

Simulating the Western Australian wheat-sheep system

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A simulation model is being built which simulates changes in biological and economic variables on an idealized, 1500 ha farm with one soil type in the W.A. Central Wheat Belt.(1). The simple farm is based on wheat, subclover, ryegrass and sheep.

Method

The state variables of the model are soil nitrogen and seed pools of the clover and grass, updated in annual steps. The standard seasonal climate and soil conditions are as for loamy sand at Wongan Hills (WA). Wheat and pasture productivities are estimated taking into account plant populations, competition, grazing, and yield potential of the site. Stocking rate is such that just one-half of the pasture and stubble production is consumed. The flock structure assumed generates income from wool and carcase.

Results and discussion

Preliminary results (Fig. 1) with a 4:4 pasture:wheat rotation illustrate the effect of (a) replacing biologically-fixed N with fertilizer, (b) relying on pasture for N input, and (c) doubling the herbicide applications in order to control ryegrass better in the crop. Estimated farm net incomes were in the order (c) > (a) > (b). The model already shows promise as a means of comparing rotations and evaluating the whole-farm implications of weed-control and pasture-management strategies.

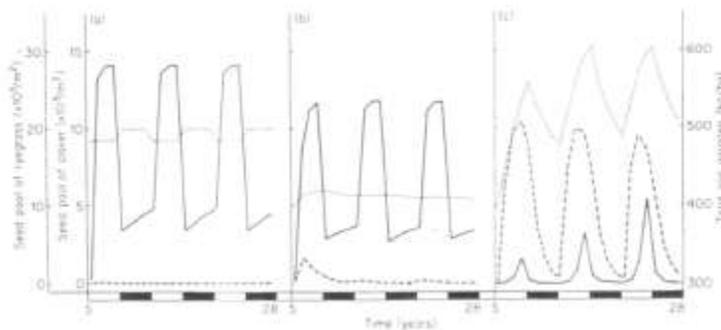


Fig. 1. Simulated time courses of total soil nitrogen (.....) and of abundance of subterranean clover (---) and annual ryegrass(____), near equilibrium. (a) Fertilizer applied, no clover sown, standard herbicide; (b) no fertilizer, clover sown, standard herbicide; (c) no fertilizer, clover sown, herbicide investment doubled.

1. B. R. Trenbath (1985). Weeds and agriculture: a question of balance. In: Studies on plant demography - a festschrift for John L. Harper (ed. J White). Academic Press, London. pp.171-183.