ECONOMIC RETURNS FROM ANNUAL PASTURES SOWN AT DIFFERENT SEEDING RATES

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Summary

Many grazing experiments have recorded the impact of a variable number of sheep on pastures of initially similar density, This study reports the influence of a fixed number of sheep on pastures with a wide range of seeding rates and plant density,

There was over a five fold increase in pasture, seed and wool production per hectare in grazed pastures as the seeding rate of Wimmera ryegrass (Lolium rigidum Gaud.) was increased from 1 to 32 kg ha^{-1}. In contrast over this same range in seeding rates in ungrazed pastures - total pasture yield was constant and seed yield was reduced by half. Crude gross margins were calculated for the seed and/or wool growing enterprises. The highest return was from the seed growing enterprise from ungrazed pastures sown at low seeding rates (1 to 16 kg seed ha^{-1}). The maximum crude gross margin for wool and wool plus seed production occurred on pastures sown at a seeding rate of 32 kg seed ha^{-1}.

Strong evidence is presented that a high annual carry over of seed reserves is a key to the maintenance of highly productive and stable grazing systems from annual pastures in Mediterranean type environments of southern Australia,, The implications of these results to farming practice are discussed,

I. INTRODUCTION

In Australia, recommended seeding rates generally range from 1 to 10 kg of seed ha^{-1} (Whittet 1965; Molnar 1974) and have often been based on the results of small plot experiments (Donald 1954) which do not monitor the effects of the grazing animal directly,

Grazed pastures in Mediterranean annual-type climates are capable of supporting high plant populations of several thousand plants m^{-2} (equivalent to seeding rates of 30 kg ha" or greater) during the growing season and plant densities of this order are essential to maintain stable and high levels of animal production from annual pastures (Sharkey, Davis and Kenney 1962; Carter and Day 1970; Smith 1972; Williams 1974). Smith (1972) among others has recorded natural plant populations in autumn, in grazed annual pastures equivalent to sowing 700 kg of seed ha^{-1}.

Much work has been carried out to show the significance to animal production of varying stock numbers on swards of similar initial density, However, to the authors* knowledge, no studies have been reported which have examined the influence on production and on economic returns from grazed pastures when seeding rate and by inference plant numbers per unit area. are varied and animal numbers remain constant.

An experiment to examine the effects of seeding rate on economic returns from annual pastures was conducted at the Mortlock Experiment Station, Mintaro, South Australia.

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II. MATERIALS AND METHODS

The experiment consisted of eleven seeding rates with a grazed and an ungrazed treatment within each seeding rate. Pastures of Wimmera ryegrass (Lolium rigidum Gaud.) were sown on the 15th May, 1971 at seeding rates of: 1,2,4,8,16,32,64,128,256,512 and 1024 kg ha^{-1}. The grazed treatments were stocked as described by Williams (1974). Three year old South Australian Merino wethers (weight 47 kg) were allocated at random to the treatments, Sheep that died were replaced, Data from replacement sheep were not included in the analyses.

Plant density at establishment (PDE) was estimated 51 days after sowing from core samples (Hutchinson 1967). Pasture dry matter (DM) production was estimated in grazed treatments using the method described by Carter and Day (1970) and in ungrazed treatments by the visual method of Morley, Bennett and Clark (1964). Seed yield was determined by harvesting ten 0.25m^2 quadrats per treatment in January, 1972. Wool production was estimated using the method described by Hutchinson (1969).

Crude gross margins were calculated from the value of seed and/or wool produced less the cost of seed sown. Clean wool was valued at $2.50 per kg (the Australian Wool Corporation% current reserve price) and seed was valued at 25¢ per kg retail price and 20¢ per kg grower price (Wright Stephenson pers. comm.)

III, RESULTS

The logarithmic relationship between seeding rate (x, kg ha^{-1}) and PDE (y, plants m^{-2}) was linear and similar in both grazed and ungrazed pastures. The pooled line is:

$$\log y = 1.52 + 1.01 \log x \quad (R^2 = 0.99,\ P < 0.001).$$

Each additional 1 kg ha^{-1} of seed sown on 15th May produced 33 plants m^{-2} at establishment on 5th July, 51 days after sowing,

Relationships between PDE and animal and plant production are shown in Figure 1a, b. Wool production increased in relation to PDE over the full range of seeding rates studied, In the ungrazed plots pasture DM production was remarkably constant from seeding rates of 1 to 1024 kg ha^{-1} (Figure 1b). Whereas in the grazed plots there was an asymptotic DM production/density relationship with production increasing up to seeding rates of 32 kg ha^{-1} (a PDE of approximately 1000 plants m^{-2}) and a near constant production for higher seeding rates,

Seed yield from grazed plots was near zero for seeding rates of 1 to 4 kg ha^{-1} and then increased up to seeding rates of 32 kg ha^{-1} and was relatively constant for higher seeding rates, In contrast seed production from ungrazed pastures was reduced by half as the seeding rate increased from 1 to 1024 kg ha^{-1}.

The highest crude gross margin was from the seed growing enterprize from ungrazed pastures sown at seeding rates of 1 to 16 kg ha^{-1} (Figure 2). The maximum crude gross margin for wool and wool plus seed occurred on pastures sown at seeding rates of 32 kg ha^{-1}.

IV. DISCUSSION

Two extremes of pasture management were examined - a heavy grazing and a no grazing system, There were large differences in pasture and seed production from grazed compared to ungrazed pastures. This is probably due to the fact that grazing and no grazing are two different processes with different effects on plant growth (Davidson 1969).

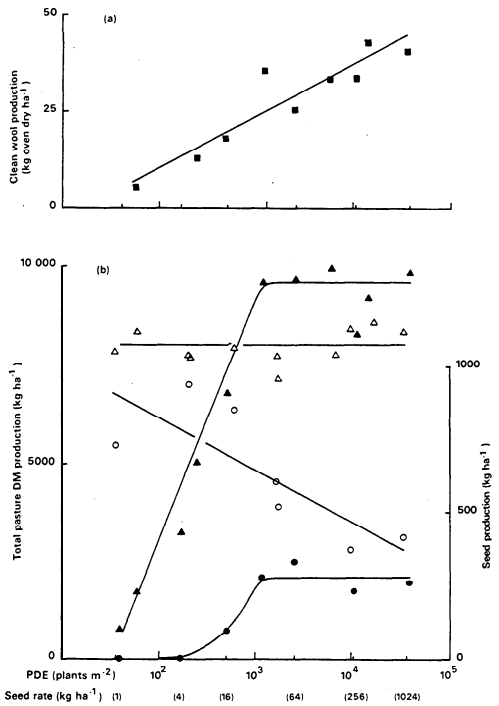

Figure 1a,b. Effects of increasing PDE (log scale) on (a) wool production from grazed pastures and on (b) pasture DM and seed production from grazed and ungrazed pastures.

Seeding rates of grazed pastures for a range of treatments are shown in parentheses.

grazed	ungrazed	pasture
■—■		wool production;
▲—▲	△—△	, DM "
●—●	○—○	, seed "

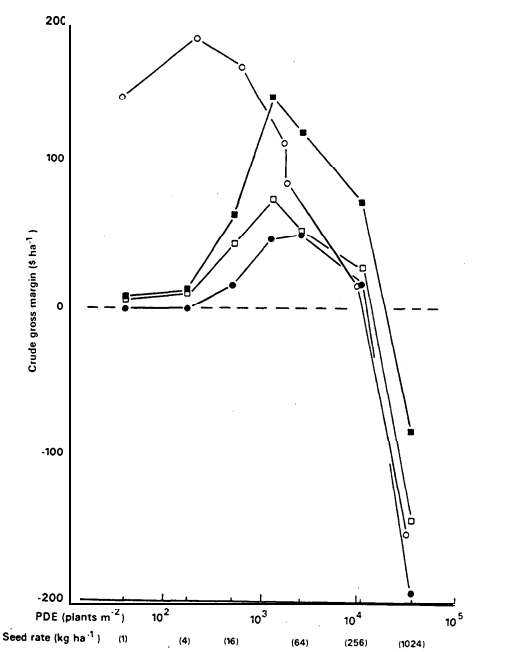

Fig. 2. Effects of increasing PDE (log scale) on the crude gross margins from the seed and/or wool growing enterprises.

Seeding rates of grazed pastures for a range of treatments are shown in parentheses.

Grazed pastures

□—□ , wool enterprise;

●—● , seed "

□—□ , wool + seed enterprise;

Ungrazed pastures

○—○ , seed enterprise.

The lower the seeding rate and plant density the greater was the magnitude of these differences. Therefore recommendations of seeding rates based solely on the results of ungrazed small plot experiments may not be-valid

in certain continuously grazed annual pasture situations (Figure I),

A useful preliminary comparison of the profitability of seled-growing and grazing enterprises was possible (Figure 2). However other variable costs such as investment in equipment or livestock capital would need to be considered to permit a comprehensive comparison of the profitability of the different enterprises, Pasture$ sown at seeding rate$ 0f 1-16 kg ha^{-1} produced the highest economic returns (from seed production) in ungrazed situations, but they did not produce acceptable levels of animal or seed production when stocked heavily in the year of establishment (Williams 1974). Wool production increased in relation to PDE over the full range of seeding rates studied, However estimated profits from wool and/or seed production from grazed pastures increased up to a seeding rate of 32 kg ha^{-1} and were greatly reduced at higher seeding rates,

Grazed pastures sown at seeding rates of 32 kg ha^{-1} and higher produced over eight times this amount of seed at maturity in year one and could be expected to produce dense, highly productive pastures for grazing in year two, Other management strategies, such as the use of low seeding rates (1-10 kg ha^{-1}) combined with reduced stock numbers per unit land area and/or closing up these pastures in the spring may be desirable in certain situations. If the sown pasture is not required for grazing until 9 to 12 months after seeding, if weeds are not a problem and if moisture and nutrients are in short supply, then lighter seeding rates of 1 to 10 kg ha^{-1} might suffice (Molnar 1974). However if a pasture is needed for grazing in 4 to 12 weeks, moisture and nutrients are adequate and weeds may be a problem then seeding rates of 16 to 32 kg or more per hectare of ryegrass could be used to support similar numbers of stock as in the current study, There is little point in establishing dense pastures if high stocking rates are not employed, Otherwise the pasture produced will not be harvested by the grazing animal,

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