

Rangelands

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Riparian Management	3
Grazing Impacts	7
Brush Management	14
Monitoring	17
Modern Native Americans	19
Stubble Height	23
Cattle in Argentina	32
Grassland in China	37



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Table 1. Available and assigned forage, stay per paddock, and productive indexes during 1988–1998

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Mean
Precipitation (inches)	14.6	10.2	16.1	12.3	24.8	13.2	12.1	10.9	13.5	27.5	11.6	15.1
Total forage production (pound/acre)	1514.3	974.1	785.7	626.8	672.3	808.1	261.6	228.6	233.0	670.6	939.3	701.0
Assigned forage (pound/acre)	896.5	605.4	450.0	383.9	390.2	486.6	175.0	168.7	169.6	446.4	674.1	440.6
Observed stay/paddock (days)	86	52	46	34	52	52	28	19	23	50	72	47
Pregnancy (%)	94	97	100	86	96	96	89	89	70	92	86	90
Weaning (%)	84	90	100	83	93	90	84	84	70	86	89	87
Weight at weaning (pound)	394.6	410.1	451.9	434.3	454.1	432.1	372.6	363.8	330.7	346.1	319.7	391.8
Beef production (pound/acre)	170	18.7	23.2	18.7	22.3	19.6	16.1	16.1	13.4	15.2	14.3	17.7

deep.⁴ This deep soil has a loamy sand texture, with 1.69% organic carbon, 28.7 parts per million available phosphorus, 0.123% total nitrogen, and an average pH of 7.

There are a few federal rangelands in Argentina. Most rangelands are private properties. The usual livestock producers, private owners, do not know much about how to manage their rangelands properly. Usual beef production on rangelands surrounding the study site is about 8 pounds per acre.⁵ This is considering an average stocking rate of 29.6 acres per animal unit, a weaning percentage of about 60%, and an average weight of 375 pounds of a 7–8-month-old weaned calf. In Argentina, an animal unit is defined as the annual average dry forage requirement of an 882-pound cow that goes through gestation and subsequent nursing of a calf, until the 353-pound, 6-month-old calf is weaned, including the forage consumed by the calf. These values only represent estimates because the breeding season is year-round.⁶ Beef production may be even lower if the calf-cow relationship

obtained through agropecuarian census and vaccination programs from Services for Fighting Animal Health Problems is considered. Most rangelands are currently overgrazed, sanitary programs are nonexistent, and infrastructure is deficient.

Procedures

What follows is a description of changes in several management aspects, which ultimately proved to improve beef production in the experimental unit (Tables 1 and 2) when compared with the usual production system.

Experimental Unit for Beef Production

This unit was implemented in the Chacra Experimental de Patagones (Figs. 4 and 5) with the objective of obtaining an increased and sustained annual beef production per acre. Local information was then gathered,^{7,8} as were basic management guidelines.^{1,5,9}

Table 2. Comparison of productive variables between the Production Experimental Unit and the usual production system

	Average usual production	Production Experimental Unit
Stocking rate (acres/animal unit)	29.6	19.3
Bull/cow relationship (%)	5	3.5
Breeding season	year-round	Nov.-Jan.
Pregnancy (%)	?	90
Cattle parturition (%)	-	92
Weaning (%)	60*	87
Months to weaning	7-8	6
Weaning weight (pounds)	375	392
Beef production (pounds/acre/year)	7.6*	20.0

* Estimated data

Estimate of Forage Availability

Annual production of herbaceous vegetation was determined in areas of 49-98 acres. Vegetation included in permanent plots ($n = 30$; 20 x 20 inches) was clipped to 1.6 inches stubble height during 11 consecutive years every time cows entered each paddock. It was then separated by species, oven-dried to 158°F, and weighed. Species were grouped according to palatability: palatable, intermediate (low palatability), and unpalatable. More than 50% of the total plant biomass was composed by palatable perennial grasses such as *S. tenuis*, *Stipa longiglumis* and *Poa ligularis*, and 27% corresponded to intermediate perennial grasses (ie, *Piptochaetium napostaense*, *Stipa speciosa*, and *Aristida* spp.).

Determination of Stocking Rate

The following factors were considered to determine stocking rate: forage availability, forage sustained conservation, and cattle-raising requirements for each of its productive cycles. Forage availability was calculated to reach a good rangeland condition. With this purpose, the tendency and cover coefficient (TCC) was modified to determine biomass production. Such a coefficient considers 100% of palatable perennial grass cover, 50% of intermediate perennial grass cover, and 25% cover of annual species to determine rangeland condition.^{9,10} A utilization coefficient of 70% was used. Stocking rate was adjusted to 19.3 acres per animal unit on the basis of an average annual forage production of 828 pounds dry matter per acre (during the period of 1984-1988), and an



Figure 2. Cattle within the shrubland with herbaceous stratum in the Chacra Experimental de Patagones.



Figure 3. Shrubland with herbaceous stratum in the Chacra Experimental de Patagones.



Figure 4. Entrance to the Chacra Experimental de Patagones. Its director, Agronomy Engineer Hugo D. Giorgetti, appears in the picture.

estimate of forage availability of 421 pounds dry matter per acre. Cow-calf requirements were calculated following Cocimano et al,¹¹ making adjustments to a monthly average value and considering the following characteristics: parturition during 3 months; weight increases in male and female calves of 1.5 pounds per day until weaning; weaning at the end of summer, and weight maintenance of nonpregnant female cattle.

Infrastructure, Diagram, and Management of the Unit

A surface area of 535 acres with Monte vegetation (Figs. 2 and 3), was divided with electric wire (Fig. 6) into 8 paddocks of 67 acres each. Initially, 29 Polled Hereford cows were incorporated and after 3 years, 14 of them were replaced by Aberdeen Angus cows. The breeding season was during November, December, and January (midspring to early summer) and cattle were checked for pregnancy by rectal palpation in April (early fall). Bulls composed 3.5% of the herd; they were removed from the system at the end of the breeding season. Calves were weaned at the end of summer and early in the fall. The percentages of pregnancy, parturition, and weaning, and weights of male and female calves at weaning were determined. Before the animals entered the paddocks, vegetation contained in 10 samples of 387.5 square inches each was clipped to 1.6 inches to estimate forage availability. In agreement with the utilization coefficient, animals grazed the 8 paddocks in a rotative way, with a variable frequency according with the forage grown each year.

Caution should be taken in extrapolating region-wide the new guidelines proposed for improving cattle raising in rangelands of central, semiarid Argentina. This is because the study was replicated in time but not in space. However, and as reported by Hulbert,¹² when the cost of replication is too high, pseudoreplicated studies can be the only or best option.

Findings

Stocking rates and paddock surface areas do not change in this production system. What changes is the cattle stay in the paddocks (Table 1). Any variation in stocking rate was the result of variation in the surface area grazed during the rotation system: some paddocks might be grazed more than once depending on year's characteristics (ie, either more or less annual precipitation). The average instantaneous stocking rate used was high (0.38 animal unit per acre), which reduced plant selectivity by animals to a minimum. This increased the utilization efficiency of plants, which can be observed if plant availability is related to stocking rate and stay in the paddocks. For a theoretical daily consumption of 20.5 pounds per animal unit,¹¹ 27.1 pounds of forage were anticipated (TCC). This would give a utilization efficiency of 75%. In practice, the observed consumption was 22.9 pounds per animal unit. This indicates that utilization efficiency of available forage increased to 85%. Observation of the main productive variables (Table 1) shows the stability of beef production achieved throughout years. This was achieved in an environment of highly variable seasonal and annual precipitation regimes, and it shows the advantages of the proposed production system.

Improvements in the productive variables in the Production Experimental Unit allow increases of beef production per acre greater than 160%, in comparison to values found in any usual production system (Table 2). Pound increases in beef production during 4 years are enough to pay off the investments required to carry out the Production Experimental Unit. Improving the production system with the guidelines reported in this manuscript will certainly increase household incomes.

Conclusions

Management practices such as establishing a breeding season, detecting pregnancy, and practicing rotative grazing are simple and known. The practice of increasing the num-



Figure 5. Facilities in the Chacra Experimental de Patagones.



Figure 6. Paddocks divided with electric wire in the Chacra Experimental de Patagones. Notice the electric wire to the left and behind the iron bar close to the wooden post.

ber of paddocks in the same surface area through use of electric wire is not difficult and it reduces costs. Fencing paddocks using electric wire is a simple task that is within the ability of the average livestock owner. Even ranchers with little theoretical knowledge of range management can use high instantaneous stocking rates, which shorten the stay of grazing animals in each paddock so that regrowth consumption of preferred forage can be largely avoided. It is then possible to develop a production system in the region similar to that employed in the Production Experimental Unit. This would allow sustainable increases of beef production per acre and year in the semiarid rangelands of central Argentina.

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