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Early Spring Forage Production for Western Oregon Pastures

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Forage production is of primary importance to Oregon's livestock enterprises and agricultural economy. The forage is either grazed or conserved. Conserved forage is needed to feed livestock in times of little forage growth—a key cost of livestock production. Extending the grazing season reduces the cost and time involved in feeding conserved forage. This publication provides management concepts and directions for extending the grazing season with production of late-winter or early-spring forage.

Forage requires moisture, nutrients, heat, and light for growth. Initiation of growth in late winter or early spring is regulated by temperature and light. Temperature measurement allows prediction of the time plants will begin to grow. In western Oregon, early growth can be increased by applying nitrogen (N) at this time.

Research in Europe and Canada compared early N application with traditional N application. Grazing could begin 2 weeks to a month earlier by timing the first N application according to heat accumulated after January 1. This method is called "T-Sum 200." The T stands for temperature, and 200 is an expression of the accumulated heat necessary for grass growth to begin.

The T-Sum 200 approach allows application to be based on plant physiology—which in turn responds to temperature—rather than on calendar dates. Traditionally timed fertilizer applications in March or April give a flush of growth about a month after application. In western Oregon, application of N at

T-Sum 200, 2 to 3 months before traditional N applications, produces feed 1 to 3 weeks earlier. In colder, drier climates such as eastern Oregon, a consistent economic increase in early forage production has not been realized from T-Sum application.

Success with the T-Sum method depends on several factors. First and foremost is the presence of adequate residual pasture dry matter in the fall. Other factors are:

- Cool, wet winters, as are typical of western Oregon and western Washington
- A grazing management system that allows plants to rest and recover between grazing

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- A grass or grass–legume forage mix that will respond to N application. An example is a pasture of tall fescue, orchardgrass, or perennial ryegrass and a clover. Bentgrass pastures do not show an economic response to early nitrogen.
- A site that is accessible to equipment for N application and can support grazing in March or early April without damaging the grass stand or the field.
- A pasture free of standing water, as wet, poorly drained soil does not permit forage growth
- No other limitations to production such as weeds, low pH, soil compaction, or a poor stand

T-Sum provides the greatest economic return when the following conditions are met.

- The pasture has at least 1,200 to 1,500 lb/acre residual dry matter or is 3 inches tall at the end of the fall grazing period.
- Nitrogen is applied at T-Sum 200 to a vigorous stand of improved pasture grass such as perennial ryegrass.
- The pasture is not grazed until at least 2,500 lb of dry matter is produced (about 6 to 10 inches high depending on the species and stand composition).
- Animals are rotated to the next paddock when pasture is grazed to a minimum of 1,200 to 1,500 lb/acre remaining dry matter.

Soil testing every 3 years will help you develop a total pasture fertilization program. For best results with the T-Sum approach, phosphorus, potassium, other nutrients, and soil pH should be adequate. For more information on interpreting soil test results, see FG 63, *Fertilizer Guide: Pastures in Western Oregon and Western Washington* (see "For more information" on the back page).

What can I expect from N applied at T-Sum 200?

Seven to 10 days after a T-Sum 200 N application, forage begins to turn darker green. Within 2 weeks, an increase in forage growth is apparent. Typically, accelerated forage growth continues for approximately 2 more weeks. If forage is grazed, regrowth occurs for another 2 to 4 weeks (Figure 1).

A T-Sum 200 (February) application of 60 lb N/acre can increase early-spring forage production for 60 to 75 days. After other pastures are fertilized on a traditional schedule, forage growth in the early-fertilized pastures is less than that in the traditionally fertilized pastures (Figure 2).

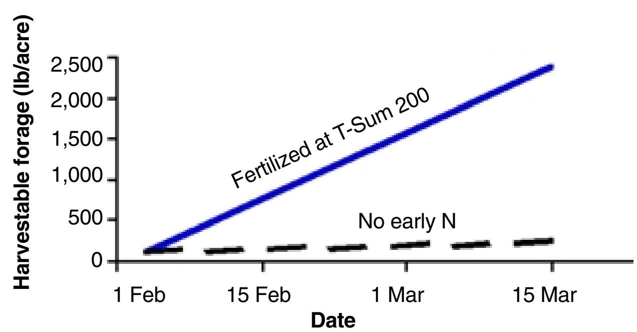

Figure 1.—Harvested dry matter from a 60 lb N/acre made at T-Sum 200 (solid line), compared to no early N application (dashed line). T-Sum 200 was February 4. Data from Marion County, Oregon, 1996.

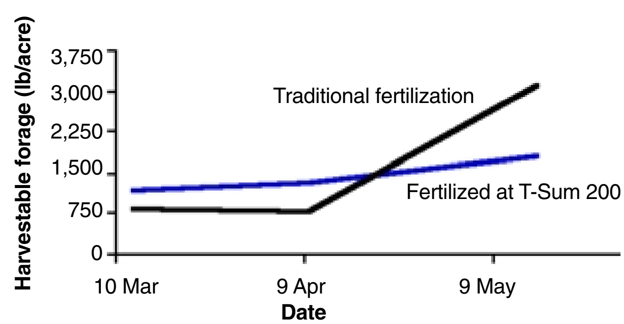

Figure 2.—Harvested dry matter from spring nitrogen of 60 lb/acre made at T-Sum 200 and the traditional time, mid-April. Data from Douglas County, Oregon, 2000.

If a second N application is made to the T-Sum 200 fertilized pastures 4 to 6 weeks after the T-sum application, forage growth continues, and in May is similar to that of traditionally fertilized pastures.

Aside from fall pasture management and residual dry matter, other factors that affect the response from a T-Sum nitrogen application are the weather during the current year, the area of western Oregon where the pasture is located, and the type of plants growing in the pasture. Considering these differences, the harvestable early-season dry matter from a T-Sum application should exceed that from a traditionally fertilized pasture by 500 to 2,000 pounds. These production estimates are based on 2 years of field trials in Coos, Douglas, Tillamook, and Benton counties and on grower experience. The average increase in dry matter from a T-Sum 200 application of 60 lb N/acre in western Oregon was 750 to 1,000 lb/acre harvestable dry matter.

The economic benefit of a T-Sum application of nitrogen comes from the reduced need for conserved feed such as hay in the winter and early spring. In addition to producing high-quality feed, you do not need to load, unload, and feed hay. Let's examine an example.

- When the cost of urea is $275/ton and fertilizer application costs $7/acre, applying 60 lb N/acre costs about $25/acre.
- If the investment in fertilizer produces the lowest return measured in western Oregon (500 lb/acre dry matter), the cost of increased standing forage is $100/ton (2,000 ÷ 500 x $25).
- When comparing forage, remember the quality of early forage is high. In field trials, the protein concentration in the 500 lb forage produced from a T-Sum application was 20 percent.
- Compare the cost of hay containing 20 percent protein, purchased in March, to the cost of producing additional forage, which doesn't have to be harvested or fed.
- The greatest increase in forage measured from an application at T-Sum 200 was 2,000 lb/acre. In this case, the increased standing forage cost less than $25/ton.

Another view of the benefit of T-Sum N application is shown in an example from the Coast Range foothills. In 1999, Oregon State University's Soap Creek Ranch applied 60 lb N/acre to 190 acres of pasture suitable for early grazing. The application resulted in earlier growth when compared to years of no early nitrogen application. Two hundred cows and young calves were put on pasture 3 weeks earlier than in previous years. The result was a savings of 63 tons of dry hay (a value of about $3,000), which was fed during the summer.

Fall-winter pasture management to ensure success

T-Sum is more than just the application of early spring nitrogen. It is part of a pasture management system. Before examining the details of timing the T-Sum application, let's review some of the important pasture management principles that will help to ensure your economic success.

A sustainable and productive pasture depends on year-round management. Several significant management choices affect the amount of forage produced. Management decisions made during the critical late-summer and early-fall periods affect the ability of the plants to survive winter, the timing of growth initiation in the spring, and how much forage is produced over the entire season.

Two major plant activities occur during fall growth. One is root regeneration, and the other is formation of shoots, or growing points, for the following year. Allowing the plants to store carbohydrates in the fall is essential for long-term pasture production. In perennial grasses, the lower stems (or crown) and roots are the major storage units for complex carbohydrates. Overgrazing or excessive forage harvest inhibits root system rebuilding and the formation of shoots for spring growth.

Table 1. Recommended residual heights for cool-season grasses during dormant periods.

Grass	Minimum stubble height
Orchardgrass	3 inches
Tall fescue	3 inches
Perennial ryegrass	2 inches

In both irrigated and dryland pastures, cool-season plants can be grazed to a minimum height as shown in Table 1. These recommended minimum stubble heights allow the plants to store carbohydrates for vigorous regrowth in the spring. Grazing below this height will reduce forage production from a T-Sum nitrogen application.

If pastures are grazed or mowed lower than the recommended stubble height in the fall, reserves are removed; the new tillers are starved and exposed to weather extremes. Root formation usually slows or stops, and the following spring tillers grow more slowly and have fewer roots for support.

Fall is a good time to test soil for nutrient status. Take soil samples during the same month each year. Fall also is a good time to apply nutrients such as phosphorus and potassium. Apply nitrogen, sulfur, and boron in the spring. Oregon State University Extension Service fertilizer guides can help you decide the type and proper amount of nutrients.

You can apply manure or other sources of nitrogen based on plant nutrient needs, but be sure not to apply too much nitrogen. Plants growing vigorously as a result of high nitrogen applications late in the fall are more susceptible to winter damage. As temperatures decline in the fall, plants produce a type of "antifreeze" called proline. This antifreeze accumulates in every living plant cell, but only if excessive nitrogen is not available. Thus, excess nitrogen inhibits plants from preparing for winter, leaving them susceptible to injury or death from the first major cold event.

T-Sum 200 application and explanation

T-Sum 200 is an accumulation of **heat units** for consecutive days beginning January 1, until a total of 200 is reached. Research shows that certain plants such as cool-season grasses initiate growth at or near this time. January 1 is used as the starting date for the accumulation of heat units simply because it is a convenient starting point and because low temperatures in December or January typically cause plant growth to slow or cease.

What is a heat unit?

A heat unit, or growing degree day, is the average of the high and low temperature for the day, in degrees centigrade. The formula for calculating a heat unit is:

$$\frac{\text{maximum °C + minimum °C}}{2}$$

For example, if the high for January 1 is 11.7°C and the low is 4.4°C, the number of heat units for that day is 8.1 (11.7 + 4.4 ÷ 2 = 8.1). **Note**: If the temperature is less than 0°C, use 0 in the formula.

How do heat units accumulate?

The T-Sum 200 method adds (sums) daily heat units starting on January 1. An example is shown in Table 2.

Temperature data for calculating T-Sum 200 are available from weather-collecting stations (radio or TV stations,

Table 2. T-Sum example using 2003 western Oregon weather data.

Date	Maximum	Minimum	Average	Sum
1 Jan	11.7	4.4	8.1	8.1
2 Jan	15.0	7.2	11.1	19.2
16 Jan	9.3	2.0	5.7	121.9
17 Jan	6.0	-1.0	3.0	124.9
24 Jan	12.8	8.9	10.9	187.8
25 Jan	15.0	9.4	12.2	200.0

airports, etc.) or from the Oregon Climate Service Web site **(http://www.ocs.orst.edu)** or other weather/climate Web sites. You also can collect your own data. If you collect temperature data in degrees Fahrenheit, use the following formula to convert °F to °C:

(°F – 32) x 0.556 = °C

For example: (40°F – 32) x 0.556 = 4.45°C

Computer programs are available on the Internet to help you calculate degree growing days: **http://ippc2.orst.edu/OR/**

Click on "full-featured calculator/DD model"
Select model or calculator: "none"
Select "Check here for °C"
Enter lower threshold as "0.01"
Select "simple average/growing dds"
Select starting and ending dates
Select location: (for example, "Salem" or "Roseburg")
Click here to run the model: "Calc"

Alternatively, you can time an early nitrogen application based on history in your location. For example, the 35-year average for T-Sum 200 is late January to mid-February in the Willamette Valley in western Oregon. Some producers use the appearance of a key plant species to alert them to the approximate arrival of T-Sum 200.

Grazing T-Sum forage

To take advantage of the early-season flush of feed when the ground is moist and continuing rain is expected, graze lighter weight animals (sheep or stocker cattle). Manage pastures to maintain between 1,200 to 3,500 lb/acre standing dry matter. Allowing pastures to exceed 3,500 lb/acre dry matter before grazing, or grazing below 1,200 lb/acre dry matter, reduces pasture regrowth. To maintain adequate intake, graze to about 1,200 to 1,500 lb residual dry matter/acre.

Clover and grass pastures grow most rapidly and efficiently at heights of 3 to 5 inches (2,200 lb/acre dry matter). At this height, their leaf area is great enough to use all of the available sunlight. Pastures of only 1 inch in height (450 lb/acre dry matter) grow very slowly because they lack leaf area for photosynthesis. Pasture growth slows with heights over 12 inches as lower leaves become shaded and die. This pattern of growth is influenced by soil temperature, soil moisture, and day length.

A controlled grazing plan will ensure optimal pasture management. Portable fencing can be used to move animals through the pasture so high-producing forage varieties can maintain their root reserves and continue producing at optimum levels.

Management after grazing starts

The amount of subsequent nitrogen applied should be based on stocking rate and on whether the pasture is irrigated. The second application of nitrogen usually is made 60 to 75 days after the T-Sum 200 application, assuming that livestock have grazed the pasture at least two or three times. A third nitrogen application may be made if sufficient late spring moisture is present or if the pasture is irrigated.

Typically, 60 lb N per application is recommended for rotational grazing systems. You can determine how much nitrogen to apply by clipping to measure forage growth and by testing for crude protein. To prevent water pollution and wasted money, the total amount of nitrogen applied during the grazing season should not exceed the amount of N removed as protein in the forage.

Fertilizer materials

Commercial fertilizer, such as urea, is the recommended source for T-Sum 200 nitrogen. Late-winter weather generally allows few opportunities for application of any material, and 100 to 200 lb of commercial fertilizer per acre can be spread much more rapidly than many tons of organic material such as manure. In addition, manure application may be limited by site characteristics such as proximity to streams. If you want to use manure for a T-Sum 200 application, consult your local OSU Extension agent for guidelines.

Summary

Nitrogen applied at T-Sum 200 can increase the amount of early forage produced for grazing livestock. With the recommended fall dry matter residual, an increase of 500 to 2,000 lb/acre dry matter can be expected over traditionally timed nitrogen applications. Keep the following important items in mind.

- Site selection is important. Choose a stand of grass that will respond to nitrogen and that can be grazed early.
- Leave adequate leaf area in the fall so that plants have sufficient carbohydrate for winter survival and early-spring growth.
- The 35-year T-Sum 200 average for the Willamette Valley is late January to mid-February. Know the dates for T-Sum 200 in your area. Be ready to apply nitrogen at this time.
- Apply 50 to 60 lb N/acre.
- Do not graze below 3 inches in height. A management-intensive grazing system will help to control the grazing pattern and height.
- Reapply nitrogen after grazing two or three times.

For more information

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