

Animal production in a subtropical region of Mexico: Rangeland's productive characteristics

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Introduction

Dual-purpose cattle farms (DP) in México and in particular in the south west of the State of México are low input, based on tropical pastures under extensive management combined with fodder trees and shrubs that contributes to forage production during the dry season, where grasses are scarce. Farms land extension ranged from 30 to 300 hectares. The stocking rate is low with less than a cow per ha. There is only a perimetral fence, there is no pasture's subdivision. Cows browse freely within the rangeland 24 h/d all year round. Cattle are predominantly Brown Swiss with small proportion of zebu cattle (Albarrán-Portillo *et al.*, 2015). Twenty DP farms in the south west of the State of México were monitored since 2008 in order to assess their socio-economic aspects, animal's productive performance, pasture productivity, biodiversity and species richness. Production and quality characteristics of forage resources in these types of farms are reported here.

Materials and Methods

During the years of 2008 and 2009 different number of DP farms (from 4 to 12) were monitored, in order to determine farm's characteristics in terms of resources, productive performance and socio-economic aspects. Four pastures (1 ha each) were monitored monthly, in order to estimate forage net accumulation, using exclusion cages of (n=6 / ha), according to the method proposed by Hodgson (1994). Pastures chemical analysis (DM, ash, CP, NDF, ADF, Lignin, Digest. and ME), were performed on monthly samples collected using the simulated grazing technique (AOAC, 1990). Pasture's botanical composition was estimated from a quadrant (0.40 x 0.40 m²) subsample of 25 g. From a second subsample morphological composition (live/dead and leaf and stem matter (kg/DM/ha)) was determined. Diversity and richness of species were assessed by using the Margalef and Menhinick and, Shanon-Weinner and Simpson indexes, respectively (Symstad and Jonas, 2011). By using multivariate analysis, for groups of DP farms were identified according to their productive orientation (PO): i) milk production oriented (DPM); ii) beef production (DPB); iii) calves production (DPC) and, iv) traditional DP (DPT). PO was defined as the activity that generates higher annual incomes to the farm and / or, the activity that demands higher proportion of hand labour (hour/day). The effect of PO was assessed in order to determine whether it has an impact on diversity and richness of species.

Results and Discussion

Star of Africa (*Cynodon plectostachyus*) was the dominating grass with 44% presence followed by *Brachiaria brizantha* (17%), *Paspalum convexum* (12%), *Cynodon dactylon* (11%), whereas the remaining proportion was composed by *Eleusine indica*, *Paspalum lividum*, *Paspalum paspaloides*, *Paspalum scrubinatum*, *Paspalum notatum*, *Paspalum conjugatum*, *Digitaria bicornis* and *Digitaria ternata*. Table 1 shows the average values of pastures from 2008 and 2009. The total herbage mass production was 8,057 kg/ha, 78% of herbage growth during the rainy season. The productivity was low but must be taken into consideration that farmers do not use fertilizer in order to keeping production cost at minimum. Leaf represented 44% of pasture's forage production, with 80% of green material during the rainy season. During the dry season, green material was 47% on average, whereas leaf represented only 32% of herbage mass. In general, the proportion of leaf is low due to the characteristic of pastures dominant grass Star of Africa (*Cynodon plectostachyus*). Differences in pasture quality characteristics between rainy and dry season were important, due to these characteristics animal production is expected to be limited, since low to moderate values of digestibility will limit dry matter intake of grazing cows (López-González *et al.*, 2015).

Table 1: Pasture average productive and quality characteristics during years 2008 and 2009

Attributes	Rainy season	Dry season
Total HM	6,300	1,757
Green material (kg/DM/ha)	5,040	826
Dead material (kg/DM/ha)	1,260	931
Leaf (kg/DM/ha)	2,772k	568
Stem (kg/DM/ha)	3,528	259
Dry matter (g/kg)	261	491
Organic matter (g/kg/DM)	905	911
Crude protein (g/kg)	116	80
NDF (g/kg)	652	676
ADF (g/kg)	307	332
Lignin	16	25
Dry matter digestibility (g/kg)	817	671
Metabolizable energy (MJ/kg/DM)	9.0	8.0

Regarding the diversity and richness of species indexes DPM had the highest score (3.95) in Margalef index, were as DPT had the lowest score (3.63). As per Menhinick index, DPC scored 1.68 (highest) while DPT scored the lowest with 1.11. DPM registered the lowest score (3.00) in Shanon-Weinner index; and DPC scored the highest (3.53). Finally, Simpson index ranged between 0.72 (DPB) to 0.87 DPC. In general DP farms with different productive orientation showed high values in the two diversity indexes, as well as the two richness indices evaluated, indicating environmental sustainability of DP farm in the study region.

Table 2: Diversity and richness of species, according to dual-purpose farm's productive orientation

Indexes	Diversity		Richness	
	Margalef	Menhinick	Shanon-Weinner	Simpson
Interval	1-5	0-3	0-5	0-1
DPFM	3,949	1,470	3,008	0,793
DPFC	3,774	1,547	2,688	0,723
DPT	3,633	1,117	2,665	0,775
DPB	4,774	1,684	3,537	0,875

The four DP farms groups evaluated had diversity and richness indexes were higher than the average reported in the literature, suggesting high ecological sustainability with no differences on indices according to productive orientation. Further, the importance value index was estimated, which is an indicator of the overall importance of species in the community structure. The species with the highest scores were *Ipomoea murucoides* (0.79), *Acacia farnesiana* (0.60), *Guazuma ulmifolia* (0.65), *Lysiloma divaricatum* (0.53), *Haematoxylum brasiletto* (0.71) and *Ceiba pentandra* (0.26). These species are relevant since they are important sources of fodder to animals during the dry season, therefore they are promoted by farmers in their rangelands.

Conclusion

Pastures are the main source of fodder to cattle in dual-purpose farms in the southwest of Mexico State mainly during the rainy season, whereas trees and shrubs become important sour of food for grazing animal during the dry season when grasses are scarce and have low nutritive value. In general, diversity and richness of species were high indicating ecological sustainability of the systems regardless farms productive orientation. However, forage nutritive value and seasonal availability represent a hurdle to increase cattle productivity.

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