Purchasing Forage For A Diverse Group Of Exotic Animals Beyond The Nutrient Analysis

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The approach of this paper is from a forage utilization perspective as it pertains to providing forage for the diverse, and often non-food related, purposes of a zoological institution. The paper covers aspects of forage production often over-looked or poorly understood by zoo professionals yet vital to the health and well-being of our captive collections. The purpose of the paper is to provide buyers with information and references pertaining to forage production to aid in the preparation of forage specifications that meet both the needs of the collection and the institution.

Key words: hay; crop pests; weeds; toxoplasmosis

Making Hay

This year forage growers will produce 151,000,000 tons of hay products in the US (National Hay Association, Appendix I). The goal of most forage programs is to maximize economic yield of nutrients while ensuring stand persistence. Harvest management of perennial legumes requires a compromise between quality and persistence (Penn State Agriculture, Agronomy Fact Sheet 7, Appendix I). For the grower, the time to harvest depends greatly on the expected crop return.

Where the forage is grown will dictate the timing of the harvest. In arid parts of the country, where irrigation is widely used, harvest timing correlates with stage of growth and expected yield/acre. The grower can simply turn off the irrigation and harvest. In wetter regions of the country, harvest must be timed around expected rainfall. The number of harvests per season will also determine when the grower will choose to harvest. Growers in the far North may only realize a few harvests in a growing season. For these growers maximizing return per acre is critical.

Understanding the pressures on the grower in the region from which your forage comes is valuable. This knowledge will allow you to negotiate a forage deal that meets your needs and is fair to both the zoo and the vendor. Utilizing the resources available to you on the Internet to evaluate these pressures is helpful. See Appendix I: General Information.

Know the forage use before you buy

Because zoos use forage for a variety of reasons, knowing the intended use prior to purchase is valuable. Forage purchased strictly for feed should meet the recommended forage nutrient levels for the target species (refer to NAG Handbook fact sheets 001 and 006). However, if the forage will be used for bedding, public events, horticulture needs, runoff control, etc., then nutrient value becomes less important. Forage appearance, texture and absorbency become more important issues. Prior to soliciting forage bids, make a concerted effort to quantify the level of non-feed use. Recognize that this forage can be of low nutritive value and that it is less expensive for the grower to grow and in less demand – both should be reflected in the price. Categorize the usage to determine the forage need. Bedding forage must be free of weeds and foreign debris. If straw is purchased for this purpose it may be important to consider bearded versus non-bearded varieties, absorbency, type and appearance. If hay is used for bedding, appearance, absorbency and type is important. Forage for public programs such as hay rides or barricades should look nice where forage used for control of runoff in construction sites can be of the lowest quality. If you choose to distinguish non-feed forage from feed forage, you must train your staff to differentiate between the two. Knowing the use of the forage will help you write specifications for the forage that will be clear to the vendor, meet your forage needs and reduce unnecessary over-spending for non-feed forage.

Weeds and Crop Pests

Forage purchased for feed and bedding must be free of dangerous weeds. The onus must be placed on the grower to practice good weed control, although keepers should be expected to go through the forage prior to feeding or bedding, it is very easy to miss weeds. The technology as well as assistance is available for growers to ensure virtually weed free fields. To produce weed free forage, the vendor must practice weed control. The use of weed free seed and/or crop rotation is an important step in achieving this goal. In conventional seeding of forage crops, where the land is plowed and where weeds are likely to be a problem, a preplant herbicide is often used (National Forage Curriculum, Lecture 8. Appendix I). Buyers should identify within their specifications the herbicides that are acceptable for usage. Growers should be required to use only EPA-registered chemicals approved for weed control on forage intended for dairy cattle. Because the dairy industry represents a major buyer of quality forage in this country and strict standards are imposed by the FDA on forage intended for dairy cattle to safeguard the nation's milk supply, these guidelines work well. Refer growers to the U.S. FDA, 1993 Pasteurized Milk Ordinance, (Appendix I). Specifications should include a provision allowing the buyer the ability to obtain the MSDS on any herbicide used by the grower. For a better understanding of what is involved in weed control in forage crops see the National Forage Curriculum, Appendix I: General Information.

The same guidelines imposed for herbicides can also be used for insecticides. In the northeast United States, the alfalfa weevil can cause major crop damage. Weevils may eat the stems and kill young alfalfa seedlings. Signs of weevil damage can be seen by May 1 and damage is usually complete by June 1. Weevils injure first cutting and regrowth of second cutting. Parasitic wasps and a fungus pathogen have greatly reduced the impact of weevils in eastern United States. However, insecticide is also used to help control weevils (Penn Jersey Extension Partnership, Field Crop Alert, Alfalfa Weevil, Appendix I). In central and southwestern United States, blister beetles are sometimes found in alfalfa during hot weather. Both live and dead beetles contain a potent irritant, cathardin, that is particularly dangerous to equids and infrequently affects ruminants [Ullrey, 1997]. Modern hay harvesting practices (e.g., hay conditioners) are believed to increase blister beetle mortality so they are more readily incorporated into hay. In addition, cantharidin oil is released when adults are crushed and can contaminate hay even if the adult blister beetles are not present. Insecticides can be used to reduce blister beetle populations. (Colorado State University Cooperative Extension, Blister Beetles in Forage Crops, Fact Sheet no. 5.524, Appendix I). Buyers should familiarize themselves with the crop pests common to the area where their forage is produced, and ask the grower how the pest is controlled within the forage harvested for zoo animals.

Foreign Debris

Since most forage is purchased by the ton, foreign debris increases the cost of the usable forage; however, the most significant issue concerning foreign debris are ingestion of trash, items that can be thrown by animals or physically harm animals, and possible disease transmission by animals caught during the baling process or animals living within the forage during storage.

Toxoplasmosis is one example of a disease that can affect zoo animals and may be unwittingly purchased within forage, if the supplier allows barn cats to live within the forage. Toxoplasmosis is an obligate intracellular parasite that probably can infect almost any mammal and has also been reported in birds. The intestinal phase occurs in cats only (wild as well as domesticated) and produces "oocysts." The disease, toxoplasmosis, can be transmitted by ingestion of oocysts (in cat feces). Under favorable conditions, oocysts sporulate to the infective stage in 24 to 96 h and remain viable for several months, thus it is possible for forage contaminated with cat feces to spread the disease to zoo animals. Macropods are particularly susceptible to toxoplasmosis, but many zoos have reported illness and death in a variety of species by toxoplasmosis [Epiphanio et. al., 1999; Juan-Salles et. al., 1997; Patton, 1993]. Other disease transmission is also possible. Fawns caught during the baling process are of particular concern since these animals can carry a mired of diseases transmissible to similar species offered or bedded on the forage. Forage

containing fecal material or animal parts should not be used for feed or bedding and the feces/animal should be examined by the veterinary staff. Hay specifications should address these special concerns.

Forage Conditioning

Chemical compounds are commonly used to reduce field curing time of forages. These compounds are categorized as desiccants and preservatives. Desiccants are applied to the hay at cutting to increase drying rate, desiccants contain potassium or sodium carbonate. These compounds disturb the waxy cuticle of the alfalfa stem to allow it to dry faster. Desiccants work only on legumes. Preservatives are applied to hay as it is baled to allow baling of wetter than normal hay without spoilage during storage. The most effective preservatives for alfalfa are organic acids, primarily propionate (proprionic acid) and acetate (acetic acid). Anhydrous ammonia is an effective preservative for grasses. It can be injected into bales or released into a stack of bales covered and tightly sealed with plastic. Anhydrous ammonia should not be used as a preservative on alfalfa because the additional nitrogen is of little benefit to animals and toxic chemicals can form in the hay (University of Wisconsin-Extension, Agronomy Advice FC 12.4.1. Appendix I). Mechanical conditioning is another type of conditioning used for alfalfa. Mechanical conditioning crushes the stem increasing the digestibility of the forage. Mechanical conditioning also changes the texture of the forage giving it a softer, grassy feel. Buyers should be aware of any conditioning processes used by their supplier and assess the benefit or risk of the conditioning.

Forage Packaging

Forage is available in numerous package shapes and sizes. Forage can be purchased in the large economy size down to the convenient palm size. For an idea of what is available visit several of the sites listed in Appendix I, Forage Equipment and Packaging and General Information.

CONCLUSIONS

Each institution should prepare forage specifications specific to their institutions forage needs. Forage specifications must include nutrient guidelines for supplies to ensure the supplier both understands the needs of the collection and are contractually bound to supply forage that meets those needs. Purchase of hay on analysis is both convenient for the buyer and the supplier, it helps prevent the return of substandard forage and offers some assurance that the hay was appropriately grown and harvested. If hay is purchased on analysis the analysis should be recent (within 3 months) and loads should be periodically checked to ensure the supplier's analysis is consistent with the load received.

Specifications should include information on acceptable herbicides and insecticides, acceptable levels and types of foreign debris, and unconditional

rejection of forage containing dangerous weeds, mold or pests. Include information on delivery and storage. Ramifications for forage not meeting the institutions specifications should be clearly outlined.

For many institutions, forage represents a major portion of the animal food budget. Forage specifications that recognize the importance of forage in the diet and bedding of animals as well as the other usage's of forage by the institution can help reduce the overall forage bill. Consideration for optimal storage and movement of forage within the institution can further improve forage utilization and cost.

REFERENCES

Epiphanio S, Guimaraes M, Fedullo D, Correa S, Catao-Dias J. 1999. Toxoplasmosis in Leontopithecus chrysomelas (Kuhl, 1820) and Saguinus imperator (Goeldi, 1907). In:.Kirk-Baer C., editor. Proc Am Assoc Zoo Vet. Columbus. pp. 337-338.

Juan-Salles C, Lopez S, Borras D, Domingo M, Prats N, Fernandez J. 1997. Desseminated Toxoplasmosis in Susceptible Zoo Species – A Sporadic Disease? In Kirk-Baer C., editor. Proc Amer Assoc Zoo Vets. Houston. pp. 227 – 231.

Patton S. 1993. Toxoplasmosis in the Zoological Park. In: Junge, R, editor. Proc Amer Assoc Zoo Vets. Saint Louis. pp. 189-191.

Ullrey DE. 1997. Hay Quality Evaluation. In: Nutrition Advisory Group Handbook, Fact Sheet 001.

APPENDIX I: Helpful Forage Web Sites.

Referenced Sites

National Hay Association,
http://www.haynha.org/

Penn State Agriculture, Agronomy Fact Sheet 7,
http://www.agronomy.psu.edu/

National Forage Curriculum, Lecture 8.
http://www.forages.css.orst.edu/Classes/NFC/Topics/Weeds/8/Body.html

U.S. FDA, 1993 Pasteurized Milk Ordinance,
http://vm.cfsan.fda.gov/~ear/pmo-1993.html

Penn Jersey Extension Partnership, Field Crop Alert, Alfalfa Weevil,
http://paipm.cas.psu.edu/CropAlert/IPM_alfweev.html

Colorado State University Cooperative Extension, Blister Beetles in Forage Crops, Fact Sheet no. 5.524,
http://www.ext.colostate.edu/pubs/insect/05524.html

APPENDIX I: Helpful Forage Web Sites (cont'd).

University of Wisconsin-Extension, Agronomy Advice FC 12.4.1.
http://www.uwex.edu/ces/forage/pubs/preserv.htm

Other Useful Sites (not referenced)
General Information

Penn State Forage,
http://forage.cas.psu.edu/

Crop Science Society of America,
http://www.crops.org/

Penn State College of Agriculture, Cooperative Extension and Outreach,
http://www.extension.psu.edu/

National Forage Curriculum,
http://web.css.orst.edu/Classes/NFC/

NCSU/USDA Forage Program,
http://www.ncsu.edu/forage/nutrpubs.htm

Morgan Consulting Group, Ltd.,
http://www.morgan-consulting.com/ag/index.html

Forage Information Systems,
http://forages.orst.edu/main.cfm?PageID=32

Lancaster Farming,
http://www.lancasterfarming.com/

Crop Pests and Pest Control

Penn State Agriculture, Insects – *Pest Control,*
http://agguide.agronomy.psu.edu/sect4/sec45b.htm#Corn leaf aphid

Forage Equipment and Packaging

Forage harvesting Equipment,
http://www.casecorp.com/agricultural/newequip/hay/forage/

Creative Packaging Inc.,
http://members.tripod.com/~CP22243/index-22.html