

## Central Washington Animal Agriculture Team



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### Timothy Hay-Drought Advisory

Steve Fransen, WSU Extension Forage Specialist  
Tip Hudson, WSU Extension Educator

An introduced cool-season grass, timothy is very winter hardy but lacks heat and drought hardiness compared to many other hay grasses, mainly because of shallow, fibrous roots. Like other C<sub>3</sub> (cool-season) grasses grown in the region, mature timothy plants produce roots in the fall and spring. During the winter and summer they shed much of the previously developed, short-lived root system. Research from the UK reported about 80% of timothy roots are found in the top 2" of soil, although roots will extend beyond 2 feet. If properly managed through a drought period, timothy roots will grow deeper, by shifting more water to root cell elongation at the expense of top growth. Seedling timothy produces new roots for most of its first year. The objective of this paper is to provide practical management recommendations to timothy producers based on an understanding of its growth and energy storage requirements. This will enable timothy to be produced with reduced water supplies and be able to survive drought conditions.

#### **Energy Storage**

Timothy is unique among grasses in that during the autumn it develops a corm, a bulb-like structure from an elongated internode. Water soluble carbohydrates, mainly fructans (chains of fructose sugars with a terminal glucose sugar) fill the corm in the spring past the flowering stage. After flowering, fructan concentration declines in the seedhead stem as starch content

increases in the seedheads. Very little fructan is stored in the seeds at crop maturity, since starch is the primary storage carbohydrate in the seed. Highest fructan concentrations are found in stem bases (the region from soil surface to approximately 3" above the ground) and the corms. Fructans molecules are stored in the vacuole of cells and vary in length and size, depending on the grass species. Fructans are produced from sucrose (common table sugar) during photosynthesis and can be created anytime of the day or night. Timothy fructan molecules are larger than those in other cool-season grasses and actually more resemble those of onions.

#### **Management Keys**

Weakened timothy stands may decline and die during a prolonged drought. There are important management keys however that will improve the potential for satisfactory yields and survival. Factors that contribute to improve yields and reduce stand losses are (1) maximizing root growth and (2) ensuring high levels of carbohydrate reserves in the crown (stubble) and corm. Proper fertilization and harvest management are the most important management keys to produce a marketable first cutting and sustain the current stand through drought conditions.

#### **Proper Fertilization**

Adequate levels of phosphorus (P) and potassium (K) fertilization are necessary for root and shoot development. Spring green-up will be earlier for fall fertilized

timothy than if no P or K fertilizer is applied. Fall fertilized timothy has greater rooting potential during the spring of a drought year, better establishing it for summer survival. It is important to get a soil sample from every hay field and fertilize according to test results with P and K to maximize spring root production. These roots will absorb water and minerals from the soil so the plant grows to its potential in the early spring growth period in a drought year. Apply nitrogen only at a level sufficient to produce the first cutting yield, likely no more than half your normal N rate. In the fall, post-drought or when rains return, soil test again and apply needed P and K. A limited application of N and S will also help the crop with adequate growth in the fall until freeze-up.

### ***Proper Harvest Management***

Following a good pre and post harvest management plan will enhance the likelihood of producing a marketable first cutting hay crop while sustaining the current stand through the drought. Proper P and K fertilization will ensure that early growth produce more tillers and fill the plant with life-saving, stored fructan sugars. Be prepared for an earlier than normal first cutting harvest in a drought year. Drought will hasten the spring development of timothy with first cutting resulting from one to two weeks ahead of normal.

Do not graze or cut the crop at boot or earlier stage as this will shorten the period of fructan storage in the stubble. Harvesting at flowering or later will ensure good carbohydrate storage. The later maturity stage standing crop will be drier than normal and may not take as long to dry in the windrow. Delaying harvest until maturity will likely reduce leaf color and export quality of the hay. When harvesting, leave 4 to 6" of stubble. The higher than normal stubble height will help save the stand through the hot, dry months. Taller stubble ensures more fructan sugars to feed the growing points (located at or below the soil surface). Taller stubble will shade the soil surface lowering soil temperatures and increasing plant survival rates. Without continued irrigation,

timothy will go into a state of dormancy before or after first cutting. After first cutting, if irrigation water is limited, then refrain from irrigating and stimulating new regrowth. Second cutting regrowth will mobilize stored fructans attempting to produce a second hay crop. Reduced fructans weakens the plant, making it more susceptible to drought induced death. Do not be tempted to graze the taller, residual stubble. Timothy regrowth and stubble, after first cutting, will be high in fructan sugars needed by the plant for the survival period. Timothy should remain dormant until the drought has passed; it likely will survive this interruption in its normal cycle.

If the drought continues from spring to early summer, gradually reduce the amount of water (with each irrigation application) to prolong the spring rooting growth as long as possible. As plants become water stressed, they will grow more slowly and the leaves will wilt. Fructan accumulation will likely decline but proline leaf concentration will increase. Proline has been found in many grasses including cereal grains, which provides partial plant protection during drought periods. Proline concentrations will decrease within 48 hours after irrigation or rainfall resumes. If this event is followed by another prolonged dry period stand losses are likely.

Depending on previous timothy management and current irrigation water availability, spring growth and first cutting yield during a drought will be less than normal. As mentioned, weakened plants (low carbohydrates) will likely not produce seedhead tillers at this time. Tillers will remain vegetative throughout the spring and summer. If timothy is harvested for hay before or at boot, great stress will be placed on the crop.

During the drought, the probability is high that timothy stands will be thinned or lost because the corms lacked time to fill and stubble lacked adequate time to store fructan sugars. Additionally, keep all classes of livestock and farm machinery (including sprayers) off the timothy fields as the plants are very delicate during the drought period.

### ***Forage Quality***

Drought stressed timothy hay and regrowth will be higher in forage quality than normal growth quality. Whole plants, leaves and stems will all exhibit lower ADF, NDF but higher protein in drought stressed timothy. Timothy will accumulate nitrates in the hay so drought stressed hay should be tested in a laboratory for nitrate concentration.

### ***Weed Control***

Weeds are always competitors for water and nutrients intended for the hay crop. Drought stressed plants, however, must be treated carefully, since they may respond adversely to certain pesticides. ***Be sure to read the label of any product applied.*** Additional product information may be obtained from company representatives. Some phenoxy herbicides will stimulate plants to increase nitrates in tissues. High plant nitrates are an animal health concern with drought stressed forages. Send a sample for nitrate testing from any timothy hay grown through a drought you suspect maybe high in nitrates. Simple field tests can be helpful in identifying potentially high nitrate pasture or hay.

### ***When Rains Return***

Timothy leaves will monitor the day-length and provide the signal to the plant to regrow fall roots and new growing points for the next year. After a severe drought, timothy can withstand a harsh winter better than other grasses. But if critical fall management is not provided stands will thin during the fall and winter. The idea is to prepare the timothy crop for the following year's normal cycle of growth and production. Drought related research is very limited on timothy hay grown in the Pacific Northwest or worldwide. The concepts in this paper have been extracted from numerous sources.