Mechanical Management of Western Snowberry

Llewellyn L. Manske PhD
Range Scientist
North Dakota State University
Dickinson Research Extension Center
Report DREC 05-1062

Western snowberry can invade grasslands by shading the understory plants with an enlarging canopy cover of aerial stems. Native grass species require near full sunlight and are reduced by low sunlight conditions. A replacement community consisting primarily of Kentucky bluegrass develops in the areas of diminished light. The rate of shrub encroachment can be decreased or increased by the beneficial or detrimental effects caused by different grazing management practices on the competitive abilities of grass plants. Grazing practices, however, will not decrease aerial stems, and some other type of management is needed to reduce western snowberry aerial stem density (figure 1).

The woody stems of western snowberry can be cut with typical farm mowing equipment. Two basic types of machines are used for general purpose agricultural mowing: the rotary mower and the sickle-bar mower. Rotary mowers are equipped with one or two horizontally rotating blades that have each end sharpened to cut on the leading edge. Sickle-bar mowers have a cutter bar with stationary guards, and a sickle with knife-edged sections moves back and forth, cutting against the blunt edges of the guards. Mechanical removal of the aerial stem top growth of western snowberry eliminates competition for sunlight and reduces stored carbohydrate energy, resulting in improved plant species composition of the ecosystem and reduced shrub stem density. Mechanical mowing equipment is effective on most western snowberry colonies; however, steep slopes, rough terrain, and large rocks may restrict mechanical equipment usage in some areas.

Pelton (1953) conducted an experiment of cutting individually marked mature western snowberry aerial stems at monthly intervals in dry and moist habitats in Minnesota. Severity or height of cutting seemed to have little or no effect on stem survival, but season of cutting and quantity of soil moisture influenced the results from the cutting treatments. Stems lightly topped in June or July frequently died partly or all the way to the ground. Stems lightly topped in August, after shoot buds had become dormant, died completely. While most of the stems cut in June and July under dry soil conditions delayed resprouting until the following year, most stems cut under moist soil conditions resprouted the same season. None of the stems cut in August, after normal dormancy of the lateral buds on the stem bases, resprouted during the same season. Pelton (1953) determined that day lengths shorter than 14 hours prevented normal vegetative growth of sucker shoots from lateral buds on crowns or stem bases and rhizomes. The only single cut treatment that was partially effective at stem kill was an August cutting on a dry site (Pelton 1953).

McCarty (1967) conducted two experiments in southern Nebraska that estimated percent reduction of western snowberry aerial stems of colonies mowed with a tractor-mounted sickle-bar mower. The mowing was repeated for 2 or 3 consecutive single annual spring treatments conducted on three dates in May, and the results were evaluated one year after final treatment.

All of the single annual spring mowing treatments repeated for two or three years resulted in some reduction of western snowberry stems. Two mowings during late May, when stems were at the full foliage stage, reduced aerial stems only 13%, and three mowings during late May caused a 30% reduction in stems (table 1). Two mowings conducted between 12 and 21 May, when new shoots were 4 to 8 inches (10-20 cm) tall, with four to six leaf pairs, reduced stems about 30%, and three mowings during mid May caused a reduction of about 50% in stem numbers (table 1). McCarty (1967) did not evaluate the understory species composition in the Kentucky bluegrass pasture for potential changes resulting from the mowing treatments' removal of the shrub canopy and the elimination of competition for sunlight. The slow rate of aerial stem reduction that resulted from repeated single annual spring mowing treatments led McCarty (1967) to conclude that mowing was an ineffective method for western snowberry control and that the impracticality of mowing extensive areas caused severe limitation of the practice as a weed control measure.

Western snowberry has an extensive belowground interconnected rhizome system that has the ability to replace destroyed or damaged aboveground stems. Vegetative suckers develop from lateral buds on the crowns and rhizomes, and the buds' growth depends on stored nonstructural carbohydrates. The potential for repeated aerial stem replacement is contingent on the replenishment of the carbohydrate reserves from photosynthetic activity of the replacement leaves on the new sucker stems.

The objective of mechanical mowing treatments is to deplete the stored nonstructural carbohydrate energy by cutting aerial stems at the times when the carbohydrate reserves are low. Energy reserves will be further reduced when vegetative sucker regrowth is produced. Repeated cutting is required to prevent replenishment of reserves used in producing new growth (Adams and Bailey 1983).

Adams and Bailey (1983) compared the nonstructural carbohydrate reserve cycle for western snowberry colonies mowed in May to that of nonmowed colonies in Alberta. Nonmowed colonies have a sharp drawdown in carbohydrate reserves from the rapid growth of early spring until shortly after full leaf, from mid April to early June (9 June). Rapid replenishment occurs during the flowering stage, from early June to mid July. A second drawdown period occurs during fruit fill, between mid July and early August. A second replenishment period occurs between mid August and early September. A gradual third drawdown occurs during pre-winter root growth and bud development, from early September to late October (Adams and Bailey 1983).

The nonstructural carbohydrate reserve cycle for western snowberry colonies mowed with a gyro-mower on 8 May was different from that of the nonmowed colonies. The drawdown in carbohydrate reserves during the rapid growth in early spring was greater on the mowed treatment than on the nonmowed control. The carbohydrate low was reached in late May and was prolonged for six weeks (until 10 July) as a result of the vigorous flush of sucker regrowth. A period of carbohydrate replenishment started when there were 9 to 13 leaf pairs on the new sucker stems. By the time the first flowers opened in mid to late June, the carbohydrates were fully recharged to levels that exceeded the quantities of mid April. After a single mowing treatment in May, western snowberry colonies were able to reestablish high carbohydrate reserve levels during the same growing season.

Adams and Bailey (1983) analyzed percent nonstructural carbohydrate reserves remaining in crowns or stem bases of western snowberry colonies during October following single, double, and triple mowing treatments conducted on 8 May, 24 June, and 13 August in Alberta. The carbohydrate reserves in the stem bases were lower on all of the mowing treatments than the reserves on the nonmowed control (table 2). The triple mow treatment with cutting in May, June, and August caused the greatest reduction in carbohydrate reserves. The double mow treatments with cutting in June and August or in May and August caused substantial reductions in carbohydrate reserves (table 2). The single mow treatment in August caused greater reductions in carbohydrate reserves than the single mow treatments in May or in June (table 2).

Vigorous sucker regrowth occurred after cutting on 8 May or 24 June (Adams and Bailey 1983). The replenishment of carbohydrate reserves from the leaves on the new sucker stems diminished the negative effects from the single mow treatments in May or in June and the double mow treatment with cutting in May and June (table 2).

No visible signs of resuckering were observed after the 13 August mowing treatments (Adams and Bailey 1983). However, excavation of stem bases in October showed that many sprouts had been produced after August mowing and were between 0.4 to 2.0 inches (1-5 cm) long. About 30% of the stimulated sprouts had broken the soil surface and had been injured by frost (Adams and Bailey 1983).

Practical Mowing Treatments

The mowing height of western snowberry colonies in grazed pastures should not be close to the ground, at the height that hay is cut, but the mowing height should be raised to about 8 or 9 inches (20-30 cm) above the ground. The cutting height should be set so most of the leaves and branches on the typical stems are removed and a relatively tall, flexible, bare stem remains. Stems one year old and older are usually killed to ground level when the tops are removed by mowing. When only a portion of the top is removed, young sucker stems do not die; branches are produced from the undamaged leaf axils, and the stems continue to develop.

Mature stems of western snowberry are flexible and can be bent to the ground without breakage (Pelton 1953). However, short stems that have been cut by mowing machines are not as flexible as uncut stems. The shorter the stems are cut, the greater their rigidity. Stems cut at 1- to 3-inch (2.5-7.6 cm) heights by sharp sickle sections are very rigid and have sharp points. These short, rigid, sharp stems can be serious problems for cattle walking through the mowed western snowberry colony areas. The stiff stems can puncture the sole of the hoof, causing an injury open to infection that can possibly result in hoof rot. These hazardous conditions can be avoided by raising the cutting height of the mower so that tall, flexible stems are left and by using dull or unsharpened mower blades so the contact between blade and stem creates a frazzled end rather than a straight, sharp point.

A single mowing treatment does not control western snowberry colonies. Repeated single annual mowing treatments reduce stem numbers slowly, and numerous years of retreatment are needed to develop substantial results. The reduction in stem numbers results from the annual removal of accumulated aboveground biomass. The annual mowing deprives western snowberry colonies of a valuable resource and disrupts growth mechanisms that require longer than one growing season to recover. Repeated single annual mowing treatments conducted in August should be expected to have greater effect on aerial stem reduction than single mowing treatments conducted during other times. Because the regrowth of sucker stems after mowing treatments conducted in May or June can replenish the carbohydrate reserves during one growing season, these early season single mowing treatments may result in a decrease of only a few stems each year.

Reduction of stem numbers is not the only benefit from mowing treatments, however. Annual mowing treatments remove the shrub canopy cover and eliminate the competition for sunlight. The increased sunlight causes changes in plant species composition toward the grassland species that were present in the ecosystem prior to the western snowberry invasion. The desirable changes in plant species alone may be adequate justification for conducting single annual mowing treatments in grazinglands invaded by western snowberry.

The triple mowing treatment with cutting in mid May, late June, and August results in the fewest growing-season days in which western snowberry colonies can replenish carbohydrate reserves. Because the cutting height of the June and August mowings must be low to remove most of the biomass of the new sucker stem growth and recutting the older stems at short heights produces hazardous stiff stems, the triple mowing treatment may require the removal of cattle for more than one growing season. The annual costs for triple mowing treatments are greater than the costs for double or single annual treatments. However, the triple mowing treatment may reduce the number of growing seasons that the treatments need to be repeated.

The double mowing treatment can be as effective as the triple mowing treatment, when mowing periods are conducted for maximum carbohydrate depletion. Because the cutting height of both mowings can be at the taller levels, cattle do not need to be removed from pastures with double mowing treatments. The seasonal low carbohydrate reserves for western snowberry occur during the period from rapid growth until near the start of flowering, between mid May and mid June. The first mowing treatment conducted during the last week in May through the third week in June should cause considerable depletion of stored carbohydrates. Growth of sucker shoots should continue to deplete carbohydrate reserves for nearly six weeks, until the new sucker stems develop about ten leaf pairs. A second mowing treatment conducted sometime during late July through August is needed to prevent full carbohydrate replenishment. Mowing in late July or August causes a substantial amount of winter injury to late-season lateral bud sprouts on the stem bases. The double mowing treatments will need to be repeated two, three, or more seasons, depending on the quantity of stored carbohydrates of the western snowberry colonies at the start of the mowing treatments.

Acknowledgment

I am grateful to Amy M. Kraus for assistance in preparation of this manuscript. I am grateful to Sheri Schneider for assistance in production of this manuscript and for development of the tables and figure.

Table 1. Percent reduction of western snowberry stems from repeated single annual mowing with a sickle-bar mower, evaluated one year after final treatment.

Number of repeated single annual treatments	Treatment Dates: 12-14 May	19-21 May	26-28 May
2	27	33	13
3	50	53	30

Data from McCarty 1967

Table 2. Percent nonstructural carbohydrates of stem bases in October following mowing treatments and percent change from nonmowed control.

		Treatments							
		Control	Single Mow			Double Mow			Triple Mow
		No Mow	8 May	24 Jun	13 Aug	8 May & 24 Jun	8 May & 13 Aug	24 Jun & 13 Aug	8 May, 24 Jun, & 13 Aug
		4 reps	4 reps	4 reps	4 reps	4 reps	4 reps	4 reps	4 reps
Nonstructural Carbohydrates	(%)	20	17	16	15	18	13	12	8
% change	(%)		-15	-20	-25	-10	-35	-40	-60

Data from Adams and Bailey 1983

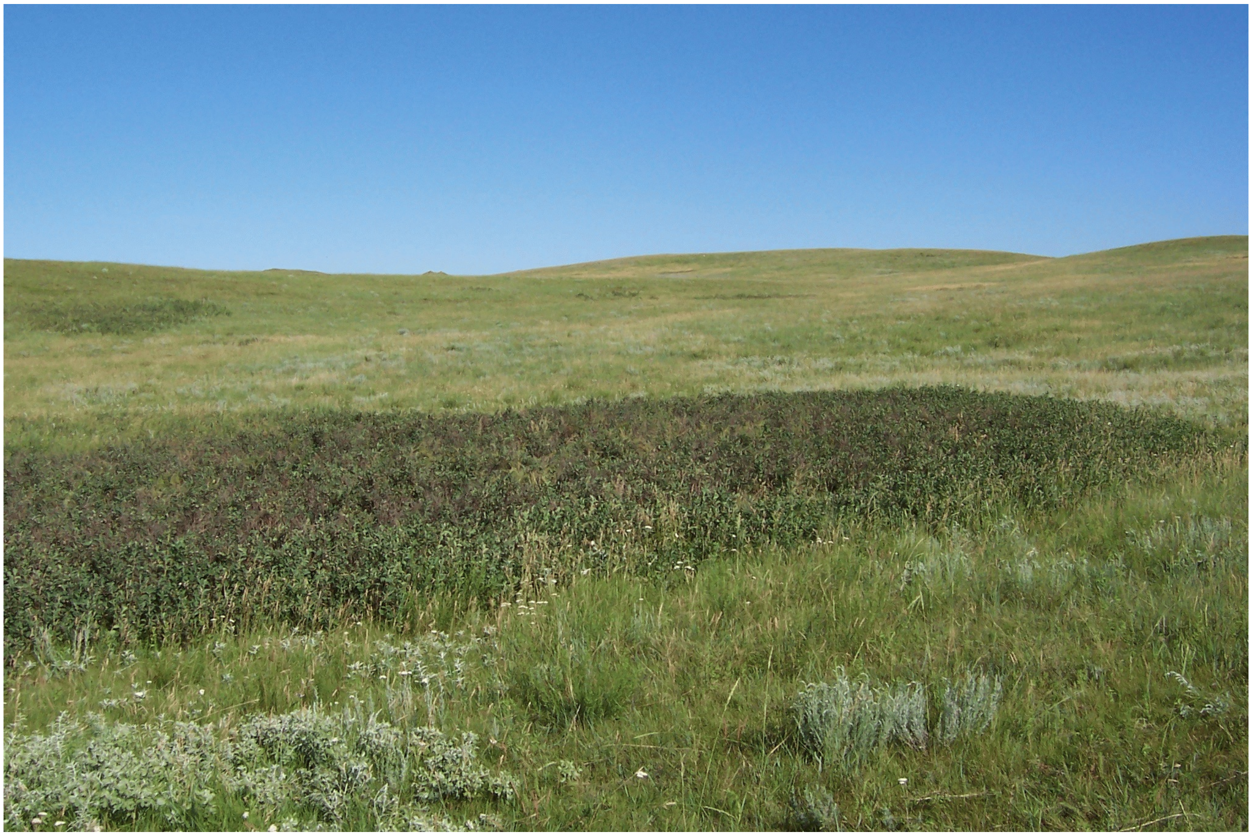

Fig. 1. Western snowberry colony in pasture grazed seasonlong.

Literature Cited

Adams, B.W., and A.W. Bailey. 1983. Effect of mowing on energy reserves of western snowberry. Agriculture and Forestry Bulletin (Special Issue). p. 72-75.

McCarty, M.K. 1967. Control of western snowberry in Nebraska. Weeds 15:130-133.

Pelton, J. 1953. Studies on the life-history of *Symphoricarpos occidentalis* Hook., in Minnesota. Ecological Monographs 23:17-39.