APRIL 1998
VOLUME 18
ISSUE 4

agronomynews

Tips for Renovating Forage Stands Using Interseeding

Interseeding can be an effective method of introducing new plant species into established forage stands. Basically, interseeding involves the use of heavy-duty drills that are designed to cut through the sod mat and place seed at the proper depth while leaving the existing vegetation essentially intact. Because of competition from the existing vegetation, this method has higher risks of stand failure compared to conventional renovation using complete tillage. However, the higher risks are offset by relatively lower costs. Interseeding can cost up to $25/acre for drilling compared to $100/acre for land preparation alone on mineral soils to over $500/acre for land preparation in mountain meadows with heavy organic soils. Other advantages associated with interseeding include reduced potentials for noxious weed invasions and erosion and the ability to seed ground that is steep and/or rocky. Generally, at least a partial hay crop can be harvested during the year of seeding using interseeding whereas the land may be out of production for up to 2 years, depending on soil type and environment, using complete renovation.

There are numerous reasons for seeding and landowners should have firm objectives in mind before proceeding. Reasons for interseeding include increasing productivity by replacing low producing species such as Kentucky bluegrass, introducing species that compete with and replace weedy species such as foxtail barley, improving forage quantity and quality by introducing nitrogen fixing legumes such as clover or alfalfa, or introducing a specialty grass like Garrison creeping foxtail that grows well in wet, boggy areas. Some landowners view seeding as a cure all when, in reality, there may be limiting factors in other parts of their management. The newest, most productive species will not perform any better than the existing vegetation if improvements in water, fertility, grazing, and weed management are not also addressed. Remember that the

INSIDE THIS ISSUE:

Renovating by Interseeding	1
Testing Forage Quality	4
Harvest Management	5
Variety Test	7

Interseeding

(Continued from page 1)

existing vegetation is there for a reason!

Not all forage stands are equally suited for use of the interseeding approach. Success of establishing new plants is greatest in existing stands that are thin and have significant amounts of bare ground. The denser the existing vegetation, the more difficult it is to successfully interseed new plants. Dense stands will generally need to be suppressed in some manner prior to seeding to reduce competition long enough to allow seedling establishment. Unless the existing stand is extremely sparse, direct seeding will be only marginally successful or will completely fail. Suppression of the existing vegetation can be done in a number of ways. The most successful but more costly method involves spraying with Roundup herbicide at least 2 weeks prior to seeding. Generally, the goal is to suppress the vegetation for a period of time, not totally kill it. In some instances, such as a stand dominated by Kentucky bluegrass, total kill may be the goal. These factors, in combination with soil type, plant species present, and environmental conditions, affect the rate of herbicide application. Roundup should be applied at rates between 2 and 1 qt/acre if the goal is to suppress the existing vegetation. Rates between 1 and 2 qts/acre should be used if the goal is to eliminate the majority of the existing vegetation. Even at the higher rates, many of the more vigorous, deep-rooted species will only be suppressed during the year of seeding and will recover by the next growing season. The higher rates are also needed to suppress many of the sedge (Carex) and rush (Juncus) species found in many mountain meadows. Drawbacks to using broadcast applications of Roundup are that the entire forage crop is generally lost during the year of seeding and the stand is opened up for possible invasion by weedy species.

Applying Roundup in bands at time of seeding is an alternative to broadcasting. This method suppresses the vegetation immediately surrounding the drill row thus allowing seedlings to become established while preserving a partial hay crop. A study on a mountain meadow near Ridgway, Colorado found that band applications of Roundup reduced hay yields by about two-thirds (from 3.2 to 1 ton/acre) while no yield was obtained from broadcast plots. Seedling establishment of birdsfoot trefoil averaged 0.4, 2.0, and 4.0 plants/ft^2 in direct seeded (control), band, and broadcast plots, respectively. Although band application of Roundup significantly improved establishment of birdsfoot trefoil, competition in this highly productive meadow still limited establishment. Essentially, establishment success was reduced by 50% in order to obtain a third of a hay crop. These types of tradeoffs must be evaluated no matter what method is used. One caution when applying Roundup at time of seeding is that seedling injury or death can occur in some species. For example, a Wyoming study found that alfalfa was injured while Garrison creeping foxtail was not.

One of the more cost-effective methods of suppressing existing vegetation is to use heavy spring grazing. Landowners with livestock like this approach because there is no

agronomy news is a monthly publication of Cooperative Extension, Department of Soil & Crop Sciences, Colorado State University, Fort Collins, Colorado.

Contributing authors are:
Troy Bauder, Water Quality
Mark Brick, Bean Production
Jessica Davis, Soils
Kirk Iverson, Soils & Agronomy
Duane Johnson, New Crops
Jerry Johnson, Crop Production
Sandra McDonald, Pesticides
James Self, Soil, Water & Plant Testing
John Shanahan, Crop Production
Reagan Waskom, Water Quality

Direct questions and comments to:
Gloria Blumanhourst
Phone: 970-491-6201
Fax: 970-491-2758
E-Mail:
gbluman@lamar.colostate.edu
Web Site:
http//www.colostate.edu/Depts/SoilCrop/extens.html.

Interseeding

(Continued from page 2)

outlay of cash as with chemical treatments and their animals benefit from highly nutritious forage. The drawback to this method, especially in highly productive stands, is that animals must be removed before seeds begin to germinate. Trampling and grazing will kill significant numbers of emerging seedlings. Therefore, newly seeded stands should not be grazed during the first year. Close mowing when the vegetation is approximately 8 inches in height will also work if livestock are not available. A 50% increase in seedling density was obtained using early mowing in a hay meadow near Clark, Colorado.

Interseeded plants experience competition for water, nutrients, light, and space as they struggle to become established. Although all aspects of competition are important and affect establishment success, competition for light is probably the one factor that is overlooked. Many landowners think that once the seed is in the ground that they are done. This is not the case. Management following seeding is often more critical than type of drill used, variety seeded, or even suppression. Given adequate water, most seeds will germinate. However, the seedlings become spindly and weak and turn yellow from lack of light. In this weakened state, they are slow to recover once the overstory is removed and many will not survive through the winter. Haying earlier than normal to open up the canopy is one management practice that is easy to implement but is seldom done. In the study near Clark, Colorado mentioned above, haying 2 weeks earlier than normal (July 12 versus July 25) led to 3 times more seedlings being established with a sacrifice of a half ton of hay per acre. The take home message with any of the above procedures is that landowners must be willing to sacrifice all or part of their hay crop during the year of seeding in order to get new plants well established.

After having made that last statement, I would like to offer one more alternative that has good potential for success with no inputs beyond drilling and seed costs. This method involves seeding in mid to late summer (depending on elevation and growing season) following harvest of either the first or second cutting of hay. This method is particularly well suited for use at elevations below 7,000 feet where reliable precipitation or adequate irrigation water is available late in the season. Following the initial flush of spring growth, most plants used for forage tend to slow their growth rate and put on more vegetative compared to reproductive growth. Therefore, competition from the existing vegetation will be significantly reduced. The vegetative regrowth following haying provides some mulch and cover but yet is not too vigorous or dense to severely restrict establishment of seedlings. Several legumes were successfully interseeded in a hay meadow near Hayden, Colorado using this method. Five alfalfa varieties averaged 2.5 plants/ft^2 while >Norcen= birdsfoot trefoil averaged 5.4 plants/ft^2. Plant densities from several other trials that used chemical suppression were comparable to the above values, but cost of inputs was significantly higher.

Such factors as type of drill used, plant species and/or variety seeded, time of seeding, and water management must also be considered when planning an interseeding program. However, applying the above tips will help insure a successful seeding.

Joe Brummer

Testing Hay to Determine Forage Quality

Evaluating forage quality is an important step in obtaining the best price for hay and for determining its nutritional contribution as animal feed. The first step in determining hay quality is to obtain a proper sample for analysis. The most commonly used sampling method for bailed or stacked hay is by using a hollow core probe to extract samples. A core sampler consists of a stainless steel tube with a sharp cutting end. Push probes are simply pushed through the bale. Rotary probes have teeth at one end and a fitting for a manual brace or an electric drill on the opposite end.

Samples should be taken from a "lot" of hay which is defined as the same cutting harvested from a field of uniform maturity within a 48 hour period. One core should be sampled from at least 20 randomly selected bales from a lot of hay. Generally a lot should not exceed 200 tons. Random sampling can be accomplished by coring every fourth or fifth bale going around the stack, truck, or down the row in the field. At least five random samples should be taken from each of the four sides of a stack.

Rectangular bales should be sampled by centering a probe in the end of the bale and drilling horizontally. Round bales should be sampled by drilling horizontally into the curved side. Loose hay should be sampled by using a probe at least 30 inches long with 3/4 inch or larger internal diameter; drill at an angle from the side of the stack to the probes full depth in 20 random locations. Hay cubes or pellets should be sampled by collecting several cubes or handfuls of pellets from 15 to 20 locations in each lot so that a minimum of 40 cubes or 2 lbs. of pellets are selected. Samples should be well marked as to lot and location and should be labeled for source, forage type, cutting, stage of maturity, and special conditions such as frost or drought.

Forage analysis is generally done by either wet chemistry methods or near infrared reflectance (NIR). Wet chemistry methods are best used for total mix rations (TMR's) or forage species that are not part of the NIR software. NIR is best used for alfalfa, grass, or alfalfa-grass hay. When determining where to send a sample for analysis, consider quality control (is the lab certified by the National Forage Testing Association?), type of lab (does the lab do both NIR and wet chemistry or only one type of analysis?), reputation of the lab, and services provided, such as 24 hour turnaround.

NIR analysis has some advantages in that it is a low cost procedure and there is usually a quick turnaround. It can also be quite accurate for alfalfa or grass forage. NIR, however, relies on prediction equations that must match the sample being tested. Wet chemistry, on the other hand, measures actual nutrient content and does not predict it. The analytical procedures are the same for wet chemistry regardless of the type of ration or forage being analyzed, but the cost may be twice that of NIR and the turnaround time may be longer. Wet chemistry is also the only current method to evaluate nitrates in forage. When evaluating forage quality, it is important to obtain the best sample possible and to be assured that lab results are accurate. Proper handling of forage samples will ensure the most economical and best nutritional evaluation of hay quality.

Jim Self

Harvest Management of Perennial Forages

One of the most important decisions one makes in managing perennial forages is harvest timing. Depending on species, one or more of the three measures of management success — yield, quality, and persistence — can be affected by when the crop is harvested or grazed. The purpose of this article is to review the various factors associated with timing of plant harvest that affect yield, quality, and persistence of perennial forage crops. It is easiest to analyze the impacts of harvest timing by looking at legumes and grasses separately. Let's look at the legumes first, using alfalfa as the representative crop.

Legume Harvest Management

Because alfalfa is a relatively short-lived perennial crop, the impact on harvest timing on persistence is probably the foremost consideration. Persistence is generally determined by the status of carbohydrate reserves, which are stored in the crown and roots. Carbohydrate reserves (also referred to as energy reserves) perform the important function of satisfying the plant's demand for energy when leaves are absent or not active. They are important to the survival of alfalfa during each cycle of regrowth after cutting and during the overwintering. The best way to insure that these energy reserves are maintained at sufficient levels is to allow the plant to reach at least the middle to late-bud stage of development before harvesting during each cycle of regrowth. This allows the plant to recharge reserves, which are critical to subsequent regrowth or winter survival. The exception to this general recommendation is the last harvest during late summer or early fall. Earlier harvest is allowable at this time of year because the plant is capable of recharging energy reserves at a much earlier stage of development.

Once the need for adequate reserves has been met, the other two factors, yield and quality, can be considered. It is generally well known that quality declines with advancing maturity, especially as the plant matures beyond the late bud stage. Thus, quality is maximized by harvesting at the earliest allowable maturity. Since persistence has to be considered, the earliest allowable maturity stage is the mid-bud stage (or an earlier stage if it is the last harvest). Generally, yield over the entire growing season is maximized when one allows the crop to develop to the full-bud stage during each cylce of growth before harvesting. This usually results in one fewer harvest than if the crop is harvested at an earlier stage. Whether or not one should harvest at the mid-bud stage depends on the relative importance (i.e., the economic return) of quality and yield in a given production system. If quality is a marketing consideration or a feeding necessity, then earlier harvest (bud to early bloom stage) are best. However, if tonnage is the primary basis for sale, then middle to full-bloom stage harvests are more likely to maximize yields and produce adequate quality.

Grass Harvest Management

Perennial cool-season forage grasses produce different challenges in assessing the most appropriate timing of harvest or grazing. The status of energy reserves during the growing season usually is not a factor affecting persistence, so the impact of harvest management on reserves is largely ignored in grasses. When grasses are harvested for hay, considerations similar to those used for determining when to harvest legumes apply. Yield and quality are normally the most important factors. To maximize yield, one should use longer intervals between cuttings, whereas, shorter intervals favor higher quality. This usually translates into harvesting at either the early heading stage (for best quality) or the bloom stage (for best yield) for the first cycle of regrowth during the growing season. If a second harvest is possible, harvest timing for hay is more difficult because the new regrowth is purely vegetative, and no seedheads are produced. In most instances, no more one additional cutting is possible, so the best option is to harvest just before (one to two weeks) the average date of the first killing frost.

When the grass is used for grazing, the most important question regarding harvest timing is whether to rotate grazing or subject the grass to continuous (i.e., season-long)

Harvest

(Continued from page 5)

grazing. The answer to this question is based on the developmental and tillering characteristics of the species being used.

If smooth bromegrass, timothy, or intermediate wheatgrass are important components of the pasture, continuous grazing, especially if it is used for several consecutive years, will result in stand injury, a general decline in these grasses, and eventual weed encroachment. This occurs because these grasses are highly sensitive to grazing injury during the stem elongation phase of development. The best way to manage grazing in these species in the spring is to graze them early (prior to stem elongation), remove animals during stem elongation phase, and resume grazing after heading by subjecting them to a heavy grazing pressure for a brief period (one to two weeks) to remove as much of the growth as possible. For the remainder of the season, the grass should be given long periods of rest (duration varies depending on level of inputs; higher inputs allow shorter periods of rest) between grazing cycles.

Most of the cool-season grasses commonly used in intensive production systems other than those listed above can tolerate continuous grazing very well. Good examples are orchardgrass, meadow bromegrass, and Kentucky bluegrass. Higher tillering capacity is the critical trait that enables these grasses to better withstand continuous grazing. The most important consideration in managing these species under this system of grazing is to control grazing pressure so that some residual leaf area is present at all times during the season. Managed in this way, these species are capable of providing ample quantities of high-quality forage for long periods of the growing season without sustaining injury.

Factors other than those mentioned above may play a role in deciding when perennial forages should be harvested. The general rule-of-thumb to use in guiding all decisions regarding management of harvest timing is to insure persistence while maintaining a desired balance between yield and quality.

Danny Smith

1997 Alfalfa Variety Test Results

Introduction

Colorado alfalfa producers annually harvest 850,000 acres which was valued at over $280 million in 1996. To help hay producers make better alfalfa variety decisions, Colorado State University researchers evaluate alfalfa varieties at multiple locations. These trials provide Colorado hay producers with reliable, local, and unbiased alfalfa variety information.

A randomized complete block design with four replications was used for each of the five alfalfa variety trials conducted in Colorado in 1997. Hay yields were calculated on an air-dry basis.

San Luis Valley
alfalfa variety trial at Center
(Merlin A. Dillon)

High-altitude alfalfa in Colorado

Results from the alfalfa variety trial in the San Luis Valley are applicable to other high mountain areas of Colorado and adjacent areas of Northern New Mexico. The San Luis Valley of Colorado is a large, flat intermountain valley surrounded by snow-capped mountains. The elevation of 7600 feet makes for a cool, short growing season. Average annual precipitation in the San Luis Valley is only 7 inches. The average frost-free period is 88 days; from June 10 to September 6. Winterhardiness and persistence are important varietal factors to consider as well as yield and pest resistance. Important pests in this area include alfalfa weevil, pea aphids, and *Phytophthera* root rot.

The 1997 season was normal until mid-July when the rain showers began. The first cutting was slightly earlier than normal and was baled without rain.

Yield results this year were typical for the area. As usual, newer varieties performed better than the old standards. Vernal and Ranger produced only average and below-average yields. The advantage of newer varieties is usually 0.7 tons/acre, more than enough to pay for the higher seed cost.

Hay production
in western Colorado in 1997
(Calvin H. Pearson)

Alfalfa is produced on more than 125,000 acres in the four counties of Mesa, Montrose, Delta, and Garfield. Much of the production is in the low valley areas, but alfalfa is also grown at elevations of 7,000 feet and higher.

The alfalfa variety performance test at Fruita was planted in spring 1996. Yield data were collected from three cuttings in 1996 and four cuttings in 1997. Haymaking in 1997 was a challenge because of the wet summer, but harvest of this trial went smoothly and on schedule. Many of the varieties during the two years of testing have exhibited excellent yield performance.

Arkansas Valley
alfalfa variety trial at Rocky Ford
(Frank C. Schweissing)

The Arkansas Valley, in southeastern Colorado, extends from the mountains on the west to the Kansas border. Alfalfa is the most important irrigated crop in the Valley being produced on 195,000 acres. The elevation varies from 3400 feet in the east to 4700 feet at Pueblo. Average annual precipitation along the Valley is 11 inches, varying from 9 inches at Pueblo to 15 inches at the Kansas border. The average frost free period is 158 days from May 1 to October 6. Successful varieties need some winterhardiness because temperatures go below 0° F, but they also must take advantage of the relatively long growing season. The most persistent pests are the alfalfa weevil, stem nematode, and tansy mustard/flixweed.

The trial was irrigated prior to the first cutting and after each of the four cuttings. This was a wetter than usual year although growing degree days were normal. Rainfall from April through October was 15.4 inches compared to the long term average of 9.7 inches. Two strong rainstorms knocked down alfalfa and harvest was complicated by lodging and drying problems. A new alfalfa variety trial was established at Rocky Ford in August 1997 with 27 varieties.

Varieties

(Continued from page 7)

Southwestern Colorado
alfalfa variety trial at Yellow Jacket
(Abdel Berrada)

Alfalfa is the main crop in southwestern Colorado in terms of acreage, production, and cash value. In 1995, 87,500 acres of alfalfa were harvested in Archuleta, Dolores, La Plata, Montezuma, and San Miguel counties. The elevation at Yellow Jacket is 6900 feet with an average growing season of about 120 days. Average annual precipitation is near 16 inches with half of it coming as snow.

The alfalfa variety trial was established in May of 1996. Two cuttings totaling 3.26 tons/acre were completed during the establishment year. Soil moisture conditions were excellent at the start of the 1997 growing season which contributed to high first cutting yields. Cool temperatures in the beginning of the growing season and rainy conditions in late July and early August delayed first and second cuttings which also contributed to high 1997 yields.

web sites

http://www.cas.psu.edu/docs/casdept/agronomy/forage/forages.html
Penn State's Forage Web Page

http://www.forages.css.orst.edu/
Forage Information System
Links to worldwide forage-related information
Maintained by Oregon State University

http://www.forages.css.orst.edu/Oregon/index.html
Oregon Forages
Part of the Forage Information System

http://www.forages.css.orst.edu/Topics/Pastures/PGIS/index.html
Pasture and Grazinglands Information System
Part of the Forage Information System

http://wwwscas.cit.cornell.edu/forage.html
Forage-Livestock Systems at Cornell University

http://www.psu.missouri.edu/lnl/
Lotus Newsletter
Information specific to Birdsfoot Trefoil

http://www.agric.gov.ab.ca/crops/forage/index.html
Forages and Range
Part of the Alberta, Canada Agriculture, Food and Rural Development System