mortality and vigor. Increasing stubble height from 5 to 10 cm reduced percent kill from severe to moderate. Further reductions in clipping intensity resulted in less damage but the magnitude of injury reduction was not as great. Clipping at weekly intervals season long to 20 cm caused no detectable injury. The results can be explained by greater accumulation of nutrient reserves since more photosynthetic tissue was retained.

Late spring is clearly a critical time for defoliation for all three species. The grasses must be given enough time to replenish carbohydrate reserves before dormancy. This can be achieved by early removal of cattle to allow for regrowth or practicing a grazing rotation that involves spring rest every second or third year. On southern British Columbia low-elevation ranges, growth of the grasses starts from mid to late March or immediately after snow melt. Growth starts almost a month later in the fescue grassland, about 600 m higher in elevation. Leaf growth ceases about mid to late May when the plants are in flower and plants mature from mid to late July depending largely upon soil moisture depletion. Fall growth is not predictable but in certain years it occurs in early September.

Despite moderate overall utilization of pastures, repeated heavy grazing on selected individual plants, as commonly occurs, will eliminate them from a stand. Fall grazing, which should not harm the grasses if spring grazing was early, should prevent the development of large plants with coarse foliage that are unpalatable to cattle and thus minimize overuse of preferred individuals.

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Poisonous Plants: The Snakeweeds

Michael H. Ralphs

Editor's Note: This is a continuation of the series that we have run in the past on various poisonous plants which may inhabit parts of our rangeland.

Broom snakeweed (perennial broomweed, matchbrush, turpentine weed) and its close relative threadleaf snakeweed (threadleaf broomweed) are noxious plants infesting many areas of our western rangelands. Both are toxic to livestock, with animal abortions being the most common problem. Broom snakeweed is perhaps more destructive to our rangeland production as a noxious increaser or invader species on depleted or disturbed rangeland.

Broom snakeweed is widely distributed throughout North America, from west Texas to California and from Saskatchewan to northern Mexico. It is one of the most widespread undesirable species, occurring in the shortgrass, desert grassland, salt desert shrub, sagebrush-bunchgrass, and pinyon-juniper dominated plant communities. The distribution of threadleaf snakeweed is much smaller, ranging from central Texas through northern Mexico to California, and as far north as southern Utah, western Colorado, and Nevada.

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Description

Both species of snakeweed are short-lived perennial half shrubs ranging from 6 inches to 2 feet tall. Numerous unbranched erect stems originate from a woody base and die back when the plant enters dormancy. Both species have taproots and dense lateral roots. The leaves are narrow and thread-like (1/8-1/4 inch wide and 3/4-1 1/2 inches long). Both species have numerous clusters of yellow flowered heads. The number of flowers per head is an important distinguishing characteristic between the 2 species. Broom snakeweed has more than 3 flowers per head while threadleaf snakeweed has only 1-2. Threadleaf snakeweed is also less dense in appearance.

Most of the ecological and control studies have been conducted on broom snakeweed but it is thought that threadleaf snakeweed reacts similarly. The average lifespan of broom snakeweed is 2.5 years. Seedlings are sensitive to soil moisture stress from intraspecific and interspecific competition and most die within the first year (Parker 1982). Broom snakeweed rapidly invades or increases in heavily overgrazed, burned-over areas or otherwise disturbed sites. The species also increases during and following drought. Its seeds germinate when favorable precipitation resumes and it

Broom snakeweed.

rapidly increases as a result of the reduced competition. Seeds lying on the soil surface or slightly buried germinate quite rapidly when conditions are favorable. However, buried seed has a low germability and serves as a long-term seed source (Mayeaux 1983). Once a stand is established, population dynamics are very cyclic and appear to be independent of grazing pressures (Jameson 1970).

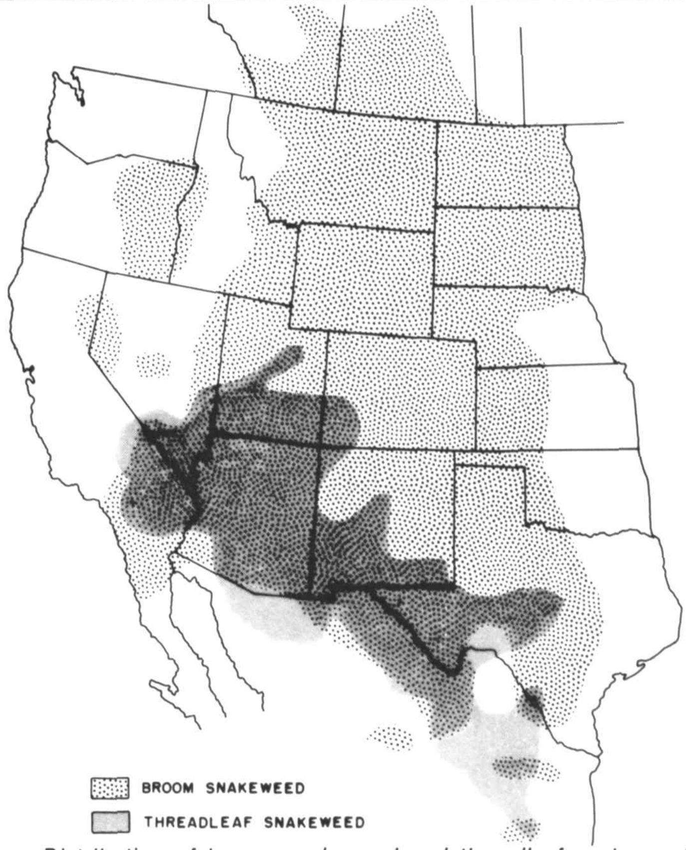
In dense stands, there is high natural mortality due to competition for soil moisture (McDaniel et al. 1982) and from insect damage. Larvae from several species of insects defoliate top growth and bore into roots resulting in large scale mortality of older mature plants (Foster et al. 1981). Broom snakeweed is also highly competitive with perennial grass species. Almost total removal is required to allow an increase in grass production (Ueckert 1979).

Toxicity

Acute toxicity has been experimentally induced in livestock by feeding large quantities of threadleaf snakeweed (Mathews 1936). The symptoms include: anorexia; mucopurulent nasal discharge; the skin on the muzzle becomes crusted and sloughs; loss of appetite and listlessness; rough haircoat; frequent urination and the animal often twists as if urination causes pain; diarrhea in early stages followed by constipation; large amount of white mucus in foul smelling feces. In pregnant cows, there is vulvar swelling and earlier than normal udder development.

More common symptoms from feeding smaller quantities of threadleaf snakeweed are abortion in cattle, premature calves that are weak or dead at birth and retained placenta. Major outbreaks have occurred in west Texas and New Mexico in which 10-60% of the cows aborted or delivered premature calves. Losses vary due to the differing susceptibilty of individual cows (Dollahite and Anthony 1957).

There is still some uncertainty as to the abortifacient compounds in the snakeweeds. Dollahite et al. (1962) extracted a saponin from threadleaf snakeweed and other plants and produced abortions and death in rabbits, goats and cattle when injected intravenously. However, Molyneux et al. (1980), identified individual essential oils in broom snakeweed and ponderosa pine (which produce remarkably similar symptoms of abortions and retained placentas) and con-



Distribution of broom snakeweed and threadleaf snakeweed (taken from Lane, 1985).

cluded that the dissimilarity of the essential oil composition made it unlikely that the essential oils were the abortifacient compounds. Although the specific toxic compound(s) have not yet been identified, it is known that small amounts of the snakeweeds will cause abortions in livestock and large amounts will cause death.

Management Recommendations

The plant begins growth in late winter and early spring when most other forage is dormant or in short supply. Most problems have been reported during this season when cows from spring calving herds are in the last trimester of gestation. Losses can be prevented by keeping pregnant cattle from grazing snakeweed infested pastures.

The snakeweeds are not considered to be very palatable. Therefore, if adequate good quality feed is available, cattle are unlikely to graze the snakeweeds. Pregnant cattle grazing snakeweed infested pastures should be carefully watched. If there is premature udder development or vulvular swelling, or if abortions occur, the herd should be moved to a snakeweed-free pasture. If abortions and premature calves are persistent problems, a rancher should weigh the magnitude of the problem against the cost of snakeweed control to determine if it is economically feasible to control the plant and create a snakeweed-free calving pasture.

Control

Considerable research has been devoted to herbicide control of broom snakeweed. Early recommendations included 2,4-D at rates of 1 lb/acre for two successive years (Sperry and Robinson 1963). Good soil moisture and growing conditions were essential for significant control. More recently, picloram has been shown to be most effective (Gesink et al. 1973, Schmutz and Little 1970). Application rates ranging from 0.25-1 lb/acre ai. for picloram pellets and liquid gives effective control (the higher rates are required on heavier soils). Low rates of picloram in combination with other herbicides have also proven effective and less expensive. Picloram at 0.25 lb/acre in combination with 2,4-D at 1 lb/acre, tryclopyr at 0.4 lb/acre, and dicamba at 0.25 lb/acre have given kill rates greater than 95% (Jacoby et al. 1982, Sosebee et al. 1982a). A good kill can be obtained anytime the plant is actively growing but more consistent results have been obtained at the end of the flowering period when carbohydrates translocate into the crown and roots for storage (Sosebee et al. 1982b). Tebuthiuron at 0.5-1 lb/acre is also effective (Sosebee et al. 1982a) but the plant takes 1-2 years to die.

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A Square of Slate

By Dick H. Hart

We learned our letters in a country school;
Not on a "chalkboard" but on honest slate.
And chalked on it as well those time-worn rules
Which taught us, like our fathers, to relate
The world to values that we held to be
As sturdy as that slate.

The school is gone, replaced
By tasseled ranks of corn. Each fall
Cicadas rasp and buzz
Where children called, and all
That's left a square of slate
Upon my office wall.

But no, not all; the values have endured
And we, beneath our graying brows, appraise
Thru eyes of boys and girls of decades past
The world in its contemporary phase
And measure it against the lessons learned
In country schoolhouse days.

Frasier's Philosophy

Everyone has had time to reflect on the record-setting Annual Meeting held at Salt Lake City. If you were there you were a part of it. If you did not have the opportunity to attend, then you have been told what a great meeting you missed. I was pleased to see the number of young people and new members actively participating on various committees and functions. Participation at the Annual Meetings is great, but don't forget the Section and Chapter levels of the SRM. Participation in activities at these levels is just as important and you can have a major impact on the promotion of range management. I challenge anyone who is having trouble in finding some activity to participate in to go out and recruit 5 new members, then ask your Section President if there is something you can work on. I would bet that he will welcome you with a smile. If that doesn't work let me know. There is something for everyone who is willing to work.

"Happiness is not a matter of good fortune or worldly possessions. It comes from appreciating what we have instead of being miserable about what we do not have".

From: *Bits & Pieces*, The Economic Press, Fairfield, New Jersey.