Risk-efficiency assessment of haying

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Introduction Pastoral livestock farms are complex, dynamic systems subject to many forms of external disturbance. Farm Management strategies are therefore typically designed to minimize system variation. The objective of this study was to explore the impacts of different haying policies, in terms of expected profit and risk, for cow-calf farms in the Salado Region of Argentina.

Materials and methods A computer model (Romera *et al.*, 2004) was used to simulate 21 haying policies (combination of area cut, AREA and cutting herbage mass, MASS), across a range of target cattle numbers (SR). The model is climatically driven, and the sub-models representing the farm's biophysical dynamics were taken from the literature. A set of decision rules was developed to represent (on a 100 ha farm) the management applied in Reserva 6, an experimental cow-calf farm located at the INTA-Balcarce Experimental Station. A simplified profit indicator based on current prices (P) was calculated. Sale price per kg of liveweight was 1.0 for calves and 0.8 for cows. The cost for haying was calculated as a function of the hay yield in kg DM/ha ($y = 0.012+0.094e^{(-5E-4x)}$). A factorial experiment was simulated, with different levels of AREA (0 to 60 ha), MASS (3 to 6 t DM/ha) and SR (170 to 350, cows plus heifers), and 20 replicates. Each replicate consisted of 50 years of random weather sampled from the real weather sequence at Balcarce, 1970-2000. The results were analyzed using the risk-efficient frontier method (Cacho *et al.*, 1999).

Results The risk-efficient frontier (Figure 1) shows the best possible combinations of expected P and risk (standard deviation of P, SD). Any policy below (or to the right of) the frontier is inefficient, as higher P is possible from the same level of risk (moving vertically) or the same P is possible with a lower risk (moving horizontally). No combination without hay (NoHay) was included in the frontier, but many policies using hay were clearly inferior to NoHay policy. The risk-efficient set included combinations that made hay at medium herbage mass and that harvested up to 40 ha (decreasing with increasing SR) (Table 1).

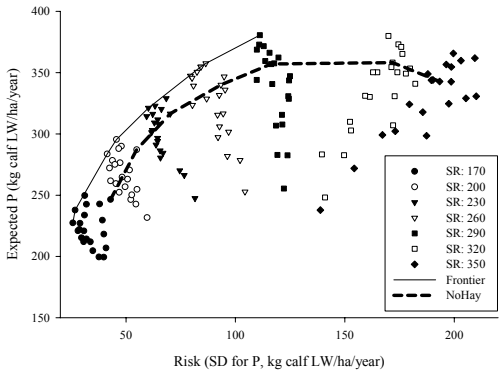

Figure 1 Risk-efficient frontier for the different haying strategies and target cow numbers (SR)

Table 1 Means (±SD) of P for the strategies included in the efficient sets

SR[1]	AREA[2] (ha)	MASS[3] (kg DM/ha)	P[4] (kg LW/ha/year)
170	40	4000	227±26
170	30	4000	238±27
200	20	4000	284±41
200	30	4000	295±46
230	30	4000	321±60
260	20	3000	355±84
260	20	4000	357±86
290	20	3000	381±111

[1]Target cow numbers in a simulated 100 ha farm (emergency sales and deaths can occur so actual stocking rates may be lower). [2]Area allocated to haying. [3]Cutting herbage mass for haying. [4]Expected profit.

Conclusions Making hay is not automatically beneficial for the system but at lower herbage masses it could be more profitable and less risky.

References

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