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Chemical Drying Agents In Harvesting Legume Hay

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Chemical drying agents can substantially shorten the field curing time of alfalfa and other legume hays when weather is good for hay making. They have no influence, however, on the drying interval when high humidity and other meteorological factors are not conducive for hay drying. Their greatest potential in Ohio therefore seems to be in shortening the field curing time of second, third, or fourth cuttings of pure alfalfa and other legumes or legume-grass mixtures where legumes predominate. Chemical drying agents have no value with grasses or mixtures where grasses dominate. Precipitation on cut forages results in significant decreases in both quality and quantity of legume hays. Digestible dry matter losses of up to one-third can occur in rain damaged forage. Losses of digestible crude protein also can be great. Proper utilization of chemical drying agents may assist some Ohio growers to produce higher yields of quality legume hay.

A typical forage plant will contain about 80% water when it is cut, but for good preservation, hay should contain less than 20% water. Every 10 lbs. of fresh forage must lose about 6 lbs. of water during the curing process. If nothing impedes water loss, water will move from a wet environment into a dry environment. In other words, if the moisture content of air (relative humidity) is less than the moisture content of forage within the windrow, water will leave the forage and enter the air. Plants, especially forage legumes, are covered with a waxy cuticle surface. This waxy surface reduces moisture loss by living plants, and increases the amount of time necessary for a cut plant to cure. Drying agents change the chemistry of the cuticle and reduce its effectiveness as a barrier to moisture loss. Drying agents do not remove water from plants, but reduce the amount of energy required to dry plants. Therefore, even when using drying agents, environmental conditions must be conducive for drying hay.

Good drying conditions include low relative humidity, air movement, warm temperatures, and sunlight. Drying is further aided by low concentration of moisture in the upper soil surface. The greater the difference between the moisture content of the air and the hay in the windrow, the faster the rate of drying. Wind, warm temperatures, and sunlight are sources of energy that increase the rate of water movement from a wet environment to a dry environment. Other conditions that affect the rate of hay

drying are size and density of the windrow. Windrows that are large and dense have less air movement within them than do small, light windrows. Conditions that reduce drying will reduce the effectiveness of drying agents; whereas, good drying conditions increase the effectiveness of drying agents. It is important to remember that drying agents also work in reverse. That is, hay treated with drying agents generally lose moisture faster than untreated hay, but also takes up moisture faster than untreated hay.

Chemicals and Application

Most commercial products are based on either sodium or potassium carbonate or a mixture of both. Potassium carbonate consistently is better than sodium carbonate in laboratory studies, but under field conditions a mixture of the two chemicals performs similarly to potassium carbonate alone. Sodium carbonate is much less expensive than potassium carbonate; therefore, most commercial compounds are based on a mixture of sodium and potassium carbonate. Commercial drying agents may contain other, often unidentified compounds. Little published research is available on the efficacy of these other compounds.

Follow manufacturer's instructions when using commercial products. When using sodium and potassium carbonate, the most economical and effective method is to mix 2.5 lb of each chemical into 30 gallons of water. This is sufficient for five tons of freshly cut forages which when dried will equal one ton of dry matter. Use more solution per acre with higher than average forage yields; do not compensate by making the solution more concentrated. Sufficient solution must be used to achieve proper coverage of plant material. The amount of water added when applying drying agents is insignificant relative to amount of water present in the plant. Nevertheless, typical legume yields require 30-50 gallons/acre of prepared solution. This results in frequent stops to fill application tanks.

The most common method of applying drying agents requires a haybine with roll-type conditioner that has been equipped with a spray boom and a push bar. The push bar height should be adjustable. Tanks can be tractor mounted for trail type haybines. Self-propelled haybines have not been designed to carry extra weight so consult your dealer or the manufacturer before mounting tanks. Roll-type conditioners have proven consistently superior to flail-type conditioners because the rolls help spread the chemical over the plant surface. After conditioning, forage should be dried in as wide a windrow as possible. This has two effects. First, more sunlight will be absorbed by the forage which means more energy is available to evaporate water. Second, a wide windrow will increase the amount of plant surface area exposed to the environment. The ideal method of drying is in the swath. Heavy, narrow windrows can completely eliminate the beneficial effect of drying agents. Michigan research has found that drying agents were twice as effective when alfalfa was left in wide swaths instead of windrows after cutting.

Results and Limitations

Research conducted in the Midwest and western Canada shows that drying agents can reduce drying time of alfalfa by 50-70% under good drying conditions. This translates to about a one-day reduction in curing time. Drying agents are most effective on alfalfa, but also reduce curing time of red clover by 30-50%.

Research also shows that drying agents are most effective on second and later cuttings, and less effective on the first cutting. Little improvement in drying rate is observed when comparing drying agents to mechanical conditioning of first cutting alfalfa. Drying agents are more effective on later cuttings because first cutting alfalfa has more and thicker stems than latter cuttings and first cutting yields are usually high.

Drying agents must dry on the plant surface to be effective. Rain during or shortly after application can completely negate the effect of the drying agent. Some research has shown that rain can reduce the effectiveness even after the drying agent has dried on the plant. The loss in effectiveness was related to the amount of rain.

Feeding value of treated hay is essentially identical to untreated hay, but superior to untreated rain damaged hay. Therefore, the only benefit of using a drying agent is to reduce potential rain damage. If rain is not likely to occur for a few days after cutting, application of a drying agent may be an unnecessary cost (approximately $5-10/ton). Significant economic benefits (approximately 3:1 return on investment), however, can result when rain damage is prevented by use of a drying agent.

Checklist

1. Calibrate spray equipment.
2. Adjust pushbar to 1/2 to 2/3 of the crop height.
3. Adjust crushing rolls for proper conditioning.
4. Estimate yield.
5. Apply 5 lbs. active ingredient (potassium or a 50/50 mix of sodium and potassium carbonate) in 30 gal of water per ton of dry matter.
6. Leave crop in a swath if possible or in as wide of windrow as possible.

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