation does eliminate much seed production, as well as ragwort foliage, some viable seed is produced by late season flowering.

Since the cinnabar moth offers only partial control of ragwort, a second insect, known as the ragwort flea beetle, *Longitarsus jacobaeae,* is being released in the Pacific Northwest. The adult beetles feed on the foliage during the fall and the larvae feed in the leaf petioles, crowns, and roots during the winter and spring. This feeding by the beetle larvae augments the cinnabar larval damage, coming at a time when the cinnabar moth is inactive. Thus, pressure is applied to the plant throughout the year and much better control can be expected where a combination of the two insects is used.

While many people have been involved in distribution of the cinnabar moth, the flea beetle is small and more difficult to collect. Specialized vacuum insect collecting equipment is needed, and the cost of this equipment may prohibit the public from getting involved in collecting flea beetles. The Oregon Department of Agriculture conducts a flea beetle collection and distribution program each autumn, beginning about the first of October. At that time beetles are made available through county Extension agents and county weed control supervisors. Sites with active cinnabar moth colonies are given preference for flea beetle releases, since a combination of the two insects gives the best control.

Biological control of tansy ragwort is not applicable to all types of grazing land. A combination of the cinnabar moth and the ragwort flea beetle may take 4 to 5 years or more to control the plant. On high-value, improved pasture, it is not economically feasible to wait that long, and chemical control is a more practical approach.

Native pasture and open rangeland are areas where biological control can be used to the best advantage. These lands are often too low in value, or the terrain too rough or inaccessible, for chemical control to be feasible. Once established, biological control organisms are self-perpetuating and can spread over most types of terrain. Where rangelands adjoin managed pasture, an active biological control program can help to keep ragwort from spreading into the improved pasture. Biological agents can be used along stream courses and fence rows, and in wood lots and waste areas. Once control of ragwort has been achieved for an area, biological agents can maintain the plant at low levels with little or no further expenditure.

Integrating management practices

In practice, the pasture manager is looking for a combination of several controls. Each situation has different characteristics and requires personal evaluation. Typical pasture situations include:

- *Management with a light infestation*—Options include all control practices, but a real attempt should be made to remove the flowering source.

On non-brushy pastures where good visibility exists, ragwort can be killed through spot spraying and by pulling. In this way no damage will occur to clover. All roots must be removed if plants are pulled.

Similar procedures are useful on brushy pastures, but some plants may be missed. This approach is only successful when the seed source is entirely removed. With low populations of ragwort, judicious stocking with cattle and horses should result in no ragwort consumption, even in the dry season. Grazing young feeder animals would be preferable to breeding stock, since feeders will be slaughtered before they accumulate lethal amounts.

- *Management with a heavy infestation* (both within and outside the pasture)— Where there have been no sheep grazing or where no grazing of any kind has taken place, ragwort populations can be high. The population of second-year plants will be large, and the potential for seed production is large. Remove all cattle and horses. Introducing sheep could effect a reduction of tansy ragwort over a short period, probably 2 years, but reinvasion will occur if seed sources are close by. The most rapid cleanup procedure is a broadcast spray application. Some clover damage may result. Long-term success is maximized by continued biological control using sheep or available insects after herbicide application.

Insects take time to increase their population, so early success will be limited. Pulling second-year plants will be futile, since populations are high. Mowing, unless frequent and thorough, will not reduce populations, since some plants will escape to make seed.

Where good populations of desirable plants don't exist, complete renovation of the pasture may be necessary. In this case, a year's delay in re-establishing a clover-grass pasture will pay dividends. During the interim year, an annual crop may be grown or the land kept fallow. In either case, cultivation must be timely during the crop or fallow year to insure that germinated ragwort plants are turned under before clover-grass is planted.

Conclusions

Purposeful management can result in pastures free of tansy ragwort. Promoting vigorous grass-clover competition through proper fertilization and grazing practices is the first line of defense to minimize future ragwort problems. Reinvasion from nearby areas is ever-present, even after a ragwort cleanup program has succeeded. Continued monitoring will be necessary to insure that new plants don't get started. If new plants appear, hand pull, dig, use chemical spot treatment, or periodically graze sheep. Even if cinnabar moths and flea beetles are present, some buildup of ragwort probably will occur before insect populations increase and provide control.

Exercising good management of pastures makes better neighbors. Keeping plants from blooming and ultimately permitting better forage plants to succeed in their places will result in more production, healthy livestock, and a positive managerial reputation in the community.

Pacific Northwest cooperative Extension bulletins are joint publications of the three Pacific Northwest states—Oregon, Washington, and Idaho. Similar crops, climate, and topography create a natural geographic unit that crosses state lines. Since 1949 the PNW program has published over 250 titles. Joint writing, editing, and production has prevented duplication of effort, broadened the availability of faculty specialists, and substantially reduced costs for the participating states.

This publication was prepared by Thomas E. Bedell, Extension rangeland resources specialist, Oregon State University; Robert B. Hawkes, entomologist, Oregon State Department of Agriculture; and Ralph E. Whitesides, former Extension agronomist, weed control, Oregon State University. It was reviewed by Extension weed control specialists in Washington and Idaho.

The Oregon State Department of Agriculture, Leonard Kunzman, director, cooperated in manuscript preparation and review and, through a grant, shared substantially in costs of printing and the color illustrations in the original (1981) edition.

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Oregon State University Extension Service, O. E. Smith, director; Washington State University Cooperative Extension, J. O. Young, director; the University of Idaho Cooperative Extension Service, H. R. Guenthner, director; and the U.S. Department of Agriculture cooperating.