AGR-169

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

Problems in Diagnosing Nutrient Deficiencies of Cool-season Forage Grasses

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Cool-season perennial grasses dominate the forage crop species grown in Kentucky. While several species can be grown, tall fescue (*Festuca arundinacea, L.*), orchardgrass (*Dactylis glomerata, L.*), and bluegrass (*Poa pratensis, L.*) are the most important and, collectively, are grown on perhaps 7 to 8 million acres in Kentucky. In contrast to many plant species, diagnosis of nutrient deficiencies by foliar symptoms on cool-season grasses is virtually impossible, with the exception of nitrogen (N). Most often, the only foliar symptoms seen on cool-season grasses, with the notable exception of N deficiency, are dying or dead leaves or leaves with yellow to brown lesions. Such symptoms are usually the result of leaf diseases and should not be interpreted as nutrient deficiency symptoms.

Nutrient Deficiencies

With the exception of N, there is virtually no mention of foliar symptoms associated with plant nutrient deficiencies in the scientific literature for these grasses. Again, except for N deficiency and leaf disease symptoms, few symptoms are noticeable from a field diagnostic viewpoint, except for poor growth or thin stands. This is because grasses mobilize nutrients from older leaves to younger leaves when nutrient stress develops. When this happens, lower mature leaves might simply turn brown and die while new growth coming from the crown retains a normal green coloration. This is a normal consequence of aging of leaves, and while nutrient deficiencies do not cause aging, they may accelerate death processes. Even with moderately low soil test levels of soil-immobile nutrients, such as phosphorus (P), identifiable leaf deficiency symptoms of those nutrients are unlikely. Poor growth more than likely will be the only symptom of deficiency symptoms of grasses growing under immobile nutrient stress. Grasses have two major components of yield (tillers per unit area and tiller size). Although both are affected by nutrient deficiencies, number of tillers per unit area is affected most. Even small application rates of lime and fertilizers are likely to prevent nutrient deficiency symptoms. Nutrient stress is greatest when a field is continuously managed for hay, and it is least under grazing management due to recycling of nutrients in manure and urine.

Fertilization management based on soil test values and proper forage utilization (hay, haylage, or pasture) provides adequate levels of nutrients for cool-season grass production in Kentucky. Research in Kentucky indicates that content of P and K in adequately fertilized cool-season grasses is in the range of 0.2 to 0.3 percent P and 2 to 3 percent K. Content of N varies with rate of N applied. While cool-season grasses deficient in N may contain 1.7 percent N or less, 80 lbs N/A will increase N to around 2 percent. Excessive rates of N applied as a single topdressing (over 100 lbs N/A) may result in non-protein N accumulations in plants. Even though some concern has been expressed about N:S (sulfur) ratios being high enough (above 16:1) to cause animal nutrition problems, analysis of cool-season grasses in Kentucky has shown no basis for this concern even with high rates of N fertilization. Lime and fertilization applications to grasses based on University of Kentucky soil test recommendations provide sufficient nutrient levels for good forage production. However, if there is concern about whether nutrient levels are adequate for good production, forage tissue testing is the best way to make this determination.

Foliar Diseases

Except for N deficiency, the most common cause of abnormal leaves is leaf diseases. Discoloration of diseased leaves is sometimes confused with nutrient deficiency symptoms. The incidence and severity of diseases are often climate-related, being more severe if climatic conditions are more favorable for the disease organism. Foliar damage from diseases can cause slight to severe yield reductions and can sometimes reduce the stand or even eliminate it. To minimize the likelihood of leaf diseases, use climatically adapted varieties. Preventing the accumulation

of lush growth by adequate grazing or timely harvest is another management practice that reduces risk of disease problems. Three of the more commonly occurring leaf diseases of grasses in Kentucky are netblotch (Helminthosporium), leafscald (Rhizoctonia), and rust (Puccinia). Specific identification of foliar diseases can be made by the University of Kentucky's Plant Diagnostic Laboratory.

Insect Damage

While insects may cause damage to cool-season grasses, the symptoms caused are not likely to be confused with nutrient deficiency symptoms. Such damage more likely results from chewing-type insects, notably grasshoppers and the various armyworms. Insect damage (defoliation) is generally not a problem with the cool-season grasses; however, if it threatens major loss of production or even life of the stand, insect specimens should be captured and identified before deciding on proper control practices.

Drought Stress

Drought stress sometimes causes confusion in diagnosing nutrient deficiencies in cool-season grasses. Although these grasses produce most of their growth during seasons when there is likely to be adequate rainfall, drought stress can occur. Damage ranges from complete loss of a young, immature stand to seasonal loss of production from a mature, established stand. While severe drought stress is easily identified during periods of widespread drought, it might be harder to pinpoint in fields that vary greatly in soil moisture-holding capacity (usually variation is due to depth of soil, sandy or gravelly areas, or severely compacted areas). During seasons of marginally sufficient rainfall, areas of fields with good water-holding capacity can appear normal at the same time that adjacent areas with poor water-holding capacity show drought stress.

Diagnosis of Some Common Field Conditions

Field Observations	**Possible Cause**
Poor color (pale, yellowish-green) and noticeably poor growth. Fields topdressed with N may sometimes appear "streaked" if swath is not overlapped. This can result in strips of N deficiency running parallel to the direction followed by fertilizer spreader.	Nitrogen deficient
"Pasture mosaic"—unfertilized pastures which show lush green growth around dunghills and urine spots.	Nitrogen deficiency except around dunghills and urine spots.
Excessive fertilizer rates or applications followed by hot, dry weather may cause foliage kill. The condition may appear uniformly but should show evidence of "application" patterns.	Nitrogen or fertilizer "burn" due to excessive application rates
Dead spots occurring in natural drainage channels or immediately adjacent to cultivated fields.	Herbicide movement or drift from adjacent fields
Dead spots or yellowish, stunted growth on newly established stands.	Herbicide carryover from previous crop
Stand thins out, leaving "clumps" of fescue which are most noticeable when winter dormancy breaks and new spring growth begins.	Prolonged heavy fertilization with nitrogen, especially at low levels of other nutrients
Plant canopy wilts at top, turns dark green to black, becomes matted and turns brown in a few days. Field may appear entirely or partially brown. Under matted areas, plants remain blackish green. Some plants show no symptoms.	Winter-kill following sudden or hard freeze when plants have not winter-hardened sufficiently.

Issued 10-96, 5000 copies.