Healthy Plants Have Smaller Forage Reductions during Precipitation Shortages

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Effective grazing management can help minimize herbage reductions during periods of below-normal precipitation, says a North Dakota State University range scientist.

"Most of western North Dakota is experiencing below-average herbage production on perennial grass spring pastures, native rangeland pastures, and grass and alfalfa haylands. Estimates of 25 to 60 percent reduction below normal herbage biomass are common," notes Lee Manske, range scientist at NDSU's Dickinson Research Extension Center. "Climatic conditions have been receiving most of the blame for these reductions, although herbage production is affected by management practices as well as by the level of precipitation in relation to normal amounts."

The majority of the state's western region was dry during late summer and fall of 2001 and cool during the spring of 2002. The dry fall resulted in reduced fall tiller growth, with an average of fewer than 1.5 leaves per tiller. Tillers of cool-season grasses require about 2.5 fall leaves for normal herbage production the following year. Cold nights and cool days during the spring resulted in a moderate reduction in the daily grass growth rate. The combination of a dry fall and cool spring is responsible for a portion of the reduction in herbage biomass in the region, Manske says.

In addition, parts of western North Dakota received less-than-normal precipitation this spring. Large areas south of Interstate 94 have various levels of water stress and several areas in south central North Dakota are experiencing drought or near-drought conditions. The below-normal precipitation further restricted herbage production on pastures and haylands in these areas and created additional problems.

"The amount of herbage biomass reduction resulting from just the combination of restricted growth of last season's fall tillers and this spring's slightly reduced rate of grass growth has not been great enough to change grazing dates or stocking rates on pastures that have been properly managed and have healthy plants," Manske says. "The annual development of healthy grass plants occurred within the normal range of dates during the spring of 2002, with a delay of only 3 to 7 days from the average date. However, in some areas large reductions in herbage occurred because the dry fall and cool spring magnified existing problems caused by detrimental management practices."

The quantity of herbage biomass produced is related to plant size and plant density. These two characteristics are directly affected by the level of plant health, which is determined by the biological effectiveness of the grazing management practices used, Manske notes. Consequently, management practices that do not meet the biological requirements of the plants retard plant processes. The resulting deterioration in the level of plant health is manifested as decreased plant density and diminished plant size that lead to reduced herbage production.

Herbage reduction percentages caused by detrimental grazing management practices such as grazing before the third-leaf stage, grazing throughout the entire season, or grazing during the fall usually vary between 40 and 60 percent below the potential herbage biomass. The greatest reductions of herbage production observed in western North Dakota have occurred on domesticated grass spring pastures that were hayed during the summer and/or grazed during the fall, on native rangeland summer pastures that were grazed during the fall, and on domesticated grass and alfalfa haylands that were hayed late and/or grazed during the fall.

"The long-term solution to management-caused herbage reduction problems is to implement beneficial management strategies that meet the biological requirements of the plants," Manske says. He recommends three management practices that improve plant health:

- Begin grazing in the spring only after plants reach the third-leaf stage (early May for crested wheatgrass and smooth bromegrass and early June for native rangeland).
- Coordinate grazing rotation dates with grass growth stages. Plant density increases when secondary tiller growth is stimulated by grazing for 7 to 17 days during the period between the third-leaf and flowering growth stages (early June to mid July for native rangeland).
- Do not graze spring and summer pastures or haylands during the fall. The common assumption that grazing perennial plants after a frost does not hurt the plants is incorrect. Fall grazing decreases the carryover secondary tillers and the new fall growth tillers and reduces the amount of herbage biomass produced the following season.

Herbage weight of perennial plants increases from early season through May, June, and July until peak herbage biomass, which occurs during the last couple weeks of July. Herbage weight then decreases as plants age and dry, Manske explains. The amount of herbage biomass produced by healthy plants is related to precipitation levels during January through July, which affect plant size and plant density.

Herbage reduction caused by low precipitation is usually proportional to the levels of precipitation below the normal range. An estimate of the amount of herbage reduction low precipitation causes in healthy plants can be determined by a comparison between the local long-term mean precipitation received during January through July and the current year's precipitation for that period. The range of normal precipitation is plus or minus 25 percent of the long-term mean.

The procedure to estimate percent reduction in peak herbage biomass caused by below-normal precipitation requires just three simple calculations: first, the monthly precipitation for January through July is totaled to give the current seasonal precipitation; then, this precipitation amount is divided by the local long-term January through July precipitation amount to determine the current seasonal precipitation as a percentage of the long-term mean precipitation; next, that percentage is subtracted from 75 percent, which is the low-normal long-term precipitation value.

"The resulting estimated percentage of reduction in biomass that below-normal precipitation has caused in peak herbage biomass provides a guideline for the percent reduction in stocking rate needed for the remainder of the grazing season--until mid October--on pastures that have been properly managed and have healthy plants," Manske says.

For example, if the January through July seasonal precipitation amount is 65 percent of the long-term mean, the estimated 10 percent reduction from normal herbage biomass would suggest a 10 percent reduction in stocking rate--assuming the proper stocking rate was being used. This method does not determine the amount for stocking rate adjustments required on pastures managed by practices that diminish the health status of plants below potential levels.

The long-term mean monthly precipitation amounts for numerous locations are available on the National Weather Service (NOAA) web site for North Dakota (www5.ncdc.noaa.gov/climatenormals/clim81/NDnorm.pdf). For the current season's precipitation, amounts collected at individual ranches and marked on the calendar can be used if a complete January through July data set is available.

Another source for the current season's precipitation amounts for many locations is the NDAWN web site (http://ndawn.ndsu.nodak.edu). These data start in April because NDAWN does not collect data for precipitation that occurs as snow. The precipitation amounts for January through March and the amount of precipitation that falls as snow during other periods must be obtained from other sources. Current season's precipitation data that include snow moisture are available on the National Weather Service site (www.crh.noaa.gov/bis/OtherHydro.htm Click on "text" for the desired month's precipitation data).

The following list of locations includes the long-term January through July precipitation, the 2002 January through July precipitation as a percent of the long-term seasonal mean, and the estimated percent reduction in stocking rate needed on healthy pastures in that area: Williston (9.8 inches, 101 percent, 0 percent), Watford City (9.7 inches, 116 percent, 0 percent), Manning (10.3 inches, 139 percent, 0 percent), Dickinson (11 inches, 114 percent, 0 percent), Beulah-Hazen (11 inches, 86 percent, 0 percent), Bismarck (10.7 inches, 67 percent, 8 percent),

Bowman (10.7 inches, 73 percent, 2 percent), Hettinger (10.5 inches, 54 percent, 21 percent), and Shields (11.5 inches, 49 percent, 26 percent).

If the percentages of reduction in herbage biomass produced on domesticated grass spring pastures, native rangeland pastures, or grass and alfalfa haylands are greater than the estimated percentage of herbage reduction reached by the comparison between the long-term and current seasonal precipitation amounts, the health of the plants is below the potential level because the management practices have not met the plant biological requirements. When management practices meet the biological requirements of the plants and the level of plant health is high, the percentages in herbage biomass reduction that occur during periods of below-normal precipitation are smaller and less problematic than reduction percentages on areas with diminished plant health.

"Dry falls and cool springs, water stress during growing-season months, and summer drought are not abnormal climatic conditions in western North Dakota," observes Manske. "Plant health status, which is affected by management practices, can magnify or diminish the negative effects these reoccurring environmental conditions have on herbage production. Management strategies that sustain high levels of plant health help to ensure that the problems accompanying below-normal precipitation are minor incidents rather than catastrophes."