Drought Feeding of Livestock

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NORTHERN Nigeria and other countries of Sahel Africa are suffering from a prolonged and increasingly severe drought and losses of cattle and other animals have been large. Although there has been much concern about the severity of the current drought losses, it is important to recognize that dry season feeding of animals presents a critical problem in this area and in many other places of the world every year, not only in the tropics. Temporary relief measures cannot be expected so bring any solution to the long time problem.

The present severe drought is the result of a small decrease in rainfall below the average and a somewhat shorter rainy season during the last few years combined with over - population of animals. Human population has also increased. The trees have been cut for fuel and the grass cover destroyed by overgrazing and cultivation to plant crops. A similar situation occurred in Central and Southwestern U.S.A. in the 1930s during the "dust bowl days", but there the wind erosion was considerably worse than in Northern Nigeria at present. Australia suffers much longer and more severe droughts than Nigeria has ever experienced. Yet with proper management of agricultural and grazing lands and supplemental feeding, profitable cattle production is practised in drought areas with lower rainfall than experienced in the

driest years in Nigeria. The problem is not primarily low rainfall, but that there are no ponds and lakes to hold the rain for future use and little grass to prevent rapid runoff and erosion of top soil.

The purpose of this paper is to review the most common nutritional deficiencies seen during dry seasons in the tropics and to outline briefly some of the ways that cattle, sheep and goats can be fed better to achieve more rapid growth, greater reproductive efficiency and heavier slaughter weights.

Nutritional deficiencies and requirements of grazing animals

The most common nutritional deficiencies of grazing animals observed in various areas are summarized in Table 1. Of these deficiencies the most serious in the dry season appear to be lack of water and total feed. The available feed is often low in protein, phosphorus and vitamin A activity. Deficiencies of trace mineral elements, cobalt, copper, selenium and iodine are regional problems in some areas of the world, but there is uncertainty about the extent of these problems in this part of Africa. Common salt (sodium chloride) is deficient in forages and most concentrate feeds and animals become salt hungry if not supplemented yet all animals have a remarkable ability to conserve tissue sodium and chloride. As a result grazing cattle and sheep do not

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often suffer depressed productivity from a lack of salt. High-yielding dairy cows are the only animals that suffer seriously from salt deprivation.

In reviewing the nutritional deficiency signs of grazing animals, it is noted (Table 1) that many deficiencies result in lowered feed intakes, poor growth or weight loss and reproductive failure. A long-standing and severe lack of feed causes similar unthrifty appearance and low productivity of animals.

If any one of the essential nutrients is lacking, growth stops, reproduction may cease and eventually the animals will die, often as a result of complications with diseases from lowered resistance to infections. There is abundant evidence to show that an animal's ability to produce antibodies depends on adequate intakes of protein and other essential nutrients. Hill (1955, 1964) has clearly shown that White Fulani cattle thrive in the presence of mild infestation with trypanosomiasis if they are well fed. Experience has shown that if work oxen are given supplemental feed, they show no ill effects from trypanosomiasis infection in Ibadan, but they will die from combined stress of work plus infection if restricted to poor dry season

grazing. Lloyd (1973) has reported that adequate nutrition will retard the progress of streptothricosis and allow infected cattle to survive and produce, but on poor feed, they die. Many other examples of interrelationships could be cited. Adequate intakes of protein and vitamin A are particularly critical for normal resistance to infections and the ability to recover from disease.

Water requirements of animals. An animal can loose almost all its body fat, over half of its protein and yet live, but loss of 10% of its water content results in death. Thin cattle and sheep are composed of 65 to 75% water, 16 to 20% protein, 5 to 10% fat and 4 to 5% mineral matter. Fat animals may contain as much as 40 to 45% fat and the water content will be proportionately lower.

A lack of water results progressively in thirst, decreased feed intake, shrunken eyes, shriveled skin and lack of saliva to swallow food. As dehydration continues the blood becomes thicker and when the heart cannot circulate the blood fast enough to dissipate the heat from the deep body parts body temperature rises to the critical level and death results.

TABLE 1 Nutritional deficiencies of grazing animals

Nutrient	Deficiency signs
Water	Thirst, decreased feed intake dehydration, death
Energy	Poor growth, weight loss, reproductive failure, starvation and death if prolonged
Protein	Reduced feed intake, retarded growth, weight loss, decreased milk yield, reproductive failure
Vitamin A (Carotene)	Retarded growth, night blindness, respiratory infections incoordination, abortion, birth of dead or weak, blind calves
Phosphorus	Reduced feed intake or depraved appetite, poor growth, weight loss, anestrus, reproductive failure
Cobalt	Reduced appetite, poor growth, weight loss, anemia, eventual death
Copper	Anemia, fading of dark hair, bone changes, sudden death of lactating cows.
Selenium	Retarded growth, muscle dystrophy
Iodine	Goiter in newborn animals, low survival
Sodium (Common salt)	Reduced feed intake, lowered yield

Water loss from the body results from perspiration, respiration, passage of urine and water loss in the feces. Losses are greatest at a high temperature and low relative humidity. Some animals, such as the camel are able to conserve water much more effectively than cattle, and some of the game animals are particularly efficient. Cattle need about 10 kg of water per 100 kg of body weight. Lactating cows need 4 to 5 kg of water for each kg of milk produced. Zebu cattle require slightly less water than European breeds. The daily water requirement of *Bos taurus* cattle varies from 3 kg of dry matter consumed when the weather is cool to 8 kg at high temperatures. A considerable part of this water can be obtained from fresh grass, which contains 65 to 75% of water, but when the feed is dry all of the water must come from the fluid consumed.

Cattle can survive only 2 to 4 days without water to drink during the hot, dry weather when only dry feed is available where they can live up to several weeks

without feed, depending on their age and condition. They can survive even longer on protein-deficient feeds, but will lose weight and eventually die. Deficiencies of vitamin A, phosphorus, cobalt, copper, selenium and iodine are seen only after cattle have received rations deficient in these nutrients for several months, since appreciable amounts are stored in the body and the deficiency diseases do not occur until these reserves have been depleted.

The requirements of total feed, protein, calcium, phosphorus and carotene are shown in Table 2. It can be seen that milking cows need more of each of these nutrients than other cattle and that young growing heifers and bulls after weaning need more than mature bulls or dry cows.

When there is abundant young, rapidly growing grass, cattle have no difficulty in obtaining sufficient feed to make rapid growth, produce milk and store body fat. As grass becomes scarce they are not able

TABLE 2* Nutrient requirements of beef cattle

Body weight kg	Daily gain kg	Daily food kg	Protein %	Energy		Ca %	P %
				ME Mcal/kg	TDN %		
Growing heifers and steers							
150	0	2.7	7.8	2.06	57	0.19	0.19
	0.5	3.2	12.2	2.61	72	0.38	0.31
300	0	4.5	7.8	2.06	57	0.18	0.18
	0.5	8.2	10.0	2.06	57	0.18	0.18
Maintenance of cows							
350	—	5.8	5.9	1.80	50	0.16	0.16
450	—	6.8	5.9	1.80	50	0.16	0.16
Cows nursing calves							
350	—	8.6	9.2	2.06	57	0.29	0.23
450	—	9.9	9.2	2.06	57	0.28	0.22

to obtain enough feed by grazing, and thus productivity declines and deficiencies result unless supplement feed is provided. The problem becomes increasingly acute when feed is scarce because animals may need to walk long distances seeking feed and this greatly increases the energy requirement.

At Ibadan grasses decline from about 12 to 6% in protein content during the dry season (Olubajo, 1973). Improved varieties of grasses are high enough in protein to meet the needs of older cattle. Tropical grasses mature rapidly. The protein content declines and fibre increases resulting in both lowered intakes and digestibility. Young growing cattle and lactating cows need more protein than is present in grass during the latter part of the wet season and particularly during the dry season when only mature forage is available. Native grasses in Northern Nigeria contain up to 8 to 10% protein in early growth, but decline to 2% when they mature (Zimmellink, 1973).

Preliminary data on the mineral content of grass species (*Cynodon* spp, *Pennisetum purpureum* and *Panicum maximum*) show no consistent trends in calcium content of grasses cut at 4, 6 or 8 weeks of regrowth and no important differences between the rainy and dry seasons. All samples were

high enough to meet the requirements for growth or maintenance of cattle, 0.7 to 0.8% (Olubajo and Oyenuga, 1974). Mixed pastures which contained some legumes were higher in calcium content.

The situation for phosphorus was quite different. Fertilization of mixed pasture swards with superphosphate increased the average phosphorus content from 0.13 to 0.25% of the dry matter. Without fertilization most samples of either pure species, or mixed forages were as low as 0.14% in phosphorus content during part of the year, too low for maintenance of mature cattle.

The requirements of the trace mineral elements are shown in Table 3. Although only very small amounts are needed in the feed, deficiencies of these minerals have been the cause of failure of animal husbandry in many parts of the world. All of these minerals are toxic if fed in too high concentrations. The toxic levels are also shown in Table 3.

Oyenuga and Olubajo (1974) also found that forages grown at Ibadan were always adequate in iron, magnesium, manganese, zinc and copper content to satisfy the requirements of growing cattle and sheep. The following ranges of concentrations in the dry matter were reported: Magnesium 0.19 to 0.27%, iron 240 to 360 ppm

TABLE 3 Requirements and toxicities of trace mineral elements

Mineral	Animal	Requirement	Toxic level
		mg/kg ration	
Cobalt	Cattle	0.05-0.07	60
	Sheep	0.008	120
Copper	Cattle	5-7	115
	Sheep	10	?
Selenium	Cattle	0.1	3-4
	Sheep	0.1	10
Iodine	Cattle	0.1	?
Zinc	Cattle	9	900-1200
	Sheep	18-22	1000
Manganese	Cattle	16-25	2000

manganese 90 to 110 ppm, zinc 36 to 52 ppm, and copper 12 to 18 ppm. No values have been reported for cobalt and selenium, two important trace mineral elements. No data were found for trace minerals in forages grown in Northern Nigeria during the rainy and dry seasons.

Dry season feeding of cattle

Alexander (1971) has summarized some of the methods of feeding cattle during the dry periods in tropical Australia. Annual rainfall varies from 100 cm to less than 2.5 cm (10 in.) with wide yearly variations. Usual dry seasons extend up to 7 months and droughts occur about 3 years in 10. In tall grass areas dry matter yields vary from 2500 to 7500 kg/ha with maximum protein content of 7% and minimum of 2 to 300. Tussock grasses in northern areas yield 145 to 2,200 kg/ha of dry matter in drought to good seasons. Yields from xerophytic midgrass have been up to 1,250 kg/ha with protein content varying from 10 to 2%. There are no native legumes.

In normal years beef steers gain weight for 6 to 8 months and lose weight for the remainder, so that net yearly gain may vary from 45 to 136 kg. Calf crops vary from 46 to 76% and yearly death loss of cows is 11 to 13%.

In tropical areas lamb crops were 20 to 70% compared with 50 to 90% for temperate zones. Death loss of lambs from birth to marking (weaning) average 36% and annual death of ewes 6 to 19%.

Drought feeding for survival

The objective of feeding during severe drought should be to preserve the more valuable animals, especially breeding females, at a minimum feed cost. Large weight losses are accepted since survival rather than growth or production is the objective.

In Northern Australia, Beams (1963) found that cattle over 2 years old could survive for 6 months on forage containing only 3.2% protein with great weight loss. The addition of molasses and urea provided nearly a maintenance ration. Young cattle (18 months old) could not survive on forage with or without the addition of molasses, but the addition of urea or some other protein source enabled the animals to survive for 7 months with slight weight loss. In Southern U.S.A. Briggs (1960) observed that sheep could not survive on low quality roughage alone which contained 4.2% protein or less, but they could on better roughage having 5.8% of protein. A supplement of wheat was of little value, but when urea was added the roughage intake increased and the sheep could survive. The results agreed with earlier studies by Franklin in Australia. Morris (1958) found that sorghum grain plus urea as a supplement to bush hay or sorghum silage (5.0% protein) was superior to sorghum grain alone for weight gain of cattle and sheep. The roughage alone maintained the animals in reasonable health for 5 to 7 months so that survival was not tested. Since protein is an expensive and critically scarce nutrient in Nigeria the use of NPN should be considered.

Nonprotein Nitrogen (NPN)

The FAO Report (1971) points out that through the agency of the bacteria in the rumen, nonprotein nitrogenous compounds (NPN), which give rise to ammonia can replace some dietary protein. Responses of ruminants to NPN are rarely as great as to the same amount of nitrogen in the form of protein; they are never greater. The utilization of NPN and the protein requirement are determined by the energy supply, and to

some extent by the form of carbohydrate provided.

A number of methods of feeding urea have been investigated. Of these the addition of urea (a) to low protein forages when they are ensiled, (b) to concentrate mixtures as a replacement for vegetable protein feeds, and (c) to molasses for feeding to ruminants have been most successfully and widely adopted. Urea is often used to replace $\frac{1}{3}$ to $\frac{1}{2}$ of the dietary protein for cattle. Preston (1971) has reported that molasses can supply up to 80% of the energy, but for good performance a protein of low solubility and high quality should supply at least 30% of the N, leaving up to 70% from NPN. Fish meal was better than groundnut meal in these type rations because of its higher quality. More complete information on urea utilization has been summarized by Loosli and McDonald (1968).

The economics and availability of feeds should determine whether or not urea or other NPN compounds can be used advantageously. At present it seems advisable to feed cottonseed or brewers grains for extra protein and energy where these are available rather than urea plus molasses or cereal grains. Groundnut cake, cottonseed cake and palm kernel cake produced in Nigeria are excellent supplements but they are often too expensive to feed cattle here because the marketing boards controlling exportation price them based on the European market.

Improving Nigeria's Cattle Production

Cattle production is a very inefficient business in Nigeria at present. Reproduction appears to be very low. Cattle grow slowly, do not reach slaughter until 4 to 6 years of age or older and carcass weights are not much more than half

those obtained in Europe. A survey of 90,844 head of White Fulani cattle in 431 herds in Kano and North Central States (Lamorde and Weinman, 1971) showed there were only 28 calves less than one year of age per 100 breeding age cows. Some 12% of the calves died the first year. Cows were 7 years old at first calving in Kano State and 4 years in North Central State. Breeding age cows made up only 30% of the herds in North Central vs 50% in Kano State. Lack of water and feed (grazing land) were listed as the greatest problems. Faced with these problems, beef cattlemen anywhere else in the world would go broke and go out of business.

Ferguson (1967) reviewed the cattle industry in Nigeria and listed a number of changes that would increase beef supplies, deserve serious consideration at present. He suggested improving grazing areas by planting better forages and adding fertilizers in some areas, developing water supplies, limiting grazing to the carrying capacity of the range, slaughtering cull cattle, fattening surplus bulls at an early age in growing and fattening facilities using crop residues and byproduct feeds. He also listed improvement of transport and marketing services to reduce shrinkage by developing more and better roads for truck transport, more loading points with cattle rest and feeding areas for railway service. Some progress has been made in improving transportation, but the majority of the cattle moved to the southern markets are still driven by trail. Many of these suggestions have been mentioned by earlier speakers today as part of present development schemes, and hopefully some of them can be put into effect soon.

The success of the Mokwa cattle feeding operation should stimulate other

ventures to utilize byproduct or waste feeds. In a recent report Heubl (1974) stated that "the only way to increase beef supplies rapidly in Nigeria is to grow to larger sizes the small, young or thin animals. There are estimated to be 250,000 to 300,000 young bulls in Nigeria that should be fed for rapid growth and fattening each year plus some 200,000 older animals that would produce considerably more meat if they were fed for short periods before slaughter. He reported that at Mokwa, Sokoto Gudali cattle weighing 225 kg gained 300 g per day on native pasture vs 500 g on improved pasture during the rainy season. They lost weight during the dry season. When fed in confinement they gained 750 g per day at a feed cost of 13.7 kobo. The gain had a market value of 25 kobo. Feed intakes averaged 5 kg molasses, 4 kg silage or 1.5 kg dry hay, 2 kg cottonseed or dried brewers grains, and 50g minerals per day. Hay was better than silage with this high molasses ration. A ton of silage or one third ton of hay was needed for each animal fattened for 5 to 10 months.

Large quantities of byproduct feeds are entirely wasted or only partially used in Nigeria. These include cottonseed, rice bran, molasses, brewers grains, citrus and other cannery wastes, groundnut shells, pineapple leaves and tops, cocoa husks, kola pods, rice straw, maize stalks and various other crop residues. There is a major problem of getting the animals and the feeds together. Establishment of growing and finishing units near the supplies of molasses, food processing plants and breweries is a possibility. These byproducts can also be dried to reduce transportation costs, but this materially increases the cost of the feeds.

Previous speakers have pointed out that rainfall varies in more or less regular

cycles and that severe droughts in Sahel Africa appear to occur in cycles of 30-33 years. During the last severe drought Collier and Dundas (1937) made a detailed survey of Niger and Northern Nigeria. Some of their findings and recommendations are still very timely and appropriate. They wrote "Historical record proves beyond doubt that the region south of the desert has been a potential famine area. The population depends for its life upon a soil most susceptible to damage by over utilization and by the unrestricted action of water and wind. It depends upon a rainfall which, at best, is precarious and barely adequate for agriculture. . . . Deforestation is taking place at an unprecedented rate. In a region where any year of subnormal rainfall must bring people perilously near the borderline of famine, there people are exposing the soil to the damaging action of the elements, and at the same time destroying the only safeguard known to the bulk of Africans for maintaining the fertility of the soil, namely the growth of natural woodland."

This type of destruction has continued to go on and decreased rainfall in the last few years has brought about the present serious condition. Certainly concerted efforts by all agencies are needed to reverse the destruction of soil cover caused by overgrazing, cutting the trees and improper agricultural practices and to introduce effective soil and moisture conservation. The cattle industry has helped to bring about this disaster as well as being a victim of it. Needed actions to correct the short and long time problems have been mentioned throughout the symposium. It is not the province alone of animal scientists, the need for cooperation among all interested agencies cannot be over stressed.

The Department of Forestry of the

University of Ibadan recently surveyed the situation in the drought-affected areas of Northern Nigeria. In summarizing the findings, Roche (1974) reported the following: "There is no doubt that drought resulting from a small decrease from the average annual rainfall is the immediate cause of a massive decrease in agricultural production and consequent social disruption in many areas. This is so because the fundamental cause of famine or near famine conditions in affected areas is not drought, but the presence of populations of people and animals way above the present carrying capacity of the land, which is being continually reduced by over-grazing, fire, shifting cultivation, and the over-exploitation of savanna woodlands for food, fuel and fodder." Throughout the north, outside the small forest reserves, the natural woodland, which traditionally provided fodder and food during the dry season, is being eliminated. The consequences of this are both direct and indirect. A direct consequence is the elimination of a major food source for man and his animals. The indirect consequences pertain to the wide spread collapse of natural ecosystems, soil erosion, lowering of the water table, and reduction in agricultural productivity following elimination of natural windbreaks. Almost all of the proposals referred to in the news papers for the amelioration of the situation in the north pertain to the effects and not causes. The proposals may be beneficial in the short run, but will have little positive effect in the long run, and indeed may even have adverse long run effects. Long term measures pertain to reestablishing a vegetative cover, range management, watershed management, and irrigation.

The present conditions in the drought-affected areas of the north are not new.

Droughts have occurred in the past and they will occur again in the Sahel countries. However, Nigeria now has the resources and knowledge to prevent a repetition of the present disaster if plans can be coordinated and actions implemented.

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