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FACT SHEET

L-899

KEYS TO PROFITABLE HAY PRODUCTION

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Hay varies in quality more than any other field crop. Give special attention to hay quality because animal performance is directly related to this and to forage consumed. Recommendations in this guideline are for production of practical amounts of good-quality hay for livestock consumption and market.

PRODUCE HIGH-QUALITY HAY

SELECT PRODUCTIVE AND ADAPTED SPECIES. Legumes, such as alfalfa, clovers, etc., usually contain a higher percentage of protein, minerals and vitamins than grasses. Legume plants also contain a higher portion of cellular contents than grass plants, and are usually digested to a greater proportion and a faster rate than grasses.

Grasses usually produce higher forage yields and greater amounts of total digestible nutrients per acre than legumes. Insect and disease damage is usually less on grasses than legumes. Stands of perennial grasses are easier to maintain than legume stands.

Length of growing season, winter temperatures, available moisture, soil condition and animals which are to consume the hay should be considered when determining the specific specie and variety to use for hay production.

Warm-season annuals and perennial species are the most adapted to prevailing climatic conditions favorable for growing, harvesting and curing good-quality hay. Cool-season annuals, such as small grains and ryegrass, can make good-quality hay when climatic conditions in the spring are favorable for harvest and curing. These species should be used primarily for grazing, with hay made from excess forage growth when the species approach maturity, if weather conditions permit.

SEEDBED PREPARATION. Good seedbeds are essential for rapid germination and continued growth of hay plants. Till soils deep enough to remove the compacted layer. Seedbed preparation should sufficiently precede planting to permit seedbeds to become settled, firm and moist. Initial applications of fertilizer should be disked into the seedbed before planting. Control weeds with common tillage equipment.

PLANTING. Plant good-quality seed of an adapted variety, using certified seed when available. Seed should be of high germination, true to variety and free from trash and seeds of other crops and weeds. Trash in planting seed affects drill operation, causing poor seed distribution and uneven stands. Treat seed with an approved fungicide and insecticide. Certified seed usually are treated with these materials to ensure satisfactory seedling growth and stand establishment.

Planting with a drill provides a more uniform stand and growth with fewer weed problems than broadcast planting. Firming the soil with a roller conserves moisture and encourages rapid germination.

Certain bermuda species are established from vegetative material because viable seed are rarely produced. Avoid exposing sprigs to warm, dry temperatures. Plant mature sprigs in moist, clean and fertile seedbeds with one end slightly above the soil surface.

FERTILIZATION. Adequate amounts of plant nutrients are essential for high production and good-quality forage. In addition to increasing hay yields, fertilizer improves protein, palatability and performance of animals consuming the hay.

A ton of 15 percent crude protein hay removes approximately 50 pounds of nitrogen, 15 pounds of phosphorus (P_2O_5) and 40 pounds of potassium (K_2O) (50-15-40) in addition to secondary and micronutrients. Soils vary greatly in their capacity to supply plant nutrients. Thus, a soil test is important for determining the kind and amount of plant nutrients needed for profitable hay production. For annual species, the initial application of nitrogen, phosphorus and potassium should be disked into the soil during seedbed preparation. Perennial grasses should receive the initial spring fertilization when growth begins.

Adequate amounts of *nitrogen* for establishment and production of the first cutting should be applied by planting time. On most soils, at least 60 pounds of nitrogen is necessary for each cutting to produce rapid growth and good-quality grass hay. (Bermudagrass requires 80-100 pounds of nitrogen.) Because nitrogen levels are difficult to build up in the soil, and nitrogen

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is readily utilized by plants, applications of this nutrient are needed following each hay harvest. Topdress applications of nitrogen are satisfactory because this nutrient moves readily into the root zone. Although nitrogen is essential for increasing protein content of grass hay, other nutrients, such as phosphorus and potassium are also necessary for protein formation.

All *phosphorus* required for establishment and the first growing season should be disked into the soil during seedbed preparation. In soils very low in phosphorus, high rates are necessary to encourage rapid seedling growth, production and a deeper root system, especially for perennial species. For annual grasses, 20 pounds of P_2O_5 should be applied in the seed zone in contact with the seed to encourage early seedling vigor. Legumes are less efficient in obtaining nutrients from the soil than grasses, and require higher rates of phosphorus for optimum growth and quality.

Potassium is required in large amounts for satisfactory production and quality. Many soils in the state are able to furnish adequate amounts of this nutrient, while others are deficient, especially for high production. When high rates of potassium are recommended by a soil test, topdress a portion of the recommended amount in mid-season. Legumes require higher rates of potassium than grasses.

Lime is essential for satisfactory growth on many soils in the eastern half of the state. A pH of 6.5 or higher is essential for optimum legume and grass growth. Apply the recommended amount of limestone well in advance of seedbed preparation and disk thoroughly into the soil. High rates should be disked into the soil before perennial hay crops are established. Subsequent applications of lime and fertilizer can be made satisfactorily as a topdress application.

WEED CONTROL. Weeds reduce hay quality and yields, and cause rejection by livestock. Weeds deprive hay crops of plant nutrients and soil moisture. Adequate seedbed preparation and use of high-quality weed-free seed planted in a clean seedbed is helpful in weed control. Broadcast or close-drill plantings retard weed growth more than row plantings. A thick stand of well-fertilized forage also reduces weed infestation.

Chemicals usually provide more effective and longer control than mowing or shredding. Chemicals are very effective when establishing perennial hay meadows from vegetative material. For chemical weed control recommendations, refer to B-1029, *Suggestions for Weed Control with Chemicals.*

INSECT CONTROL. Insects and mites can cause extensive losses in quality and yield. Legume hays are more likely to suffer insect damage than grass species. Growers should be familiar with the major pest species, and observe hay crops for insect or mite buildups. For detailed information on insect identification, biology and characteristic damage, refer to B-975, *Insects Attacking Forage Crops.*

The most damaging insects attacking grasses include grasshoppers, fall armyworms, cutworms and white grubs. Various lepidoptera larvae (worms), alfalfa weevils, clover weevils, clover head weevils, grasshoppers, three-cornered alfalfa hoppers and aphids are important legume infesting pests. Refer to MP-339, *Texas Guide for Controlling Insects and Mites on Corn, Sorghums, Small Grains and Grasses* or *Texas Guide for Controlling Insects and Mites on Legumes* for control recommendations.

Proper selection and use of soil insecticides and/or seed treatment is the best means of reducing losses caused by soil-infesting insects. Crop rotation and weed-free fields will aid in reducing or eliminating losses.

Carefully follow label recommendations on chemicals to obtain effective control and to avoid pesticide residues and toxicity hazards.

DISEASE CONTROL. Certain diseases may attack hay crops and reduce yields and quality. Forage disease prevention and control with chemicals usually is not economical. Good fertility increases resistance to certain diseases. Disease specimens may be submitted through the county agricultural agent to a plant disease diagnostic laboratory for identification.

When leaf diseases occur, harvest before defoliation becomes excessive.

For disease control in annual grasses, treat seed with recommended fungicides; keep residue out of seedling zone; plant tolerant hybrids or varieties; rotate with non-related crops and control johnsongrass. Avoid planting susceptible legumes, such as alfalfa, in fields known to be infested with cotton root rot.

HARVEST WHEN QUALITY IS HIGH

STAGE OF GROWTH AFFECTS QUALITY. As hay plants mature, crude protein, digestibility, palatability and animal performance decline, as shown in Table 1.

Harvest hay plants when the greatest amount of digestible nutrients per acre may be obtained. This usually is at a stage of growth slightly before plants

Table 1. Crude protein declines as hay crops mature.

Crop	Stage of growth	Percent crude protein
Alfalfa	Early bloom	19.3
	Full bloom	16.9
Coastal bermuda	3 weeks' growth	18.3
	7-8 weeks' growth	6.7
Oats	Pre-boot	27.6
	Early bloom	15.3
Sudan	Early boot	16.8
	Full bloom	8.1
Johnsongrass	Early boot	15.0
	Half bloom	8.6
	Mature	5.7

begin maturing or producing seedheads. Delaying harvest may provide a slightly greater increase in yield, but this increase consists primarily of stems, stalks and other low-quality parts. Highest yield of digestible nutrients will usually be obtained when the crop is harvested at the stage of growth shown in Table 2.

Table 2. Stage of growth for harvesting hay crops to obtain greatest amounts of digestible nutrients.

Crop	Stage to harvest
A. Perennial grasses:	
Bahiagrass	Boot to early bloom
Bermudagrass (Coastal and Coastcross-1)	14-16 in. height (maximum 4 weeks' growth)
Bermuda (Common, NK-37 and WS-300)	Early bloom
Bermuda (Midland)	12-14 in. ht. (max. 4 weeks' growth)
African stargrass	14-16 in. ht. (max. 4 weeks' growth)
Blue panicgrass	Boot-early bloom
Bluestem, introduced and native	Boot-early bloom
Buffelgrass	Boot-early bloom
Dallisgrass	Early bloom
Johnsongrass	Boot
Lovegrass	Boot
Mixed perennial grasses	As for predominant grass
Perennial grass-legume	As for grass
B. Annual grasses:	
Millet, German or foxtail	When heads start to emerge
Millet, Pearl or cattail	Boot
Sorghum, forage	Bloom-soft dough
Sudan varieties and sudan hybrids (including sorghum almum and sorgrass)	Boot
Oats	Early bloom
Ryegrass	Early bloom
Mixed annual grasses	As for predominant grass
Annual grass-legume	As for grass
C. Legumes:	
Alfalfa	1/10-1/4 bloom
Sericea lespedeza	12-15 in. height or 1/10 bloom
Sweetclover	Early bloom
Alyce clover	15-18 in. height, but before leaves begin to drop
Burclover (including button)	Full bloom
Clover, true (crimson, hop, red, white, Persian and arrowleaf)	Early bloom
Cowpea	When first pods turn yellow, but before lower leaves begin to drop.
Soybean	Pods ½-¾ filled
Lespedeza, annual	Early bloom
Peanut	Harvest to retain maximum leaves
Vetch	Early bloom
Mixed legumes	As for predominant legume
Legume-grass	As for legume

Cure hay quickly after mowing. Hay crops contain 60 percent and higher moisture contents when harvested, and must be dried to 12-18 percent moisture for safe baling and storage. Rapid curing and baling conserves leaves, nutrients, color, palatability and other quality factors. Use a hay conditioner to reduce curing time, especially for large-stemmed plants. Hay conditioners permit moisture to evaporate quickly and reduce losses from climatic factors which reduce quality. Use a hay conditioner within 15 minutes after cutting. To prevent heating and molding, avoid baling hay with excess moisture.

Loose-stacked hay is gaining interest among livestock producers. Stacking hay loosely can provide lower harvesting cost, lower labor requirement for hauling, quality equal to baling, lower storage investment and self-feeding for livestock. For detailed information, see L-857, *Loose Hay Stacking.*

Store baled hay inside a shed, on dry, level, well-drained sites. Stack the bales to avoid wasted space and permit easy handling.

DETERMINE HAY QUALITY

Because quality varies more in hay crops than in other field crops, hay producers should determine the quality of each cutting. Two major techniques are available for estimating quality: 1) visual estimation and 2) chemical analysis (forage test). Both are essential for accurately estimating performance of livestock when consuming hay.

VISUAL ESTIMATION. When estimating the physical characteristics of hay, a representative bale should be opened and one or more sections examined. Examining the knife edge of the bale gives a general estimate of physical characteristics.

- **Stage of maturity** at which hay is harvested is one of the most important factors influencing quality — especially grass hays. Stems in several sections can be examined for seedheads and evaluated for maturity as recommended in Table 2.

- **Texture** pertains to the stem size and pliability. It indicates to some extent the palatability or acceptance by animals. Small stems which are pliable and flexible are desired.

- **Leafiness** is an indicator of quality; immature, good-textured hays usually contain a high percentage of leaves to stems. Leaves contain two to three times as many nutrients as stems. Thus, a high proportion of leaves is desired.

- **Foreign material,** such as weeds, grassburs, stubble, stalk, manure, mold and other objectionable matter should be avoided. Wire, glass and other durable items can be injurious to livestock.

- **Color** is influenced by fertilization and curing. A bright, dark green in grass hays usually indicates high carotene and protein contents. It also indicates the crop was cured and baled to preserve the maximum

quality possible. Grass hays lose color faster than legume hays. Color should receive *minor emphasis* when visually estimating hay quality. The following scorecard may be useful in this evaluation:

Factor	Grass	Legume
Maturity	40	20
Texture (size of stem and pliability)	20	10
Leafiness	10	35
Freedom from non-injurious foreign material*	20	20
Color	10	15
	100	100

*Non-injurious foreign material includes weeds, weedy grasses, sedges, rushes, stubble and stalks and other residue from other crops, manure and other non-injurious but objectionable matter.

CHEMICAL ANALYSIS (FORAGE TESTING). Chemical analysis is a guide for estimating the nutrient value of hay. Crude protein percentage is the most common chemical determination. Digestible protein is calculated from the crude protein content of forages. A *complete* analysis provides estimates of total digestible nutrients and net energy. Chemical analyses give accurate measures of the nutrient content, but are unable to indicate musty, moldy, shattered, weathered or objectionable features. Both testing methods should be used to determine accurately the feeding value and acceptance of each cutting of hay.

MARKETING HAY

Hay grown on livestock farms is usually marketed in the form of meat or milk. Here, emphasis is on efficiency of handling and storage to minimize costs.

The second marketing method is for cash. This usually involves moving hay into an intensive beef or dairy production area.

Marketing procedures that result in the highest net price to producers include:

- Link production with marketing as interdependent phases of a business.
- Develop effective group marketing and/or bargaining programs including conditions and terms of trade.
- Consider seasonal price changes and alternative of storing for later sale to selling at harvest time.
- Forward contract before harvest if satisfactory terms can be arranged. This can stabilize price and provide an orderly flow from producer to user. (Contract on a group basis.)

Successful hay marketing depends upon concerted and unified action among producers in each production area.

ECONOMICS OF HAY PRODUCTION

Adequate fertilization of hay crops is essential for efficient production. High tonnages of good-quality hay are more profitable than small tonnages of poor-quality hay, as shown in Table 3. In addition, drastic increases in quality usually occur with fertilization.

Table 3. Estimated production and harvest cost per acre, Coastal bermudagrass hay, yielding 8 tons per acre.

Production cost:	
Fertilizer, 400-100-200	$ 67.44
Lime—1 ton per acre	7.00
Chemical weed control	1.20
Tractor and equipment—1.26 hr. @ $.77	.97
Labor—1.4 hr. @ $1.30	1.82
Interest—8 percent for 6 months	3.14
Total production cost	$ 81.57
Harvest cost: (owned equipment)	
Mowing and raking—3.72 hr. @ $.84	$ 3.12
Baling—2.35 hr. @ $1.22	2.86
Twine—@ $.88 per ton of hay	7.04
Hired labor—7.80 hr. @ $1.30	10.14
Hauling—264 bales @ $.10	26.40
Total harvest cost	$ 49.56
Total production and harvest cost	$131.13
Production and harvest cost per bale (60-pound bales, 33 bales per ton)	$ .49
Production and harvest cost per ton	$ 16.39

Further hay profit increases may be realized by harvesting hay from excess forage during seasons of rapid growth. Cross-fencing pastures facilitates hay-making from one portion of the pasture area. Quality may be less than ideal, but forage utilization is more efficient and profitable for the livestock producer.

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