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SIMULATION OF COW-CALF SYSTEMS IN THE SALADO REGION OF ARGENTINA

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ABSTRACT

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The Salado region of Argentina covers 9.5 million ha, is located in the centre-East of the Buenos Aires Province, and concentrates about 6.9 million cattle. Cow-calf systems are predominant in the area. A simulation model was developed with the purpose of assisting in the design and evaluation of cow-calf systems in the Salado Region. The model was designed to produce long term simulations of the dynamic interactions between herd structure, climatic variation and farm management over periods of several decades using daily weather data, real or simulated. Existing models were used to describe soil, pasture and animal components of the farm, linked with management actions in a dynamic framework. The model was driven by decision rules entered by the user, which allowed the representation of management options that respond to changing farm conditions according to a predetermined policy. An object-oriented approach (OOA) was used in the design and implementation of the model. In the OOA, objects in the real world (e.g. cows, paddocks) are represented as objects in the computer program. The simulation of individual cows and individual paddocks made it possible to distribute feed resources flexibly among animals and provided many other points of flexibility in management strategies.

The management strategies simulated in trying to improve cow-calf systems in the Salado region were based on Reserva 6, an experimental cow-calf farm located at the INTA-Balcarce Experimental Station. Every spring-summer, 30% of the area is devoted to make low quality hay (by cutting at high herbage mass), most of which is destined to provide maintenance feed for pregnant adult cows in winter. Cows are kept on a small paddock from weaning (March) to calving (August-September), during which time they receive 6-9kg DM of hay per day. A set of decision rules was developed to represent (on a 100ha farm) the management applied in Reserva 6 and, using this as a base system, a series of simulation experiments was conducted.

Firstly, three preliminary experiments, aimed at gaining insight into the system and testing the model, were carried out. In the first of these, the effect of delaying the breeding season 15 and 30 days was analysed. The model was run over 30 consecutive years using a real weather sequence, 1970-2000, from INTA-Balcarce, for each scenario. It was found that, when the appropriate management variables (i.e. weaning and sale dates) were adjusted accordingly, changing the calving period had little effect on the productivity of a cow-calf system. In the second experiment, the dynamic consequences of three different heifer replacement policies on the production outcomes of the system were explored. The policies produced different patterns of oscillations in key farm outputs as a result of periodic behaviour in the age structure of the herd, and the differences between strategies were shown to be dependent on the environmental variability being simulated. The third experiment analysed different policies for hay use during the autumn-winter period, including a control strategy in which no hay was harvested or used. The results suggested that, provided hay was utilized on the farm, the pattern of use did not make much difference to liveweight production.

Secondly, the long term performance, in terms of annual liveweight sold, of a range of hay quantity-quality combinations was compared. Each policy was simulated across a range of cow numbers (170 to 350, cows plus heifers in a 100ha farm) and was replicated 20 times. Each replication consisted of 50 years of random weather sampled from the real sequence (1970-2000). The benefit of using hay and the contrasts between the effects of different haymaking strategies on animal outputs increased as the cow numbers increased. The long term analysis suggested that the liveweight production of cow-calf farms, under a calendar-based haymaking policy like that followed in Reserva 6, would be maximized by harvesting 40-50% (but not more) of the total farm area and aiming to harvest hay at medium herbage mass (therefore medium quality). Therefore, the policy currently followed in Reserva 6 of allocating 30% of the farm to haymaking could be considered as conservative, and its productivity might be increased by making hay at lower herbage mass.

Thirdly, the possible advantages of incorporating flexibility into the haymaking policy used in Reserva 6 were evaluated using the same experimental design. The results indicated that controlling haymaking in a flexible fashion, basing the decisions of closing, releasing and cutting paddocks on a simple pasture budget, would give the system productive advantages (i.e. increases in productivity and reductions in variability) in relation to a calendar-based approach. Using a flexible haymaking policy allows the manager to make more hay than required for the next winter, providing a buffer for the system. A flexible haymaking policy permitted significantly greater levels of herbage utilization by making large amounts of hay without negative effects on the carrying capacity of the system. A preliminary analysis of risk and costs highlighted major advantages in using hay in cow-calf systems, especially when a flexible approach to haymaking is implemented.

Keywords: cow-calf systems, computer model, long term simulation, haymaking policy.

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