



## UNIVERSITY OF MINNESOTA

Dairy Extension  
 Department of Animal Science  
 101 Haecker Hall  
 1364 Eckles Ave.  
 St. Paul, Minnesota 55108  
 (612) 624-4995

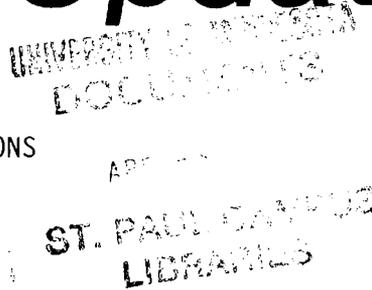


# Dairy Update

FEEDING MANAGEMENT AND UTILIZATION OF  
 COMMON FORAGES DURING DROUGHT CONDITIONS

Issue 83  
 July, 1987

J.G. Linn, Extension Animal Scientist  
 N.P. Martin, Extension Agronomist



Under drought conditions, dairy producers should be concerned with obtaining adequate quantities of forage first. Forage quality, while an essential component in obtaining high production, is secondary. All plant species reduce or suspend growth during moisture shortages to conserve moisture. Thus, yields will be reduced. Quality of the forage crop may or may not be affected. Grain and grain byproducts are usually more readily available than forages and can be readily used to substitute for deficiencies in forage quality once minimum forage needs are met. The following information will provide guidelines as to:

1. Determining minimum forage requirements;
2. Best utilization of common drought stressed crops in feeding dairy cattle;
3. Problems associated with feeding drought stressed crops;
4. Suggestions for alternative energy, protein and fiber sources to replace some forage in dairy rations; and
5. Some general dairy feeding considerations during drought years.

## FEED INVENTORY

Lactating cows will require a minimum of 1.4% of their body weight in forage dry matter (DM) per day or no less than 40% of the total ration DM from forage. For the average Holstein, the minimum amount of forage DM required per day would be 18 lb. This could come from a variety of forage sources such as hay, haylage and corn silage. Preferably, some hay (minimum of 5 lb/cow/day) with haylage or corn silage containing particles of 2 to 3 inch length (3/8 inch knife setting on chopper) should be fed to provide adequate physical fiber for good rumen function. Pelleted or finely chopped forages contain forage nutrients but lack physical fiber characteristics that provide good rumen function for normal butterfat tests.

This archival publication may not reflect current scientific knowledge or recommendations.  
Current information available from University of Minnesota Extension: <http://www.extension.umn.edu>.

Dry cows require a minimum of 1.5% of their body weight in forage DM per day. Very low quality forages can be used for the basis of the ration with grain and protein supplemented to meet energy and protein requirements. Again, adequate physical form of forage is required in dry cow rations just as it is for lactating cows.

Youngstock will vary in forage requirements depending on age. Calves (less than 4 months of age) can get by with no forage when some fibrous grains are included in the starter. Heifers from 5 to 12 months of age need about 1% of their body weight as forage DM (4 to 6 lb) per day. Older heifers (12 to 24 months of age) also require a minimum of 1% of their body weight as forage DM (7 to 12 lb) per day. Caution is required with minimum forage rations to prevent overconditioning of heifers. Grain amounts may have to be restricted and the animals may be a little hungry to prevent fattening. This will not be a problem if nutrient requirements are met.

Minimum monthly forage requirements for Holstein cattle are listed in Table 1. A 10% feeding and storage loss is figured into this table.

Table 1. Minimum monthly tons of forage DM for Holstein cattle.<sup>1</sup>

Animal	Forage net energy (Mcal/lb DM)		
	<.52	.53 to .6	>.6
	----- Tons DM/month -----		
Cows - 1300 lb body weight <sup>3</sup>			
Lactating	.30	.32	.34
Dry cow	.29	.30	.32
Heifers			
0 to 4 months	0	0	0
4 to 14 months	.13	.15	.16
14 to 24 months	.20	.22	.24

<sup>1</sup> Amounts listed assume a 10% feeding and storage loss.

<sup>2</sup> Estimates can be adjusted for different breeds. Multiply amounts by .7 for Jerseys and .8 for Guernseys.

#### UTILIZATION OF COMMON FORAGE SOURCES

Corn plants under moisture stress during the vegetative stage will have reduced stalk height, decreased leaf area and less grain yield than plants stressed at a later maturity. Moisture stress at silking up to maturity reduces weight and number of kernels.

Drought stressed corn plants accumulate nutrients in the stalk and leaves because of limited ear development. Nutrient content of drought stressed corn plants is similar to plants which have received adequate moisture (Table 2). One significant change, however, is in the form of nitrogen in the barren stalks. As little as 25 to 30% of the crude protein in barren stalks may be in the form of true protein. An appreciable amount of nitrogen may be in the form of nonprotein nitrogen (NPN) with nitrates being the major form of NPN.

Table 2. Protein and fiber comparison of drought stressed and adequate moisture grown corn plants.

Composition	Moisture	
	Drought	Adequate
	----- DM basis -----	
Crude protein, %	8.5	9.0
NDF, %	58.2	68.9
ADF, %	28.3	35.9
TDN, %	60 to 65	70

Stressed corn plants can be fed as green chop or ensiled for later feeding. If nitrates are high, ensiling before feeding is recommended (see Problems section for discussion on nitrate levels) to reduce nitrate amounts. Nitrate contents will be highest in corn plants stressed during pollination. Do not add ammonia, urea or an NPN to the corn plants at ensiling. The addition of another readily available form of nitrogen may reduce the amount of nitrates broken down during fermentation. The objective in ensiling plants containing high nitrates is to extend fermentation. Add 5 to 10 lb of ground limestone per ton of ensiled material to buffer the acids produced during fermentation and extend the fermentation time.

Sorghums and sorghum-sudangrass are common forages grown during drought conditions. However, they may accumulate nitrates during drought conditions. Highest concentrations of nitrates occur in the early bloom stage and then decline with maturity. Nitrogen content of the soil will greatly affect nitrate contents. Sorghum or sorghum-sudangrass grown under heavy nitrogen fertilization are at the greatest risk of having high nitrate concentrations.

Another problem associated with sorghum and sorghum-sudangrass forages is prussic acid or cyanide poisoning. Cyanide concentrations are highest immediately following a frost and during a drought. Allow plants to grow at least 24 inches tall before grazing or chopping. After a frost or rainfall, check regrowth and make sure it is at least 24 inches tall before feeding.

Sorghum (forage or grain), sorghum-sudangrass and sudangrass can be green chopped, ensiled or dried down and harvested as hay. Green chopping is the most dangerous method of feeding due to nitrate or prussic acid poisoning problem. Ensiling will reduce nitrates but not prussic acid. Sun curing after conditioning for hay harvesting will reduce prussic acid concentrations but has no affect on nitrates.

Small grain forages (oats, barley, rye, triticale and wheat) are acceptable forages in dairy rations. Quality of the forage will depend on stage of maturity at harvest. Vegetative to boot stage harvesting will yield the most nutrients and palatable feed.

Small grains can be harvested as silages or hay. Ensiling at 45 to 60% moisture will result in the best fermentation. Beards and awns will be most palatable when ensiled. Oats and barley make better hay than wheat or rye.

Small grains may be high in nitrates if grown under heavy nitrogen fertilization and stressed during pollination. Ensiling will reduce nitrates in small grain the same as for corn. Drying does not reduce nitrates so small grains suspected of containing nitrates should not be harvested as a hay crop.

Legume and grass forages should not be forgotten about during a drought. Yields of these forages will be low but quality will, in general, be high. Harvest all amounts possible.

Legumes (alfalfa, birdsfoot, clover) do not accumulate nitrates. Grasses (timothy, orchard, brome, quack, etc.) will accumulate nitrates if they have been fertilized with nitrogen. This is generally not a problem due to a lack of nitrogen fertilization.

Weeds such as redroot pigweed, lambsquarter, giant ragweed and cocklebur, and others commonly found in corn, small grain, new direct seeded legumes and hay fields are nitrate accumulators. Evaluate the amount of weeds in relation to the principle crop in the field, consider the nitrogen fertilization level and how the crop is to be stored when assessing nitrate problem potential from weeds.

Other crops not commonly harvested for livestock feeding may be useful as a feed during drought conditions. However, the chemicals applied to these crops and their carryover must be considered. Especially insecticides and herbicides which are not cleared for livestock feeding. CHECK ON CHEMICAL APPLICATIONS TO ALTERNATIVE CROPS BEFORE HARVESTING. Most vegetable and specialty crops come under this category.

#### PROBLEMS - NITRATE, PRUSSIC ACID AND SILO GAS

Nitrate toxicity may be a problem if plants are stressed during pollination or grown under a prolonged drought and harvested within a few days after a heavy rainfall. Soil nitrogen level and plant maturity will affect nitrate levels. NITRATE TESTING IS RECOMMENDED. Most commercial feed testing laboratories do nitrate testing. Obtain a random sample of chopped plants, place in a quart plastic bag and freeze immediately. Keep the sample frozen until tested. Do not allow the sample to unthaw and ferment during shipment to the laboratory for testing. Check with the following laboratories for specific nitrate analysis and cost:

	<u>Telephone</u>
Ingman - Minneapolis, Minnesota	612/333-6419
Markley - New Brighton, Minnesota	612/633-5477
Station Biochemistry - South Dakota State University	605/688-6171
Dairyland - Arcadia, Wisconsin	608/323-3988
Minnesota Valley Testing - New Ulm, Minnesota	507/354-8517

Green chopped forages will be the highest in nitrates. Do not allow green chopped plants to set in forage wagons and heat. Only chop amounts cattle will consume within a few hours.

Ensiling will reduce nitrates 25 to 50%. Allow several weeks for fermentation before feeding.

Nitrate-nitrogen levels and corresponding animal responses follow:

Nitrate nitrogen (NO <sub>3</sub> N)		Feeding guide
Percent <sup>1</sup>	Parts per million (PPM)	
0 to .3	3,000	Gradually introduce feed.
.3 to .5	3,000 to 5,000	Limit to 1/2 of the total ration dry matter.
Over .5	5,000	Limit to 1/4 of the total dry matter or lower (depending on level).

<sup>1</sup> Dry matter basis.

Analysis may be reported several ways. Convert to nitrate nitrogen by:

Nitrate (NO<sub>3</sub>) x .23 = Nitrate nitrogen  
 Potassium nitrate (KNO<sub>3</sub>) x .14 = Nitrate nitrogen  
 Sodium nitrate (NaNO<sub>3</sub>) x .16 = Nitrate nitrogen

Symptoms of nitrite toxicity in animals are increased pulse rate, quickened respiration, heavy breathing, muscle tremble, weakness, staggered gait and blindness. If these symptoms occur, change feed source.

Prussic acid or hydrogen cyanide poisoning is a problem with sorghum-sudangrasses after a frost or during droughts. Alfalfa, grasses and corn plants do not accumulate hydrogen cyanide. Nitrogen fertilization and low phosphorus soils increase prussic acid poisoning potential.

Highest prussic acid concentrations will be in green chopped plants. Do not allow green chopped plants to set in a wagon and heat. This will increase the potential for prussic acid poisoning. Ensiling plants will reduce prussic acid concentrations. Allow several weeks of fermentation before feeding.

Testing plants for prussic acid or cyanide is extremely difficult and impractical. Safest practice is to allow 24 inches of regrowth after freezing before feeding.

Feeding recommendations for prussic acid containing forages are:

Prussic acid ppm (dry basis)	Feeding guide
0 to 250	Safe, can be fed as only forage source.
250 to 500	Limit to 25% of ration DM or less. Best when blended with other forages.
Over 500	Extremely toxic -- do not feed. Fresh plants should be ensiled to reduce levels.

Symptoms of prussic acid poisoning include increased pulse and heart rates, gasping, muscle twitching and convulsions. Blood will be cherry red.

Silo gases are poisonous to humans as well as animals. Plants high in nitrate and/or prussic acid will produce more than normal quantities of lethal silo gases. Allow plants with high concentrations of nitrates and/or prussic acid to ferment several weeks before feeding. Provide ample ventilation around the silo and in silo rooms during the first few weeks of fermentation to dispense silo gases. Run the blower for at least 10 minutes to ventilate silo, chute and silo room during the first week after silo is filled.

#### ALTERNATIVE FEEDS

There are a number of alternative feeds which could be considered for fiber, energy and protein. Price and specific nutrient need for the feed must be considered. Listed below are some feed suggestions with amounts for adding fiber to rations and for protein and energy supplementation.

<u>Feed</u>	<u>Feeding guideline maximum lb/head/day</u>
Fiber and energy sources	
Beet pulp	5
Brewers grain, wet	40
Cottonseed, whole	7
Ear corn	35
Corn gluten feed, dry	15
Oat hulls	5
Soyhulls	10
Wheat bran	8
Wheat midds	8
Protein sources	
Alfalfa pellets	10
Corn gluten meal	4
Sunflower meal - 28% CP	5

Alternative fiber sources can not be used to replace the minimum forage requirements estimated previous. They will be beneficial in supplementing minimum forage amounts with fiber and energy to attain a more "normal" fiber level in rations. The better fiber sources are beet pulp, cottonseed, brewers grains and unground soy or oat hulls. Finely ground or pelleted alternative feeds lose their fiber effectiveness even though the fiber analysis value remains the same as before grinding. A good example of this is pelleted alfalfa. The fiber value is the same as baled hay but effective fiber is probably no better than ground ear corn.

The Professional Nutritionist-Beef and Dairy Formulation program can be an invaluable tool to determine feed alternatives and competitive prices. Use the least cost portion of the program. Nutrient analysis of several feed and feed byproducts are listed in the appendix section of the manual.

## GENERAL FEEDING CONSIDERATIONS

The goal of dairy producers during droughts is to maintain optimum milk production. This goal can be achieved if management practices can be adjusted and certain basic principles are followed. Management strategies to help meet optimum production goals are:

1. Plan feeding program. This includes:

- a. Determining minimum forage inventory needed until next cropping season.
- b. Locate and obtain needed forage amounts before supplies become limited.
- c. Test all forage sources for nutrient and antinutrient contents if questionable.
- d. Use least cost rationing to evaluate alternative feeds, select best buys for protein, energy and fiber, and balance rations to ensure animal performance.
- e. Reevaluate forage inventories and rations monthly to be sure the projected feeding program is on target.

2. Feeding management strategy will include:

- a. Divide minimum daily forage amount into 3 or more feedings. Do not feed all the hay at one time during the day.
- b. Feed grain several times daily.
- c. Use better quality forage in the milk cow ration. Lower quality forages can be supplemented easier and more completely when fed to dry cows and youngstock.
- d. If low quality dry forage must be fed to milk cows, grinding or chopping will help improve intake. Addition of molasses may also help intake. Mixing low quality forage into total mixed rations is ideal for those who have the capability.
- e. Adjust cows to the higher grain lower forage rations gradually. Buffers will help prevent digestive problems and lower fat tests associated with high grain feeding.

Sodium bicarbonate - 4 to 7 ounces/cow/day

Magnesium oxide - 1 to 4 ounces/cow/day

Bentonite - 4 to 8 ounces/cow/day

Other additives which are beneficial with high grain rations are:

Methionine hydroxy analog - .2 to .3% of grain mix

Whey - 10% of grain mix

3. Selective culling of dairy animals may be necessary. Older, marginally productive animals should be culled first. Replacement animals should be culled only when absolutely necessary. Their feed intake needs on a per animal basis are less than a cow's. Several head of youngstock will have to be culled to equal feed savings from culling one or two poor production cows.