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Comparison of four suckler cow systems differing in the level of agronomic intensification

A. Fanchone^{1*}, Alexandre G.¹, Coppry O.², Farant A.², Mahieu M.¹ and Naves M.¹

¹INRA, UR143, Animal Production Unit, F-97170 Petit-Bourg Guadeloupe (F.W.I.)

²INRA, Tropical Platform of Animal Experimentation, F-97170 Petit-Bourg Guadeloupe (F.W.I.)

* Corresponding author: Audrey.Fanchone@antilles.inra.fr

Introduction

Cattle production is one of the main components of mixed farming systems (Stark *et al.*, 2012, this congress). In Guadeloupe, as in most tropical countries, beef production is mainly based on suckling systems using local breeds reared at pasture. Most of the arable land being already cultivated, the increase in production dictated by the growth of local consumption of animal products goes through the increase of productivity per unit of area. The latter goes through the intensification of forage production, which can be achieved through 1/ the selection and/or the introduction of high productive forage, and 2/ the agronomic intensification of pasture management, using both fertilization and/or irrigation.

Therefore, the objective of this work was to study the effect of agronomic intensification of the pasture on the performances of suckler cows and their calves fed on a natural grassland dominated by a native forage grass (*Dichantium sp.*) and a introduced high productive grass, i.e., Pangola (*Digitaria decumbens*).

Material and Methods

This study was carried out from January 2000 to January 2010 at the animal experimental station of the “Institut National de la Recherche Agronomique” (INRA) in Guadeloupe (French West Indies, latitude 16°16'N, Longitude 61°30'W). This experimental station is located in the dry zone of the island (annual rainfall 1300 mm), characterized by a severe drought between February and July.

Four paddocks divided each into five plots were used in this study. Treatments were Pangola fertilized non irrigated (Paddock1, PD), Pangola fertilized and irrigated (Paddock 2, PI), native fertilized irrigated (NI) and native non fertilized non irrigated (ND). Area of each paddock was 5.6, 4.0, 4.1, and 5.2 ha for PD, PI, NI, and ND, respectively. On each paddock a group of eighteen cows was conducted. Each paddock was grazed throughout the year in a rotational grazing system. Animals grazed 7 days on the same plot before being moved to the subsequent plot. Animals returned on the same plot after 28 days of regrowth. When fertilization was performed, one kg ha⁻¹ day of regrowth⁻¹ (day = 28) mineral fertilizer (27 N, 9 P, 18K) was applied on each plot after removal of animals. Animal had free access to water. On each paddock, one of the five plots, considered as representative of the paddock was retained as sentinel plots for pasture characterization and animal measurements.

One season of reproduction was managed in order to obtain calving at the end of dry season. Reproduction was performed by artificial insemination, after hormonal synchronization. One

week after artificial insemination, natural service sires were introduced, one per flock, and natural mating occurred during 8 weeks, sires being switched after 3 weeks. A pregnancy test was performed at the end of the season of reproduction, and non pregnant cows were removed. Replacement of removed cows was performed using pregnant heifers, aged 24-month, mated at the same season in a separate feedlot. The main causes of culling were fertility issues (two successive reproduction periods without pregnancy), and lactation issues (calf mortality or low growth during the lactation period).

A total of 170 cows which have given birth to 647 calves were used in this experiment over the 10 years period. Cows were weighed once a month. Calves were weighed at birth and once a month until weaning. Herbage mass was measured at the entrance of animals on the sentinel plot. Herbage mass was estimated by cutting the herbage under the plate over an area of 3 m² with mowing machine at ground level. Each of the five herbage samples was weighed fresh, and the samples were then pooled per sentinel plot. A sub-sample of 200 g was kept to determine dry matter.

Data collected on the same animals were analyzed using the GLM procedure of SAS (version 8.1; SAS Institute Inc., Cary, NC). The model included the main effects of parity of the cow, sex, year and system, as fixed effects, and the sire as random effect; no interaction was introduced.

Results and Discussion

Birth weight, weaning weight, and resulting average daily gain (ADG) of the calves (average 27.5, 156, and 614 kg) were both affected by the sire, parity, sex, year, and system effects ($P < 0.01$). These results are slightly higher than that reported by Naves (2003) with Creole cattle reared in close conditions from 1980 to 2000 (on average 26.3 and 145 kg for birth weight and weaning weight, respectively). This increase of animal performances can be related to the genetic improvement program set up since 1980 to Creole cattle, and a better management in our system where herd requirements have been matched with availability of forage.

Birth weight was lower in ND than in the 3 other systems. This can be explained by the low availability of forage in this system during the 3 last month of gestation (on average 2.9 kg of DM.kg LW-1 for the ND system and 6.2 kg of DM kg LW-1 for the 3 others systems), when the fetus requirements and growth are higher. This low availability of forage can also explain the 4% loss of weight of the cow observed in ND during this period (data not shown).

Weaning weight and ADG were higher with dry systems than with irrigated ones. . This suggests that the lower birth weight observed in the ND can be compensated over the lactation period. Differences in calves weigh between irrigated and dry systems appeared in the 3 last month of lactation ($P < 0.001$, data not shown), i.e., when growth performances of calves are mainly related to forage availability.

System productivity (kg of weaned animals ha-1) was higher with irrigated systems (on average 590 kg ha-1) than with dry systems (on average 451 kg ha-1). At the same time, overall stocking rate was also higher with irrigated systems than with dry ones. Hence, higher gain per animal and lower gain per hectare was obtained with dry systems, i.e., when stocking

rate was low and forage available. Our results are in line with the previous work of (Jones and Sandland 1974) in a review of the relation between animal gain and stocking rate.

Variable	A – Native Dry	B – Pangola Dry	C – Native Irr.	D – Pangola Irr.
Pasture area (ha)	5.24	5.6	4.12	4.01
Number of years	10	7	10	10
Overall stocking rate (kg ha ⁻¹)	1719	1596	2209	2365
Fertility (% pregnant cows)	84.3	81.1	86.8	90.0
% calves weaned	97.7 (169/173)	100 (120/120)	100 (173/173)	98.9 (175/177)
Birth weight (kg)	26.6 ^a	28.0 ^b	27.7 ^b	27.8 ^b
Weaning weight (kg)	165.9 ^b	167.5 ^b	154.9 ^a	149.7 ^a
ADG (g d ⁻¹)	658 ^b	668 ^b	606 ^a	580 ^a
Overall Productivity (kg weaned calves ha ⁻¹)	466a	435a	584b	597b

Conclusion

Comparison of the 4 systems shows that intensification of forage production allows a better productivity with irrigated systems, mainly related to the increase in stocking rate. Moreover, whatever the level of intensification, native pasture allows similar performances than introduced pasture. However, before promoting such systems to farmers, economic and environmental evaluations are necessary to conclude on their sustainability.

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