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## ABSTRACT

The traditional farm in the Caatinga region of northeastern Brazil raises cattle, sheep and goats. The herds graze extensively on the native vegetation, where overstocking is the rule, and the production levels are the lowest in the country. However, this pastoral production system provides an adequate adaptation to the harsh environmental conditions, by allowing changes in herd composition in relation to the availability and botanical composition of the forage for a given year. On the other hand, the nature of the vegetation, dominated by low trees and shrubs with a productive herbaceous layer in some sites, favors the simultaneous grazing by several herbivorous species to enable full use of its forage resources. The manipulation techniques of the woody plants result in a substantial increase of forage production by both ligneous and herbaceous vegetation which is reflected in the significant increase of the animal output from the caatinga range. Under natural conditions, the best animal production levels of the caatinga are obtained with simultaneous grazing by sheep and goats. The figures are 9.9 ha/AU/year for stocking rate and 15.5 kg/ha/year for liveweight production. With an increased ligneous component, the best animal combination is goats and cattle, the carrying capacity increases to 3.9 ha/AU/year and production reaches 46.5 kg/ha/year of animal liveweight.

## INTRODUCTION

Combined grazing consists of the simultaneous use of pasture by two or more herbivorous species. This practice is commonly used to take advantage of the differences in the diet and grazing behavior among animal species, so as to obtain a more uniform use of the forage plants and higher pasture production (Cook, 1954; Merrill et al., 1966).

Combined grazing has several advantages, including the biological control of undesirable and noxious plant species, utilization of inaccessible areas, natural stabilization of plant succession with an evenly distributed grazing pressure (Stoddart, Smith & Box, 1975; Heady, 1975) and increasing economic returns from the pasture (Merrill & Taylor, 1976).

The successful use of combined grazing depends, among other factors, on the diversity of the vegetation. With respect to goats, the presence of woody species is fundamental to keep goats from competing with other herbivores. Due to its ability to adapt to the existing forage conditions, the goat is perhaps the best animal to be used in a mixed species grazing program (Gall 1981). Throughout the world, particularly in areas covered by a dominant brush vegetation, the simultaneous use of the range by two or more animal species, including goats, is a common management practice. This is particularly true for the caatinga vegetation of Northeast Brazil.

## CAATINGA VEGETATION

The caatinga is the predominant vegetation of the semi-arid region of Northeast Brazil. It is a low thorny forest, dominated by brush and low trees which lose their leaves during the dry season.

The characteristic climate of the region is classified as BSW'L (Brasil, Ministerio da Agricultura, 1973), i.e., hot, semi-arid and steppe type. The temperature ranges from a maximum of 36.6°C to a minimum of 22.2°C, and the precipitation averages 650 mm. Two seasons may be identified: the rainy season (January-June) and the dry season (July-December). Although they generally occur during a six months period, the rains tend to be concentrated in a short period of three to four months. The total precipitation varies greatly from year to year with periodical droughts.

The caatinga is found at elevations ranging from sea-level to 400-500 m. Trees tend to dominate the vegetation as elevation increases, probably due to the improvement of hydric conditions.

The predominant soil types are sedimentary sandy or of arquean origin (Duque, 1980) and belong to the following associations: red yellow podzolic, non calcic brown, solodic planossol, and litholic soils.

Intermixed in the Northeast region are two principal types of caatinga: the scrub which is dominant in the sertao, and the caatinga forest which is dominant on the slopes of the mountains and some bottomland

sites (Cole, 1960). Most of the livestock activity is concentrated in the sertao dominated by the low scrub caatinga: Cole (1960) indicated this is an edaphic climax, with the nature and composition of the vegetation being associated with relief, rainfall, ground water conditions and soils. Lima (1965) considers the shrubby caatinga as almost a disclimax of the arboreous caatinga forest.

The dominant trees and shrubs belong to the Leguminosae and Euphorbiaceae with several other families being represented. The number of tree species in the whole region is high but locally there is a low number (approximately 26) of native woody species (Kirmse et al., 1983). The well represented undergrowth (Lima, 1965) may be either dominated by Bromeliaceae in the caatinga forest or by a herbaceous layer in the scrub caatinga. Ligneous species cover in the caatinga may vary from 20 to 70 per cent, with the density ranging from 440 to 13,360 plants/ha and the herbaceous layer production varying from 0.78 to 2.34 t/ha (De Araujo Filho et al., 1982).

#### FORAGE PRODUCTION POTENTIAL OF CAATINGA

The woody species, foliage and herb biomass production in the caatinga averages roughly 4.0 t/ha, but it varies widely with the season, the year, location and type (Kirmse, 1982; De Araujo Filho et al, 1982; Pfister, 1983).

During the rainy season the bulk of the forage is provided by the herbaceous layer and the green foliage of trees and shrubs. However, as the dry season progresses, dry fallen leaves of the ligneous plants tend to become the only source of forage. This is reflected in the diet selection of goats grazing native caatinga. In the middle of the dry season, they grazed heavily on the dead leaves of trees and shrubs (62.4 per cent) and lightly on the herbaceous species (28.7 per cent). In the first months of the rainy season, green leaves of ligneous species comprised 65.9 per cent and herbaceous species 34.1 per cent of goat diet. As the rainy season progressed, this changed to 81.6 per cent of herbaceous species and 18.4 per cent of tree and shrub green leaves (Schacht, pers. comm.).

The prevailing rainfall conditions substantially affect forage production in the caatinga. Kirmse (1982) found a total production of 3.9 t/ha in a normal year, while Pfister (1983) obtained only 1.5 t/ha of biomass in an abnormally low rainfall year in the northern sertao. Similarly, the production varied from 4.1 to 1.5 t/ha from a normal to a dry year in the southwestern sertao (UFC, 1985).

The manipulation of the woody vegetation of the caatinga in some sites will result in the transferring of forage production to the herbaceous layer, but not necessarily in increasing overall production. The manipulation of woody species may be done by lowering (cutting the tree and shrub stems at a height of 30 cm and letting them resprout), thinning (controlling the resprouts of undesirable woody species) or a combination of the two methods. Kirmse (1982) obtained 3.3 t/ha for ligneous species production and 0.6 t/ha for herbs in native caatinga, while with lowered caatinga the production was 1.1 and 3.6 t/ha for the

woody and herbaceous species, respectively. UFC (1984) obtained 3.7 t/ha for total and 1.3 t/ha for herb production in the lowered caatinga, and 4.5 t/ha for total and 2.1 t/ha for herb production with thinned caatinga.

The composition by groups of species (grasses and broad leaf weeds) of the herb biomass varies with the year and is probably associated with the rainfall characteristics. The results obtained by UFC (1985) showed that in 1983 (244.1 mm of rainfall) the grasses composed 72.5 per cent of the herbaceous production, while in 1985 (1105.6 mm of rainfall) they represented only 37.6 per cent of the herbaceous floristic composition.

#### MIXED GRAZING - A TRADITION IN THE CAATINGA PASTORAL MANAGEMENT

The first steps for the livestock occupation of the caatinga were taken at the beginning of the 17th century (Braga, 1965). The periodic droughts, the erratic character of the precipitation, the soil limitations and other environmental constraints would not allow the establishment of a dependable crop production agriculture in the caatinga region, thus encouraging the raising of livestock.

Presently, 17.9 per cent of the cattle, 34.1 per cent of the sheep and 90.7 per cent of the goats in Brazil are raised in the caatinga area (Anuario Estatístico Do Brasil, 1984). The predominant characteristic of this activity is its extensiveness. Overstocking is the rule and the production indexes are the lowest in the country.

Gutierrez-Aleman (1983) described the production systems for livestock in the caatinga region, particularly for the state of Ceara. The traditional farm of semi-arid Northeast Brasil raises cattle, sheep and goats. This was found on 92 per cent of the ranches. On an average the farmer raised 63.5 head of cattle, 106.8 sheep and 67.0 goats. However, during the drought period of 1981-1983, a 16.0 per cent increase in the number of cattle and of sheep, respectively, was observed (Queiroz, Gutierrez-Aleman & Ponce de Leon, 1984).

The average farm size was found to be 680 ha, varying widely from 92 to 1622 ha. The average stocking rate was found to be 4.4 ha/AU/year (AU is equivalent to an adult cow or to eight adult goats or sheep). This is well above the research findings and recommendations of 12.4 ha/AU/year on native caatinga under mixed grazing by cattle, sheep and goats (De Araujo Filho, 1985).

The three animal species do not receive the same levels of management care during the year. This is particularly true with feeding management. When a requirement for supplementation occurs cattle are given first preference, followed by sheep and lastly by goats. In fact, goats can survive and produce better than sheep and cattle under native caatinga conditions (UFC 1984).

## DIET SELECTION BY CATTLE, SHEEP AND GOATS ON CAATINGA VEGETATION

In the late dry season the diet selection by sheep and goats was identical on native caatinga (Pfister, 1983). This was probably due to the available biomass composition, which was entirely dominated by woody species leaf litter. However, in the early wet season, goats shifted their diet selection to browse, and sheep to grass and forbs (Pfister 1983), possibly reflecting the new pattern of the biomass composition, which allowed better conditions for free diet selection by the animals. However, under cleared caatinga conditions (complete control of ligneous species), goats were selecting a diet higher in forbs, followed by grasses and, finally, by browse.

A four year study reported by the Federal University of Ceara (UFC 1983), showed substantial changes in the botanical composition of lowered caatinga grazed separately by cattle, sheep and goats. Under cattle grazing, the percentage of grasses decreased from 30.6 in the first year to 6.6 in the last, while forbs increased from 69.4 to 93.6 per cent, during the same period. Under sheep grazing, the effects were even greater in the first three years - grasses decreased from 65.6 to 2.9 per cent, while forbs increased from 34.4 to 97.1 per cent in the botanical composition. However, when goats were used, the grass composition increased from 59.1 to 96.4 per cent, while forbs decreased from 40.9 to 3.6 per cent. This probably represented a response of the herbaceous vegetation to the grazing preferences of the different animal species. The data also suggest that goats were grazing the herbaceous species lighter than both sheep and cattle. Therefore, while the available biomass of the herbaceous layer increased from 583.1 to 1,043.0 kg/ha in the goat paddocks, it decreased from 506.6 to 195.9 kg/ha in the cattle pastures, and from 715.4 to 191.2 kg/ha in the sheep areas, during the same period. As for the mixing of the animal species in the same paddocks, under cattle and goat grazing, the grass decreased in composition from 47.3 to 25.0 per cent, while with cattle and sheep the decrease was from 47.2 to 9.9 per cent. As for the biomass production, with the first combination, there was a decrease from 658.7 to 302.6 kg/ha, while with cattle and sheep, the decrease was from 618.0 to 68.9 kg/ha, for the same period. The conclusions were that, in terms of vegetation responses, the best animal combination for lowered caatinga was a mixing of cattle and goats. Sheep should definitely not graze on lowered caatinga.

## ANIMAL PRODUCTION UNDER EXTENSIVE CAATINGA CONDITIONS

It is very difficult to evaluate the animal production on a per hectare basis of native caatinga range under a ranching operation system. Gutierrez-Aleman (1983) found an average stocking rate for the sertao region of Ceara of 4.4 ha/AU/year. Even though this figure represents the carrying capacity of the farm as a whole, including native caatinga ranges, manipulated caatinga, cultivated pastures and abandoned crop fields, the land was considered to be overgrazed.

The monthly fluctuations on the liveweight of cattle were monitored in the sertao region of Ceara (Anderson, De Araujo & Rodrigues, 1969). Weight losses that amount to 30 per cent of the initial weight were observed from August to February, and gains were found from March to July. The stocking rate was 4.6 ha/AU/year and the production for that year below 6.0 kg/ha of animal liveweight.

Under research situations, the results of the last 10 years indicate a considerable variation in stocking rate figures for caatinga vegetation. Catunda et al. (1978) report a stocking rate of 11.3 ha/AU/year for native caatinga and 5.3 ha/AU/year for thinned caatinga with goats. For sheep the results were very similar; 12.2 ha/AU/year in the native caatinga and 5.1 ha/AU/year in the thinned caatinga. In a five year research study conducted by the Federal University of Ceara in Taua, Ceara (UFC, 1983; 1984; 1985), native caatinga produced its best livestock results when grazed either simultaneously by sheep and goats in the proportion of two goats to one sheep, or by goats alone. The stocking rates were 9.6 ha/AU/year for goats, 10.0 for sheep, and 9.9 for goats and sheep together. The liveweight production in kg/ha/year was 15.1 for goats, 10.9 for sheep, and 15.5 for the combination of sheep and goats. Under lowered caatinga conditions, the best biological and economical results were obtained by the combination of goats and cattle in the proportion of one head of cattle to four or six head of goats. The stocking rate increased from 12.2 ha/AU/year, when cattle were raised alone to 6.0 ha/AU/year when the pastures were stocked with goats, and to 3.9 ha/AU/year when goats and cattle grazed together. The animal production on a kg/ha/year basis was 23.4 for cattle, 34.4 for goats and 46.5 for the cattle and goat combination. However, when the woody vegetation of the caatinga was thinned, transferring the bulk of forage production to the herbaceous species, the best results were obtained with cattle alone.

## CONCLUSIONS

The caatinga vegetation has been traditionally grazed simultaneously by several domestic herbivores. Its composition in terms of the presence of ligneous and herbaceous species favors this practice. This is confirmed by research results that suggest an increase in the production levels through management techniques. Lowering the trees and shrubs of the caatinga increased the forage availability in both ligneous and herbaceous strata. The grazing combination of sheep and goats seems to be the best option for native caatinga grazing, while that of cattle and goats is the best for the lowered caatinga. Considering both the biological and economic aspects, the most appropriate management technique for animal production for the caatinga vegetation is lowering, followed by combined grazing of goats and cattle in the proportion of four to six head of goats to one of cattle.

## LITERATURE CITED

- Anderson, R.J., De Araujo J.A. & Rodrigues S.C. 1983 <sup>1969</sup> Balancas revelam problemas basicos da pecuaria de corte. Boletim de Informacao Agropecuaria 69 (2): 3-13
- Anuario Estatistico do Brasil 1984 FIBGE. Secretaria de Planejamento da Presidencia da Republica: Rio de Janeiro.
- Braga, R.A. 1965 Introducao da semente pecuaria no Brasil. Bol. Soc. Cearense de Agronomia 6: 23.
- Brasil, Ministerio da Agricultura 1973 Departamento Nacional de Pesquisa Agropecuaria. Divisao de Pesquisa Pedologica. Levantamento Exploratorio. Reconhecimento de solos do estado do Ceara. Recife. Serie pedologica N°16.
- Catunda, A.G., Maciel, D.F., De Araujo Filho, J.A., Torres, S.M., Serafim, R.G., Machado, F.M.F. & Macedo, F.A.R. 1978 Ensaio de pastejo rotativo continuo com ovinos. IN: Reuniao da Sociedade Brasileira de Zootecnica, 15, Belem, 1978. Anais... Belem, Soc. Bras. Zootecnia.
- Cole, M.M. 1960 Cerrado, caatinga and pantanal: the distribution and origin of the savanna vegetation of Brazil. Geographical Journal 136: 168.
- Cook, C.W. 1954 Common use of summer range by sheep and cattle. Journal of Range Management. 7: 10.
- De Araujo Filho J.A., Torres, S.M. de S., Gadelha, J.A., Maciel, D.F. & Catunda, A.G. 1982 Estudos de pastagens nativas do Ceara. (Estudos Economicos e Sociais N°13) Fortaleza, BNB.
- De Araujo Filho, J.A. 1984; Pastoreio multiplo. IN: Simposio sobre manejo da pastagem, 7, Piracicaba, 1984. Anais... Piracicaba.
- Duque, J.G. 1980 O nordeste e as lavouras xerofilas. Terceira Edicao BNB/ETENE.
- Gall, C. 1981 Goat production. Academic Press: London. 619 p.
- Gutierrez-Aleman, N. 1983 Sheep and goat production systems in the sertao region of Northeast Brazil, a characterization and linear programming analysis. Purdue University: Lafayette.
- Heady H.F. 1975 Rangeland management. Edwards Brothers: New York.
- Kirmse, R.D., Pfister, J.A., Vale, L.V. & de Queiroz, J.S. 1983 Woody Plants of Northern Ceara Caatinga. SR-CRSP: Logan, Utah.
- Kirmse, R.D. 1984 Effects of clearing on forage production, quality and decomposition in the caatinga woodland of Northeast Brazil: Implications to goat and sheep nutrition. Utah State University: Logan, Utah.

- Lima, D.A. 1965 Vegetation of Brazil. Proceedings of the IX International Grassland Congress.
- Merril, L.B., Reardon, P.O. & Leinweber, C.L. 1966 Cattle, sheep, goats... mix em up for higher. *Tex. Agr. Prog.* 2 (4): 13.
- Merril, L.B. & Taylor, C.A., Jr. 1976 Diet selection, grazing and range management. *Rangeman's Journal* 3(3): 74.
- Pfister, J.A. 1983 Nutrition and feeding behavior of goat and sheep grazing deciduous shrub woodland in Northeastern Brazil. Utah State University: Logan, Utah.
- Queiroz, J., Gutierrez-Aleman, G. & Ponce de Leon, B. 1984 Ecology and management of small ruminant production systems in the sertao of Ceara State, Northeast Brazil. (Mimeo).
- Stoddart, L.A., Smith, A.D. & Box, T.W. 1975 Range Management. McGraw-Hill Book Company: New York.
- UFC 1983 Relatorio tecnico anual das atividades do Convenio BNB/FCPC - Pastoreio combinado bovino, ovino e caprino. Universidade Federal do Cearo: Fortaleza.
- UFC 1984 Relatorio tecnico anual das atividades do Convenio BNB/FCPC - Pastoreio combinado bovino, ovino e caprino. Universidade Federal do Cearo: Fortaleza.
- UFC 1985 Relatorio tecnico anual das actividades do Convenio BNB/FCPC - Pastoreio combinado bovino, ovino e caprino. Universidade Federal do Cearo: Fortaleza.