ASSOCIATED GRAZING OF CATTLE, SHEEP AND GOATS AT THE SEMI-ARID REGION OF NORTHEAST BRAZIL

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Resumo

Associated grazing of ruminant species has been promoted as an excellent alternative for the use of nature pastures characterized by large botanical diversity. This practice offers the possibility to maintain the flower diversity of the pasture vegetation, resulting in high level and maintenance of production and productivity. The semi-arid region (caatinga) of the Northeast of Brazil is grazed by multiple species since the first settlers arrived. Presently, more than 90% of the producers raise cattle, sheep and goats together in the native caatinga. Production and productivity indexes are very low due to the random use of animal species associations and to inadequate pasture management. This article discusses the results obtained in several areas with the use of associate grazing and its alternatives under the conditions of the caatinga ecosystem. The associations of goats-sheep for the native caatinga, cattle-goats for shortened caatinga, and cattle-sheep or cattle-goats-sheep for thinned caatinga.

Keywords: Biodiversity, stability, native pasture, production, thinning

1 Introduction

The fact the several species of herbivorous animals use the same pasture, simultaneously and during the same season, does not mean they occupy the same niche and that they directly for the same pasture resources; this is designated as multiple or combined grazing. This practice is based on the diversity of the botanical composition of the pasture sward, on differences in diets and grazing habits of the animals, and also ease of access and movement in the area as a function of topography. Cattle, goats and sheep have marked differences in the botanical composition of their diets and in grazing habits, which result from the pasture botanical composition and availability, season, grazing intensity, and morphological aspects of the animal. However, there is an overlapping of the botanical composition of the diet of these ruminants, which can be intensified in situations of low botanical diversity of the pasture sward and low pasture availability.
Several studies on combined grazing with domestic and/or wild herbivorous species have been carried out worldwide. Studies of several combinations of cattle, goats and sheep on native pastures under different grazing intensity found that combined grazing resulted in better weight gain of cattle and sheep as compared to single-species grazing. However, the association with cattle and sheep did not affect goat performance. Adding sheep to cattle grazed areas reduced cattle weight gain and pasture production. Other studies found that the association with sheep had little effect on cattle weight gain, but there was an improvement in sheep performance. The combined grazing of cattle and goats is, at long term, the best alternative for tree-shrub vegetation areas. On the other hand, the combination of sheep and cattle in grasslands seems to have an excellent potential to improve animal production, particularly due to the low overlapping of their diets. It was also verified that sheep had better daily weight gain than goats, whether in single or combined grazing on oats and ryegrass pasture. The combination had no effect on the performance of the two ruminant species.

Results of studies on combined grazing are often seemingly contradictory, possibly due to difference in sward composition, forage availability, and to inherent variation in diet selection among breeds of a same species.

2 Discussion

2.1 The Semi-Arid Region of the Northeast of Brazil

This region occupies an approximate area of 1,640,000 km$^2$, corresponding to 19.9% of the national territory, and it is extended through nine states. It is located at 1° to 18° south latitude and 34°30’ to 48°20’ west longitude. About 60% of the total area, i.e., 980,000 km$^2$ comprise the Semi-Arid Region of the Northeast of Brazil.

2.2 Climate

A dry and hot or megathermal climate predominates in this region, with average monthly temperatures over 18°C. Three types of climate are identified in the region, according to K classification:

- **BShw** - semi-arid, with a short summer rainy season, with rainfall concentrated in December and January;

- **BShw’** - semi-arid, with a short summer-autumn rainy season, with rainfall concentrated in March and April;

- **BShs’** - semi-arid, with a short autumn-winter rainy season, with rainfall concentrated in May and June.

Most of the rivers are intermittent, and the water volume is limited, in general. Altitude varies from 0 to 600 m, annual average temperature between 24-28°C, average precipitation of 250-1,000 mm, and a potential evaporation-transpiration of about 2,700 mm/year, characterizing a high water deficit.

2.3 Soils

In general, the soils of this region are chemically adequate, but there are several physical constraints. About 15 soil classes are found in the semi-arid region of the Northeast of Brazil, mentioned per area of coverage: 21.0% of latosols; 19.2% lithosol, 14.7% podzol, 13.3% non-calcium dark soil, 9.3% quartz sand, and 9.1% solodic planosol.
2.4 Vegetation

Most of the territory of this region is occupied by xerophilous vegetation, with varied physiognomy and composition, called caatinga, covering a total area of about 950,000 km². In this area, there are about 126,000 km² covered by vegetation of the cerrado (savanna), particularly in the state of Piauí. Approximately 50% of the soil covered with caatinga are sedimentary, rich in underground water. The word caatinga is typical of the semi-arid region of the Northeast of Brazil, and it has Native origin (caa - forest; tinga - white, open), meaning white forest. Its vegetation mostly consists of shrubs and short tree species, usually thorny and deciduous, loosing the leaves in the beginning of the dry season. Substrate consists of cactaceae, bromilaceae, and a less significant herbaceous component, consisting of herbaceous dicotyledonous annual grasses. In phyto-sociological terms, density, frequency, and dominance of the species are determined by topography, type of soil, and rainfall. Although 12 types of caatinga can be physiognomically identified, besides the wide variation in plant composition resulting from anthropogenic activities, tow general models are represented: the shrub-tree caatinga, predominant in the semi-arid areas; and the tree caatinga, characteristic of water springs and hill foots, and of alluvial areas. Grazing activities tend to use the shrub-tree type, whereas crops are cultivated in the tree type.

There is not a complete list of species in the caatinga, which are found in diverse edaphic-climatic situations agreste, sertão, cariri, seridó, carrasco, among others). In qualitative and quantitative studies on the flora and vegetation of the caating, about 596 shrub and tree species were recorded, and 180 species are endemic. The number of species tends to increase, particularly the herbaceous species. The most frequent species are Caesalpinaceae, Mimosaceae, Euphorbiaceae, Fabaceae and Cactaceae, with the genus Senna, Mimosa and Pithecellobium with the largest number of species. The most abundant plants found in survey studies in the caatinga area are Caesalpinia pyramidalis Tul., Mimosa spp. and Croton spp., which are the pioneer species in the process of secondary succession resulting from anthropogenic action. The caatinga is very rich and diversified, with a very high forage, wood, fruit, medicinal, and fauna potential.

2.5 Forage potential of the Caatinga

The production of phyto-mass of leaves and herbaceous branches of the aerial part of the vegetation is approximately 4.0 ton/hectare/year, but with significant variations determined by season, year, location and type of caatinga. Moreover, the plant composition of the produced forage, especially due to dominant annual herbaceous components, significantly varies due to the above-mentioned factors.

During the rainy season, most forage is provided by the herbaceous stratum, with low participation of tree and shrub foliage. However, as the dry season progresses, the foliage of deciduous woody species becomes almost the only source of forage for the animals.

The manipulation of the woody vegetation in some sites of the caatinga results in an increase of forage availability, not always increasing phyto-mass production of the aerial part. This practice may involve decreasing the height of woody forage species, increasing forage availability through grafting; control of undesirable woody species, increasing forage production of the herbaceous stratum; and enrichment, with re-seeding of native and/or exotic forage species, with a true increase in forage production.

2.6 Combines grazing - a tradition in animal production in the region of the Caatinga

Animal production in the caatinga started in the beginning of the 17th century. The periodic droughts, the erratic character of the rainfalls, soil limitations, and other environmental constraints did not allow the establishment of intensive agriculture, stimulating grazing animal production. Production reached its peak when the salted beef industry flourished, and started to decline in the last decades of the 19th century. Presently about 17.9% of the cattle herd, 49.8% of the sheep herd, and 89.0% of the goat herd in Brazil are raised in the caatinga. The system is predominantly extensive, overgrazing is the dominant factor, and productions indexes are the lowest in the country.

The traditional farms of the interior of the Northeast of Brazil raise cattle, goats and sheep under combined grazing. Studies revealed that farms with an average size of 500 ha raised 64 cattle, 67 goats
and 107 sheep. The average animal load is 4.4 ha/AU/year, much higher than the 12.5 ha/AU/year, recommended for the native caatinga under combined grazing. These three species receive differential treatment when there is lack of feed, with cattle being fed first, sheep second, and goats, lastly.

2.7 Diet selection by cattle, goats and sheep in the *Caatinga*

Cattle, goats and sheep have more differences than similarities in the botanical composition of their diets in the native caatinga. As to grasses, which have low participation in the plant composition of the forage, the coefficient of similarity was 40.7% for cattle x sheep, 22.3% for goats x sheep, and 28.8% for cattle x goats. As to herbaceous dicotyledones, the percentage of similarity was 48.9% for cattle x sheep, 37.3% for goats x sheep, and 40.2% for cattle x goats. Considering woody species, the coefficient of similarity was 44.6% for cattle x sheep, 61.4% for goats x sheep, and 49.2% for cattle x goats. This suggests that the competition among ruminant species in the native caatinga is relatively low, with higher expression in the combination cattle x sheep. Taking into account the low competition for the same forage resources, the combination of goats with cattle or sheep seems to be the best for the native caatinga. On the other hand, in the thinned caatinga, the situation is inverted, that is, there are more similarities than differences in the diet composition among domestic ruminant species. Thus, for goats x sheep, the coefficients of similarities were 86.7% for grasses, 81.5% for herbaceous dicotyledons, and 89.6% for woody species. So, under the conditions of thinned caatinga, there is an intense competition between goats and sheep as to the composition of their diets, and the combined grazing of these species is not recommended.

2.8 Impact of combined grazing on the vegetation of the *caatinga*

Cattle, goats and sheep cause different effects on the vegetation of the caatinga due to differences in the botanical composition of their diets, and also to grazing habits. Therefore, the manipulation of the vegetation of the caatinga may affect these differences by inducing changes in the plant composition of forage offer.

In the native caatinga, combined or single grazing by any of the three mentioned species does not significantly affect vegetation if carried out according to preservation practices. However, under overgrazing conditions, sheep and goats may induce significant changes in the vegetation of the caatinga, due to destruction of tree and shrub trunks up to eating of seedlings, preventing the renewal of woody species supply.

The reduction of the height of the shrubs and trees promotes the formation of an herbaceous stratum, and also increases the offering of leaves and buds in trees and shrubs. However, due to the high percentage of coverage by woody species, the herbaceous component becomes fragile. Under these conditions, close shearing of sheep is extremely harmful, producing significant changes on the botanical composition of the herbaceous layer, particularly due to the disappearance of forage grasses. Goat grazing, single or combined with cattle, is one of the alternatives with the lowest impact on this type of vegetation.

The thinned caatinga is characterized, in many places, by the presence of a vigorous and very diversified herbaceous stratum, which under conditions of conservative grazing can be maintained for long periods, without notable changes in plant composition. Therefore, it can be grazed by the three species of domestic ruminants, singly or in combination, with no impact on its stability or sustainability of production.

2.9 Animal performance in the *caatinga* under combined grazing

Average weight gain of growing cattle under single grazing, during the year, and under native caatinga conditions, is about 60.0 g/head/day. The combination of cattle with sheep or goats does not change their development. Goats, under the same conditions, have an average gain 26.6 g/head/day, and the combination with cattle or sheep does not change their performance. Sheep may gain up to 31.0 g/head/day in the native caatinga, with no adverse effects on performance if combined with cattle or goats. Taking into consideration animal live weight production, the best performance is obtained by the combination of cattle-goats-sheep, with 13.8 kg/ha/year, followed the association goats-sheep with
about 12.1 kg/ha/year and single grazing of goats with 11.9 kg/ha/year. These results favorably compare with the 5.6 kg/ha/year obtained with single grazing of cattle in native caatinga.

In shortened caatinga, cattle, goats, and sheep in single grazing annually produced 227.0 g/head/d, 47.1 g/head/d and 34.0 g/head/d, respectively. The combination of cattle with goats or with sheep increased cattle daily weight gain to about 100.0 g/head, but it did not influence goat or sheep performance. On the other hand, decrease in shrub and tree height creates, in term of forage availability, an intermediate situation between the native and the thinned caatinga, that is, high availability of tree and shrub leaves associated to availability of annual herbs and grasses. In this type of caatinga, animals that are more opportunistic in terms of diet composition, such as sheep and goats, successfully compete with those that are more selective, such as cattle. Animal live weight production in the shortened caatinga is highest with single grazing of goats (41.3 kg/ha/year) or with the goat-cattle combination (39.0 kg/ha/year).

Thinning of the caatinga results in a higher forage availability by the herbaceous stratum, and thus single grazing can promotes gains of up to 376.0 g/head in cattle, 40.0 g/head in goats, and 55.0 g/head in sheep annually. The combination of cattle with goats reduces cattle weight gain, but does not affect goat gain. This is also for the combination of cattle with sheep in this condition. The combined grazing of goats and sheep in the thinned caatinga does not affect the performance of either species. Therefore, due to the high similarity of the diets of these domestic ruminants, grazing does not benefit the animals, nor the pastures. In the thinned caatinga, in terms of animal live weight production, the best performance was found in cattle under single grazing, with 57.8 kg/ha/year, followed by the combination cattle-goat-sheep, with 51.9 kg/ha/year and the association cattle-sheep, with 47.5 kg/ha/year.

### 3 Final considerations and recommendations

The results shown and discussed in this article allow some conclusions and recommendations, aiming at better use of caatinga pastures by combined grazing:

1. Although the combination cattle-goat-sheep has shown better performance, the goat-sheep association is recommended for pasture use in the native caatinga, as these two ruminant species are more resilient to the effects of droughts than cattle, resulting in better production stability at long term. The best ratio is 2 goats per 1 sheep. Measures must be taken to provide proper adjustment of animal load, and also to maintain the biodiversity of the woody vegetation.

2. In the shortened caatinga with reduced height, the cattle-goat combination is the best option as it allows better distribution of grazing pressure due to differences in diet selection, favoring the maintenance of the botanical diversity of the pasture. The cattle-goat ratio may be 1:4 to 1:6. However, further research is needed to better determine this parameter. Sheep must not graze in this type of caatinga considering their grazing habit very close to the ground and the fragility of the herbaceous stratum, main component of their diet.

3. Pastures of the thinned caatinga can be successfully used by single grazing of cattle or by associations of cattle with sheep, or cattle with goats and sheep. Studies show that the thinned caatinga is less affected by droughts, will animal production losses (animal live weight) of less than 20%.

4. The choice of the type of manipulation of the vegetation of the caatinga, or the most suitable combination of animals, must be based on criteria such as site potential, characteristics of native forage resources, training of the available labor force, input and equipment availability, and market conditions. The use of environmental-friendly technologies must be considered in order to obtain optimal and sustainable production.

### 4 References


MERRIL, L.B.; YOUNG, V.A. 1954. Results of grazing single classes of livestock in combination with several classes when stocking rates are constant. Texas, Agricultural Experiment Station (Progress Report, 1726). 7p.

