

# Modelling the effect of maize silage and winter oat forage crop on cow-calf systems in Argentina

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## Introduction

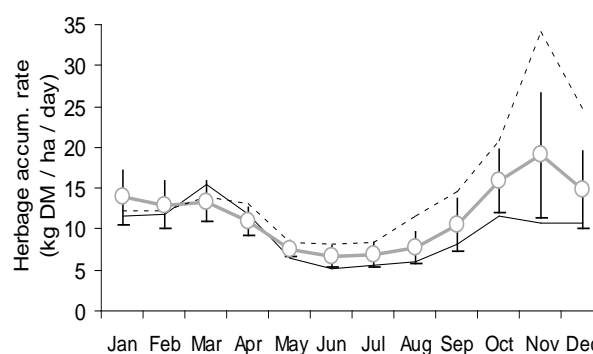
Cow-calf systems in the flooding Pampa - Argentina, are facing increasing competition with cropping systems for resources and land. In this context, to be more competitive livestock systems require system intensification, which demands an improvement on the feedbase. Forage crops and feeding silage have been used widely on dairy and beef cattle finishing systems. The purpose of the study was to assess with a model the level of intensification that can be achieved in cow calf systems and its economic effects by incorporating maize silage and winter grazing oat crops.

## Methods

A representative base cow-calf farm (BF) of 700 ha was defined for the Laprida Region (37°33'00"S 60°49'00"W) based on regional data (CNA 2002), and updated by a participatory study with consultants (Machado *et al.* 2009), where the feedbase was constituted by natural grassland and sown pastures. A biophysical whole farm model (Machado *et al.* 2010), was used to simulate the farm system where an increasing area of a soil rotation of maize and oat crops (M&O) was incorporated to the farm plan. The approach followed to perform the study was based on previous modelling studies (Chapman *et al.* 2008).

The production of natural grasslands and sown pastures typical of the Laprida were estimated by remote sensing (Piñeiro *et al.* 2006) on 8 farms during 8 years (Recavarren *et al.*, unpublished). Forage supply showed the highest variation during the spring seasons. Years with spring growth rates 20% higher or lower than mean, denominated here "Normal" and "Dry" years respectively, accounted for 25 and 38% of the data series (Fig. 1).

The modeled BF was compared to other modeling scenarios with 5, 10, 15, 20 or 25% of the farm area allocated to M&O. Maize was conserved as silage and fed in winter mainly, but extended when needed into February and March when enough stock were available. Oats were grazed in May and September. Scenarios were simulated both, on a Normal and a Dry year, and the maximum possible stocking rates for each scenario were



**Figure 1.** Monthly herbage accumulation rates for average (—○—), upper average (---), and a dry year (—), from the Laprida Region beef systems (Recavarren *et al.* unpublished). Bars represent standard error of the mean.

identified constraining the simulations by minimum monthly targets for herbage mass (THM)/ha and animal body condition scores (BCS). As in Dry year the same maximum stocking rate achieved on Normal conditions were applied, different management policies (more silage supplementation, early weaning) needed to be applied to achieve same THM and target BCS established for Normal years. Total Kg liveweight (LWT) sold (cows discarded and calves sold), total maize silage fed (t DM/ha/year), and gross margin (GM, income minus direct costs incurred in the production cycle) jointly with profit % on herd and equipment assets (PA), were set as the main indexes for production and economic performance respectively.

## Results and Discussion

In a normal year the area allocated to M&O enabled that the farm carrying capacity to be increased up to 1.3 head/ha when these crops occupied 10 or 15% of the farmland (Table 1). As a minimum limits to system key variables were established in order to assure system viability, pregnancy rate (PR), weaning rate (calf/pregnant cow) and calf LW at weaning date were similar between scenarios at Normal conditions (means and standard deviations were 83.8±3.9 %, 87.3±2.7 %, 179.2±1.2 kg LW/head). Total LWT sold was linearly associated (slope: 34.6,  $R^2 = 0.98$ ) to the stocking rate

**Table 1. Productive and economic performance for beef systems with different area allocated to the rotation maize/oat on a normal and dry year on the Laprida region**

Type of year	Normal						Dry			
	0	5	10	15	20	25	0	5	10	15
Maize/oat area (% of farm area)	0	5	10	15	20	25	0	5	10	15
Achieved Stocking rate (head/ha)	0.7	0.9	1.3	1.3	1.0	1.0	0.7	0.9	1.3	1.3
Total liveweight sold (kg LWT/ha/year)	129	146	205	203	167	161	137	133	210	224
Total maize silage fed (tonne/ha/year)	0	0.23	0.68	0.71	1.57	1.24	0	0.41	0.92	1.27
Gross Margin (US \$ /ha )	185	197	256	196	112	69	179	193	217	220
Profit on herd & equipment assets (%)	48	35	31	25	16	10	42	34	25	25

achieved on each alternative (Table 1). The higher physical and economic performance were achieved by 10% and 15% M&O scenarios with 59 and 57% extra LWT sold, and 38 and 6% increase in GM. Conversely, herd size and incremental costs due to larger double crop areas reduced PR, which made 20 and 25% M&O not viable alternatives.

Only scenarios up 15% M&O were simulated on a dry year, as higher levels were not feasible. All supplemented scenarios fed more silage and for longer to early spring and late summer (0.09 ton per each % of M&O  $R^2 = 0.99$ , estimated from Table 1). Additionally, as stored silage was less than the needed to overcome feed shortage, 10% M&O required that calves were early weaned and feed in pens up to the normal weaning weight. Production was kept steady, but economic performance was slightly reduced on all these alternatives due to the increased cost of distributing more silage (feeding was extended from 6, 4 and 7 to 7, 11 and 11 months for 5, 10 and 15% M&O), or more cows culled (PR falls from 78% to 71%) in the case of BF. Cost associated to early weaning implied a further reduction on GM for 10% M&O.

The impact of climatic variability was reduced by allocating 15% of the farm to M&O, but it required an increase in investment (reflected on its PA). Dry years represent 38 % of the series, hence the GM weighted mean from Normal and Dry years was 28% and 16% higher on 10% and 15% M&O when compared to BF.

## Conclusion

The results of this analysis suggest that feeding maize silage and winter grazing oat crop constituted a viable

alternative to intensify cow-calf systems on the flooding pampas from Argentina. Land allocated to this double crop would be between 10 and 15% of the total farm depending on farmer risk attitude and on his/her financial capacity to intensify the system and to cope with inter-annual variations on forage supply.

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