Simulating Options for Managing Seasonal and Annual Variations in Feed Supply of Mixed Crop/Livestock Systems in Sub-Tropical Australia

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Introduction Mixed crop/livestock systems in subtropical Australia are based on a variety of summer and winter growing crops and forage species, but summer active grass-based pastures (both native and improved) are the predominant forage source used for livestock in the region. Rainfall in the region is summer dominant (65% of annual) and has a high degree of seasonal and inter-annual variability (26%-34% CV). In this unpredictable climate, managing variability in forage supply for livestock both within years and between years is a major challenge. Simulation modelling was used to demonstrate strategies for mixing grass pastures and forage cropping that can reduce variability in whole-farm feed supply.

Materials and methods Monthly forage growth was simulated for 5 forage species, lablab, oats, forage sorghum (sweet sorghum) and lucerne modules in APSIM version 5.3, and APSIM-Grasp was used to simulate a grass pasture. Simulations used a grey vertosol (217 mm PAWC) and long-term historical meteorological data for Goondiwindi, southern Queensland. At different % of farm area allocated to grass pasture, the % area of other forage sources was optimized to minimise the coefficient of variation (CV) in annual DM production. The proportion of months that a 4-month running total of simulated forage growth was less than livestock demand (9 kg DM/AE) for the same period was calculated for 3 stocking rates and feed systems with 20% area of different forage crops.

Results and discussion A feedbase consisting entirely of grass pasture is exposed to a high degree of variability in annual forage production, with a CV of 44% (Table 1), and livestock demand frequently exceeds forage supply over a 4 month period (Table 2). If the farm feedbase is supplemented with forage crops this variability is reduced. Lablab reduces fluctuations in annual DM production, but oats lessens the frequency of feed deficits during the autumn/winter period (Figure 1 & Table 2).

Table 1 *Optimal mix of forages (% of farm forage area) to minimize CV in annual DM production for the whole-farm feedbase with different proportions of grass pasture.*

Constrained % grass pasture	Lablab	Oats	Forage sorghum	Lucerne	CV(%)	Mean DM (Mg/ha/yr)
100	-	-	-	-	44	4.1
90	10	0	0	0	38	4.3
75	18	7	0	0	31	4.7
60	20	20	0	0	27	5.0
50	21	29	0	0	25	5.2
25	25	36	14	0	23	5.9
0	27	39	26	8	22	6.4

Table 2 *Frequency (% of months) that the 4-month running total of livestock demand exceeds DM production for the same period under different feed systems.*

Feedbase	Stocking rate (AE/ha forage area)		
	0.1	0.25	0.4
Grass only	10	16	25
Grass + lablab	9	18	27
Grass + forage sorghum	8	17	25
Grass + lucerne	5	12	16
Grass + oats	3	5	7

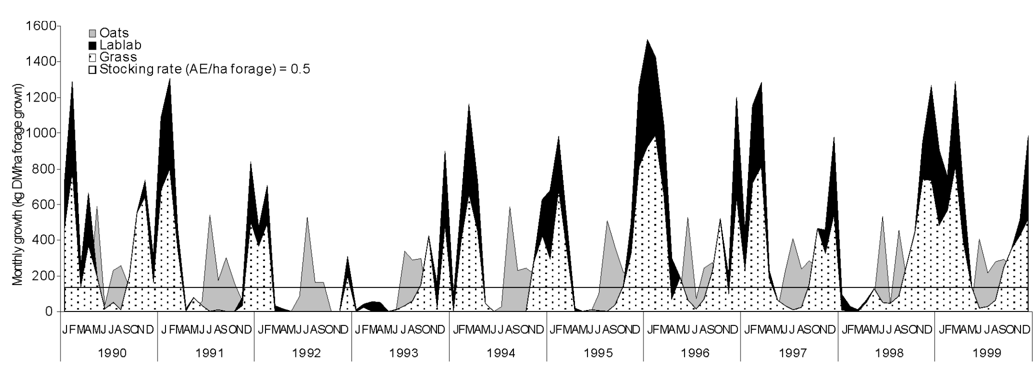

Figure 1 *Simulated monthly forage production from a feedbase comprised of 60% grass pasture, 20% oats and 20% lablab at Goondiwindi over a 10 years period from 1990—1999.*

Conclusions A feedbase of 60% grass-pasture, 20% oats and 20% lablab (summer growing legume) is a feasible arrangement for farming systems in the region that would significantly reduce within-year and between-year variability in forage production across the whole farm and also improve the overall nutritional quality of feed available for grazing.