

EVALUATION OF DESICCANTS IN ALFALFA

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ABSTRACT

Desiccants speed the curing of alfalfa hay. Used properly, desiccants help reduce harvest losses by decreasing respiration, mechanical handling losses and leaching losses. Research conducted in California shows that potassium carbonate or potassium hydroxide based desiccants reduce the drying time of alfalfa as much as 60%. Producers should apply 5 lb. of either potassium carbonate or potassium hydroxide per ton of alfalfa for optimum results. Desiccants must be applied in enough water to thoroughly cover the forage; this usually requires 20 to 25 gallons of water per ton of hay. Economic analyses show that desiccants are most beneficial when the threat of rain is eminent and drying conditions are favorable.

Key Words: alfalfa, drying agent, desiccant, harvest loss

INTRODUCTION

Producing high quality alfalfa hay can be difficult even under the most ideal conditions. One factor limiting productivity is nutrient losses associated with harvesting. Using a hay desiccant is one tool producers can use to control these losses. But before we discuss the use of hay desiccants let's review why they are an important management tool.

Harvest Losses

Even under ideal conditions harvest losses approach 20%. They can reach as much as 50% under adverse circumstances. There are three sorts of nutrient losses associated with harvesting alfalfa: respiration losses, mechanical handling losses and leaching losses. Each type is explained in more detail below.

Respiration losses

Even after alfalfa is cut, the plant continues to metabolize plant sugars until it reaches about 35% moisture. Preserving these plant sugars is the key to making high quality hay. The key to minimizing respiration losses is to ensure that the plant rapidly wilts and dries. If cool, rainy, cloudy, or humid weather extends the drying process then respiration losses increase. Dry matter losses to respiration can reach as much as 16% under poor drying conditions.

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Mechanical handling losses

Even with ideal management, mechanical losses account for a 10 to 15% dry matter loss. Mechanical losses approach 30% when alfalfa is harvested improperly. And because alfalfa leaves tend to dry more rapidly than stems, much of the material lost to mechanical handling is the high quality leaf. A high proportion of leaves leads to hay with a higher crude protein and lower fiber content.

Leaching losses

Leaching losses occur when alfalfa hay is rained on. During a rainstorm the water washes away many of the soluble sugars and minerals that would otherwise be present in high quality alfalfa. Rain on recently cut, unwilted forage causes surprisingly little leaching loss. However, rain on nearly dry hay can cause a significant loss of leached sugars and soluble minerals. Minimizing the curing time of alfalfa helps to avoid rainfall and leaching losses.

Unfortunately, the environmental conditions in California are not always conducive to minimizing harvest losses. Low solar radiation and high humidity, especially during the late winter or early spring, often make the time required to cure alfalfa hay excessive. Reducing the duration of curing is critical to minimizing these losses.

Practical Ways Producers Can Speed Haymaking

Although haymaking is partly dependent on the weather, producers have considerable control over how fast hay cures. Some practical ways to hasten the drying process to lower harvesting losses are:

1. Use modern weather forecasting to minimize exposure to rain
2. Mechanically condition the hay
3. Dry hay in wide swaths as opposed to narrow windrows
4. Apply a chemical drying agent (a.k.a. desiccant)

Perhaps the newest (although by no means recent) way to maximize hay drying is to apply a chemical drying agent. We have learned much about the use, formulation, and application of these desiccants over the past 25 years.

How a Desiccant Works

If you look closely at the morphology of an alfalfa plant you will find that it is covered with a wax like material called "cutin". A closer look will reveal that stems have a thicker cutin layer than do leaves. The purpose of this natural wax layer is to prevent the growing plant from wilting under arid conditions. Another benefit of this wax is that it protects the plant from some insects and diseases. Unfortunately, when we attempt to cure alfalfa for hay this wax is a barrier to water trying to escape from the plant.

One way to eliminate this problem is to apply a chemical drying agent at harvest. A chemical desiccant hastens drying by destroying or removing the natural wax layer. Research as early as 1972 showed that a chemical desiccant applied to alfalfa could accelerate the drying process dramatically.

Which Desiccant Should You Use?

Several desiccant products are available commercially. Experimental studies conducted in Michigan, New York, Wisconsin, California, Australia and Canada show that the most effective products can reduce drying times by 60% or more under favorable conditions. The same studies also point out that many commercial products contain diluted and/or ineffective ingredients and as a result did not reduce drying time. Research conducted here in California shows that of the products on the market, those containing potassium carbonate and or potassium hydroxide are most effective (Table 1). Potassium hydroxide, however, is more difficult to handle and is considerably more expensive than potassium carbonate

Although results at times can fluctuate greatly, our research shows that potassium carbonate reduces the time required to dry alfalfa 50 to 60% (Table 1). We have tested several rates of application and find that 5 lb. of potassium carbonate or potassium hydroxide per ton of forage provides the maximum drying rate. Applying more than this amount has not reduced drying time.

How To Apply a Desiccant

Desiccants must be applied uniformly to be the most effective. Two factors are important. First, the desiccant must be applied in sufficient water to thoroughly cover the forage. Research shows that this requires 20 to 25 gallons of water per ton (dry basis). Second, a sprayer system to uniformly apply the desiccant is needed.

Two different sprayer systems have been developed. One system applies the desiccant just behind the push-bar and just in front of the pick-up reel of a convention mower-conditioner. As the crop is bent-over by the push bar, the spray is directed at the stems. This seems to be the most popular system in California. The other system sprays the desiccant just in behind the pick-up reel and in front of the conditioning rolls. This system partly uses the conditioning rolls to help apply the desiccant.

When Should You Apply a Hay Desiccant?

Perhaps the most difficult question to answer is "When should I use a desiccant on my alfalfa?". Unfortunately, there is no simple answer. Several environmental and economic factors make the picture complex. However, economic studies suggest that desiccants are most economical when the threat of precipitation is great and drying conditions are favorable (i.e. low relative humidity, warm temperature, clear weather). Studies further indicate that the effect of

using a desiccant is nullified if hay is placed in to heavy windrows instead of wider swaths or is not mechanically conditioned. Thus a desiccant is only economical if other haymaking practices are in order.

CONCLUSIONS

Desiccants are one tool California hay producers have to decrease harvest losses and make higher quality hay. The keys to using a desiccant most effectively are:

1. Apply potassium carbonate or potassium hydroxide at 5 lb. per ton of forage. Avoid products that do not contain one of these compounds.
2. When applying the desiccant use enough water to thoroughly cover the forage. This requires 20 to 25 gallons of water per ton of forage.
3. The hay must be mechanically conditioned for the desiccant to be effective.
4. Hay should be dried in wide swaths instead of narrow windrows.

Table 1. Drying time of alfalfa treated with three different hay desiccants at four rates of application. Data were collected in February and again in June of 1995.

Product	Rate of application	February	June
	pounds per ton	hours to reach 18% moisture	
Potassium Carbonate	2.5	127	32
	5.0	67	22
	7.5	70	24
	10.0	73	21
Potassium Hydroxide	2.5	139	30
	5.0	61	21
	7.5	84	19
	10.0	71	20
Sodium Carbonate	2.5	157	45
	5.0	127	38
	7.5	129	34
	10.0	119	35
Untreated Control		164	51
LSD (0.05)		14	6

The desiccants were applied using a front mounted commercial sprayer on a Hesston 8400 Mower/Conditioner. Samples were taken every 2 hours for moisture content. Hay yield was approximately 1.5 tons per acre and the hay dried under field conditions in a 8 ft. wide swath. The experiment was conducted near Blythe, California.