MANAGEMENT NOTES

Sweetclover as a Range Legume[1]

ARTHUR D. MILES
Rancher, Livingston, Montana.

Highlight

Sweetclover grows among native grasses and supplies nitrogen and phosphate. Sweetclover has been increased on the ranch by managing for seed set, for seedling establishment and by introducing it into new areas. Seed set is favored by grazing off the heavy second year growth to conserve moisture for seed production. Seeding establishment is favored by spring grazing that reduces competition. The ability to reseed itself has been found to be limited to south facing slopes. The sweetclover provides nitrogen and extracts phosphate from the soil for its large growth; the fertility remains to fertilize the grasses.

Sweetclover (*Melilotus officinalis*), growing among the short native grasses, produces a thick growth, 3 to 4-foot high, that compares in forage value to irrigated and fertilized pasture. The nitrogen the sweetclover fixes and the phosphate the sweetclover draws from the soil is left to fertilize the grasses. What is more, the sweetclover grows naturally. It has been maintaining itself on certain range areas of the ranch for over 40 years.

To the ecologist, sweetclover is an invader. To the rancher making a living running cattle, sweetclover is a plant that produces forage in far greater abundance and of higher nutritional quality than the bluebunch wheatgrass (*Agropyron spicatum*), western wheatgrass (*Agropyron smithii*), and Idaho fescue (*Festuca idahoensis*). Sweetclover, with its thick, four-foot-high growth, makes it amazingly apparent that the sunlight, soil, and moisture available has a greater potential of production than the short growing, unpalatable, fertility starved native grasses indicate.

An effort has been made in the past 25 years to increase the amount of sweetclover growing on the ranch. The ranch is in south-central Montana at the edge of the plains. Elevations range from 4700 to over 7000 ft. Much of the yearly precipitation comes in March, April, May, and June. Considerable snow accumulates some winters, and snow drifting is a factor in moisture distribution. The average total precipitation is about 20 inches, but there is a sharp variance from one year to another and in moisture patterns. July and August are hot and dry with low humidity. High winds are characteristic and are associated with periods of low humidity. Soils have been formed from decomposed sedimentary sandstones and shales. The ranch area is broken by steep hills rising 1500 feet from the valley floors. The steep hills create marked site differences under the same climatic conditions, the south exposures having markedly different growing conditions than the north facing slopes. Under the varied conditions of soil, moisture, exposure, and elevation, the adaptability and growth habits of the biennial sweetclover is considered.

The ranch's sweetclover program has consisted of (1) getting more sweetclover to grow and (2) accommodating the sweetclover that does grow to give it greater opportunity to use its ability to fix nitrogen, its ability to use phosphate, its ability to root into winter accumulated moisture and its ability to produce a tremendous amount of carbohydrate and protein.

The sweetclover growing program is in two phases: (1) getting more to grow on sites where it already exists, and (2) introducing it into new areas.

Characteristics of Sweetclover

Sweetclover is a biennial. It grows in abundance some years and is almost completely absent in others. Factors that have been found to affect the establishment of sweetclover seedlings, determining whether there will be sweetclover the following year are: (1) availability of seed, (2) moisture, (3) competition, and (4) soil.

Apparently, after there once has been good seed production, the availability of seed is no longer a factor. Hard seed is ready and waiting in the soil regardless of the number of years since it was produced. Several hundred pounds of seed per acre are produced in a year of good seed set. Where some seed sprouts under favorable moisture condition, sufficient hard seed remains to assure sufficient seed in the following years.

The extent of natural seed production was demonstrated when a 450 pound per acre seed yield was obtained from a volunteer stand. The 450 pound yield was considerably less seed than would have been produced had the sweetclover gone unharvested. Some of the mature seed fell off the stems and was lost. A still greater amount was never formed, since at the time of harvest there was a high percentage of immature seed, with the sweetclover still blooming.

Managing for Seed Production

Grazing in the right amount and at the right time favors seed production. If the second year growth is not grazed, the sweetclover exhausts the soil moisture before seed is produced. Too close utilization limits seed production. To obtain the best forage utilization and seed production, grazing should start just before blooming as the plant is lengthening out. Grazing then should stop when the sweetclover has been grazed to a 10-inch stubble. From the 10-inch stubble, the sweetclover regrows using the moisture that has been conserved to produce an abundance of seed.

Moisture Relations

Moisture, particularly the way the moisture comes, is an important factor in creating an abundance of sweetclover.

[1] Received May 22, 1969; accepted for publication June 30, 1969.

A number of days of continual soaking is required to cause the hard seed to swell and sprout. When February and March have continual wet snows, seedlings become established. Seeds continue to sprout in April, May, and June, but late sprouted seedlings find greater competition for sunlight and fertility. Few seeds sprout during chinook periods in winter or during wet fall periods.

Sweetclover seedlings survive better in above average moisture years, when competition for moisture and fertility is less. This effect has been demonstrated where a stock water ditch was run through a range area. Three feet on each side of the ditch, where moisture was ample, sweetclover grew in abundance. In springs with above average moisture sweetclover grows most everywhere in abundance.

The sweetclover seedling frequently grows in the high moisture, high humidity spring period, only to succumb to the dominating effect of the associated plants as the humidity drops and the soil dries. Seedlings establish every year if there is no competition.

It has been found possible to conserve moisture and provide sunlight for the seedling by spring grazing. Early utilization curtails the grass growth with the removal of the nitrogen contained in the early growth. The grass makes little regrowth for lack of fertility. With the grass growth checked, the sweetclover has been produced on areas grazed closely in the spring, in what has turned out to be an otherwise "off" year for sweetclover.

Sweetclover itself, the second year growth, has been found highly competitive to seedlings. This may be the main factor in the occurrence of two successive sweetclover years. Close utilization has been found necessary to reduce sweetclover competition to favor the establishment of the seedling the second year.

Heavily used sites tend to be kept open and receptive to sweetclover because of preferential grazing. The heavily used areas are south facing slopes, low down on the slopes. Higher up on the slope, particularly where the snow drifts, sweetclover has been found to grow if it is introduced. However, well grassed areas on upper slopes where the snow blows off afford too much grass competition.

The fertility provided by the sweetclover causes the grasses to thicken up. If grazing is curtailed to restrict removal of fertility provided by sweetclover, the grasses fully occupy the ground to the exclusion of the sweetclover. On the other hand, if the desirable grasses are not managed so they have a chance to use the fertility, undesirable plants such as cheatgrass (*Bromus tectorum*) move in.

Soil Factors

A soil high in calcium, potash, phosphate and short of nitrogen is considered to favor the legume over the grasses. Since the legume fixes its own nitrogen it has a competitive advantage in a nitrogen short soil. Since sweetclover is able to use phosphate that is unavailable to the grasses, it has an advantage on soils with a shortage of available phosphate.

Sweetclover will grow on north facing slopes, but won't reseed there. Whether the factors that prohibit the reseeding on the north facing slopes are edaphic or competitive have never been determined. Sunlight, particularly as it determines the amount of seed produced may be an important factor on north facing slopes.

Cracking, powdering of the soil, and treading of the animals all affect seed coverage. Sprouting seeds have been observed to need some soil cover to become established. Seeds sprout on the surface during extended moisture periods, only to perish. Poor root penetration is considered the reason.

FIG. 1. Sagebrush is mowed, burned after drying, and sweetclover seed broadcast to introduce sweetclover in new areas.

Introducing Sweetclover to New Areas

All the south facing slopes on the ranch have been found suitable for sweetclover, even at the highest elevation. The problem has been to get the sweetclover started in the areas adapted to it.

Broadcasting seed introduces sweetclover. However, just broadcasting a few pounds of seed per acre without taking other measures has resulted in slow establishment. Fifteen years after just broadcasting seed, small patches of sweetclover start to appear.

A more effective introduction has been achieved where sweetclover seed has been broadcast after fire has destroyed the limber pines (*Pinus flexilis*) and big sagebrush (*Artemisia tridentata*). The few plants that establish from the first broadcast seed produce an abundance of seed. The ash, the openness of the soil, and the absence of competition favor the sweetclover.

With no site preparation, the few plants established produce little seed because of close grazing by the deer. However, with the large amount of sweetclover resulting from seeding following burning, the deer are confronted with more growth than they can keep from going to seed. Sweetclover is difficult to establish on summer ranges because of the close use by the livestock, particularly sheep.

Inoculation with nitrogen fixing bacteria (*Rhizobium*) is considered essential for best introduction. Spread may be restricted to the area where the bacteria infests the soil. Artificial inoculation is better affected where the seed is drilled into the ground rather than broadcast on the surface.

Variety

Seed harvested from volunteer stands has been found to be better adapted to the site. The sweetclover undergoes

selection and the ecotype has better ability to reseed under local conditions. Broadcasting of white sweetclover (*Melilotus alba*) seed produced no plants.

Value

Sweetclover produces twice, once in its own growth and again when it fertilizes the grasses.

In above average moisture years the sweetclover provides many times more forage than the associated grasses. Even in average years it adds considerable to the forage yield.

Much or most of the nitrogen and phosphate contained in the sweetclover finds its way back to the ground to fertilize the grasses. The nitrogen effect is readily seen in the darker green color of the grasses growing in association.

Extra management effort has been found necessary to obtain the greatest benefit from sweetclover. Grazing needs to be closely regulated to provide for seedling establishment, seed production, and optimum utilization.

Sweetclover will cause bloat. A factor in preventing bloat has been to allow the grasses the greatest opportunity to grow so there will be a mixture of grass and clover. Where spring grazing is intense to favor seedling establishment, fall grazing is not desirable.

Prospective

Sweetclover is growing without any attention to its needs, other than regulating grazing. It is believed that it would grow in greater intensity and on more areas if its needs for such fertility elements as calcium, magnesium, potassium, phosphate, molydenum, sulfur were determined and satisfied. It is believed that if the seedling needs for such elements as potash and phosphate were more fully met it could withstand greater grass competition.

Sweetclover has become a part of the biotic climax. For the effort of close management sweetclover returns a tremendous amount of forage and fertility.