The relationship between pre- and post-weaning performance of lambs on Italian ryegrass

J.F. de Villiers*, T.J. Dugmore and W.A. Botha

Cedara Agricultural Development Institute, Private Bag X9059, Pietermaritzburg, 3200 Republic of South Africa

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The relationship between pre- and post-weaning performance of lambs on Italian ryegrass was investigated by grazing lambs at different stocking rates. A positive correlation was found between both the pre-weaning stocking rate ($P = 0.008$) and weaning mass ($P = 0.001$) and the post-weaning average daily gain, where post-weaning stocking rate was not significant when related to animal performance. The correlation between the weaning mass in early August and the final mass of lambs in November, after 83 days on ryegrass, was highly significant ($P = 0.001$). Lambs stocked at a low stocking rate (20 ewes with lambs/ha) prior to weaning gained 13.3 kg, while lambs in the high pre-weaning stocking rate (36 ewes with lambs/ha) gained 11.9 kg during the post-weaning period. The smaller lambs, originating from pastures with heavy stocking rates, could not catch up on ryegrass pastures, in terms of mass gain, to achieve acceptable slaughter mass within a reasonable period of time. The optimum pre-weaning stocking rate for ewes and lambs/ha on ryegrass will depend not only on the weaning mass desired, but also on the marketing strategy of the producer for the lambs after weaning.

Die verwantskap tussen voor- en na-speen prestasie van lammers, wat Italiaanse raaigras teen verskillende veebeladings gewei het, is ondersoek. 'n Positiewe korrelasie is gevind tussen beide voorspeen veebelading ($P = 0.008$) en speenmassa ($P = 0.001$) op na-speen gemiddelde daaglikse massatoename, met na-speen veebelading nie betekenisvol verwant aan dierepresta sie nie. Die korrelasie tussen speenmassa vroeg in Augustus en die finale massa van die lammers in November na 83 dae op raaigras is hoogs betekenisvol ($P = 0.001$). Lammers in die voorspeen lae veebelading (20 ooie met lammers/ha) het 13.3 kg en die lammers in die hoë voorspeen veebelading (36 ooie met lammers/ha) het 11.9 kg in massa gedurende die na-speen periode toegeneem. Die kleiner lammers, afkomstig van hoë veebeladings, het nie op die weiding in terme van massatoename opgevang om 'n aanvaarbare slagmassa binne redelike tyd te bereik nie. Die optimum voorspeen veebelading vir ooie en lammers/ha op raaigras sal nie slegs bepaal word deur die speenmassa wat bereik wil word nie, maar ook deur die bemarking strategie van die produsent met die lammers na speen.

Keywords: Italian ryegrass, lambs, pre- and post-weaning performance.

* To whom correspondence should be addressed.

Introduction

The optimum stocking rate for ewes and lambs on Italian ryegrass will depend on the specific production system, the weaning mass to be achieved and the marketing strategy of the producer for the lambs after weaning. De Villiers *et al.* (1993) found that the average weaning mass of lambs over a period of four seasons declined ($P \leq 0.05$) from 22.9 to 17.2 kg when the stocking rate levels increased from 20 to 36 ewes with lambs/ha, respectively. Farmers can choose to stock ryegrass either heavily or lightly with ewes and lambs during the pre-weaning phase. However, the success of heavy stocking will be influenced by the extent to which small lambs from the heavy stocking rates will undergo corresponding or better gains during the post-weaning phase when ryegrass is freely available. This is a critical factor in production systems because, if the smaller lambs do not catch up in mass gain, they will have to be kept on the farm for a longer period in order to reach an acceptable live mass for slaughter.

The possibility that compensatory growth might be of little significance is based on the results obtained by Kirton (1970). He ran two groups of hill country lambs together on good sheep pastures for 10 weeks. At weaning (approximately 17 weeks of age) the groups differed in live mass by 5.8 kg. Their growth curves were essentially parallel and the estimated difference in carcass mass between the groups at the beginning of the experimental period was reduced by only 22% at the end of the growth period, suggesting that compensatory growth was of little practical significance. Allden (1968a) found that the effects of reduced lamb growth rate due to nutritional stress, from 0 – 6 and 6 – 12 months of age, persisted for 56 and 11 months, respectively, and compensatory gain was subsequently recorded only for the latter group (Allden, 1968b). Although Keenan *et al.* (1970) observed higher gains in sheep following restriction, they attributed most of the difference to extra water in the gut. Likewise, Drew & Reid (1975) found that part of the 46% greater gain of immature sheep undergoing re-alimentation was associated with a rapid accumulation of body water. In their appraisal of previous research, Moran & Holmes (1978) reported that there was compensatory gain in only one-third of the studies while almost another third showed that restricted animals gain less during re-alimentation.

The hypothesis tested with this data is whether small lambs that emanate from heavy stocking rates on Italian ryegrass will have the ability to catch up, in terms of mass gain, and

Table 1 The post-weaning stocking rates relative to pre-weaning stocking rates for the different treatments

	Pre-weaning stocking rates (ewes with lambs/ha)				
	20	24	28	32	36
Post-weaning stocking rates (lambs/ha)					
1984 Season:					
Aug. – Sept.	16	27	21	34	38
Sept. – Oct.	23	36	27	45	51
1985 Season:					
Aug. – Sept.	26	37	39	49	46
Sept. – Oct.	34	49	52	65	61

achieve acceptable slaughter mass within a reasonable period of time on Italian ryegrass.

Procedures

Stocking rate trials with ewes and lambs were conducted on irrigated Italian ryegrass (*Lolium multiflorum* cv. Midmar) pastures for two seasons at Cedara (29°32'S : 30°17'E and altitude 1075 m) in the Natal Midlands. Pre-weaning stocking rates of 20, 24, 28, 32 and 36 South African Mutton Merino ewes with lambs/ha were applied during each of the two seasons (De Villiers *et al.*, 1993). An eight-camp rotational grazing system with a fixed period of stay of 3.5 days per camp was applied. This allowed for a 24.5-day regrowth period. The ewes and lambs were kept on the pasture for 12 weeks before the lambs were weaned at approximately 100 days of age. The lambs (balanced for single and twin lambs) were not re-randomized during the post-weaning period and continued to graze the ryegrass in a rotational system for about 83 days. During the first year, the post-weaning stocking rates varied from 16 to 38 lambs/ha and during the second year from 26 to 49 lambs/ha at the start of the grazing during the first week of August (Table 1). Owing to the increased growth rate of the pasture during spring, the grazing cycle was reduced from a four- to a three-week cycle; also, the area was reduced (i.e. stocking rate increased) to compensate for the increased growth rates to achieve good utilization of the pasture. The range in stocking rates for the latter part of the season therefore varied between 23 and 51 for the first year and between 34 and 65 lambs/ha for the second year (Table 1).

The lambs were weighed once a week. Water and feed were not withheld prior to the weighings. The lambs had free access to fresh water in portable water troughs and to a mineral lick consisting of 50% salt, 25% bone meal and 25% feed lime. Lambs were dosed and inoculated according to a local management programme.

Multiple regression (Statgraphics, 1988) techniques were used to describe the relationships between: (i) post- and pre-weaning stocking rates and post-weaning ADG, (ii) weaning mass and post-weaning ADG, and (iii) between weaning mass and final mass.

Results and Discussion

The relationship for pre-weaning stocking rate (X) and post-weaning ADG (Y) was:

$$Y = 197.5\ (\pm 14.76) - 1.40\ (\pm 0.522)X$$

($s_{y.x} = 39.68$; $r^2 = 0.039$; $P = 0.008$; $n = 178$)

At a pre-weaning stocking rate of 20 ewes with lambs/ha, the equation predicted an ADG of 169 ± 4.99 g/day, while a pre-weaning stocking rate of 36 ewes with lambs/ha the

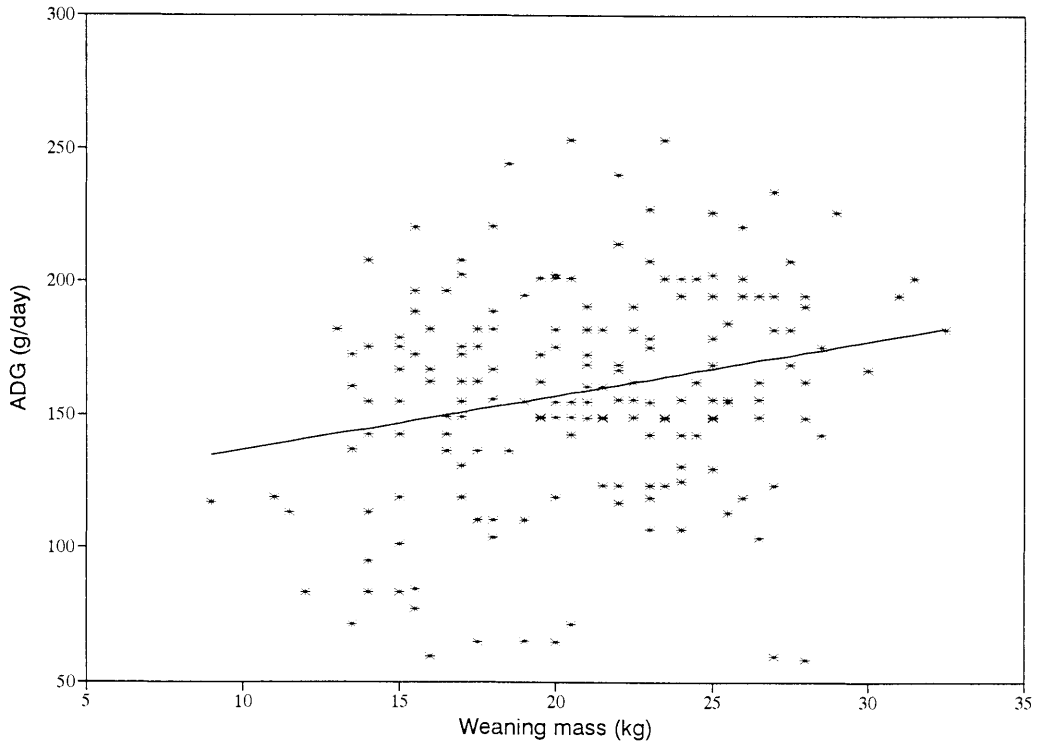

Figure 1 The relationship between weaning mass (X) and post-weaning ADG (Y) of lambs on ryegrass (Y = 116.5 (±13.51) + 2.03 (±0.632)X; $S_{y.x}$ = 39.4; r^2 = 0.05; P = 0.001; n = 178).

Table 2 The relationship between weaning mass (X) and post-weaning ADG (Y) of lambs in the same pre-weaning stocking rate and the overall effect

Pre-weaning stocking rate[1]	Equation	n	r^2	Level of significance	$S_{y.x}$
20	Y = 99.7 (±40.91) + 2.80 (±1.682)X	39	0.07	0.10	43.80
24	Y = 114.8 (±45.45) + 2.10 (±2.031)X	39	0.03	0.31	40.09
28	Y = 151.4 (±27.73) + 1.32 (±1.338)X	30	0.03	0.33	33.91
32	Y = 102.3 (±23.84) + 1.88 (±1.149)X	39	0.07	0.12	31.86
36	Y = 128.1 (±35.27) + 1.29 (±2.064)X	31	0.01	0.53	40.27
Pooled data	Y = 116.5 (±13.51) + 2.03 (±0.632)X	178	0.05	0.001	39.40

[1] Ewes with lambs/ha

lambs would be expected to gain 147 ± 5.26 g/day post-weaning.

Analysis showed that the regression of post-weaning ADG (Y) on post-weaning stocking rate (X) was not significant:

$Y = 169\ (\pm 10.9) - 0.29\ (\pm 0.306)X$

($s_{y.x} = 40.37$; $r^2 = 0.005$; $P = 0.341$; $n = 178$)

Post-weaning stocking rate was included as an additional variable to weaning weight to predict post-weaning ADG, which proved to be non significant ($P = 0.70$). A positive correlation ($P = 0.001$) between weaning mass and post-weaning ADG was observed (Figure 1), illustrating clearly that the heavier the lambs at weaning the better the post-weaning ADG. The regression equations summarized in Table 2 also describe the positive relationship between weaning mass (X) and the post-weaning ADG (Y) of lambs within a particular stocking rate.

The regression equation describing the relationship between the weaning mass (X) in early August and the final mass (Y) of lambs in November was:

$Y = 9.82\ (\pm 1.070) + 1.13\ (\pm 0.050)X$

($s_{y.x} = 3.12$; $r^2 = 0.744$; $P = 0.001$; $n = 178$)

The results in Figure 2 clearly illustrate the highly significant ($P = 0.001$) correlation between weaning mass and the final mass. From the equation derived, it is clear that for every 1 kg increase in weaning mass, the final mass increased by 1.13 kg. Thus the heavier the lambs at weaning, the larger the mass of such lambs at the end of the ryegrass season. After 83 days on the pasture, the lambs, stocked at the rate of 20 and 36 ewes with lambs/ha pre-weaning, and weaned at an average mass (during the 1984 and 1985 season) of 23.9 ± 0.67 and 16.9 ± 0.61 kg, reached a final mass of 37.2 ± 0.98 and 28.8 ± 0.87 kg, respectively. The lambs on the pre-weaning low stocking rate gained 13.3 while the lambs on the pre-weaning high stocking rate gained 11.9 kg during the post-weaning period.

The data from this trial provide strong evidence that small lambs emanating from high pre-weaning stocking rates (up to 36 ewes with lambs/ha) on annual ryegrass pasture do not

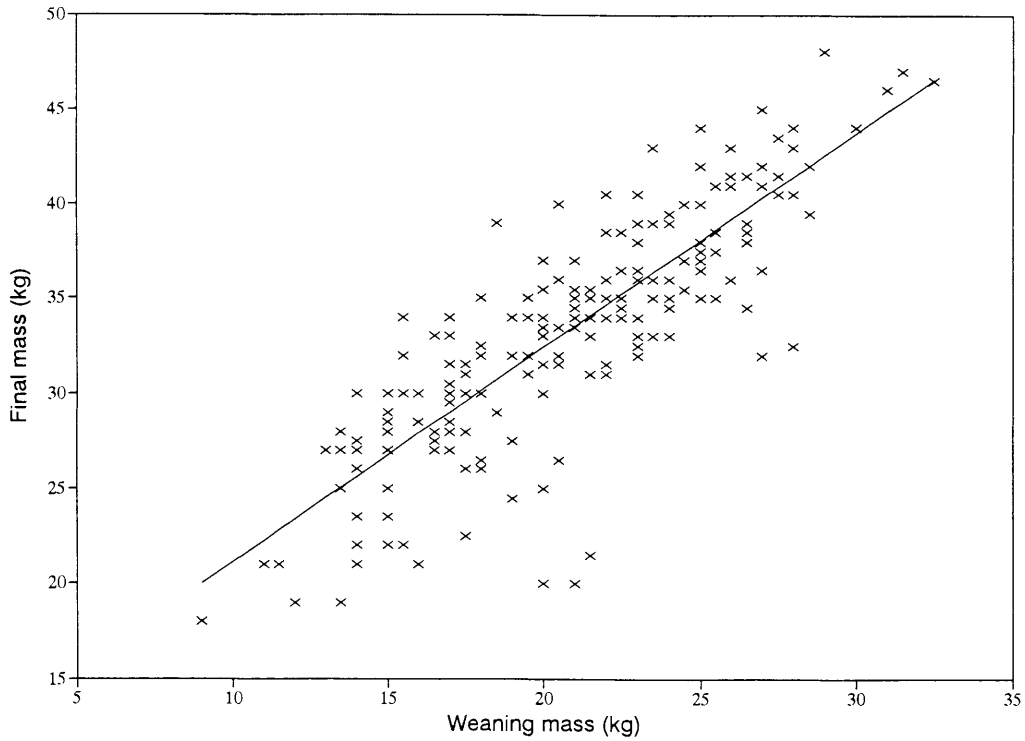

Figure 2 The relationship between weaning mass (X) and the final mass (Y) of lambs on ryegrass ($Y = 9.82\ (\pm 1.070) + 1.13\ (\pm 0.050)X$; $S_{y.x} = 3.12$; $r^2 = 0.744$; $P = 0.001$; $n = 178$).

have the ability to narrow the live mass difference at weaning during the post-weaning period, even when grazing ryegrass under conditions where there is little competition for feed. This agrees with Kirton (1970) who found that weaned 14-week-old lambs, differing in live mass, did not exhibit a compensatory gain over a 10-week period on good quality pasture. He found that live mass gain curves were almost parallel, and he considered compensatory gain to be of little practical significance. Similar conclusions have been made with cattle. Friesian bullocks grazed at two intensities had mean daily gains of 0.59 and 0.89 (first experiment) and 0.84 and 0.95 kg (second experiment), or respective live mass differences of 38 and 16 kg at the start of winter feeding (Wilkinson & Prescott, 1970). Despite consuming more organic matter, the higher stocked bullocks did not compensate to any significant extent. Meyer *et al.* (1962) reported that the *ad lib* feeding of groups of lambs previously restricted in either intake, energy or protein for 6 weeks, resulted in live mass gains similar to those of unrestricted lambs. Lishman *et al.* (1974) found that the underfeeding of lactating ewes significantly ($P = 0.001$) reduced the live mass of their ewe lambs at weaning. The deficit in growth of the lambs was gradually reduced during the post-weaning period, but was still evident at their first parturition at 18 months. Cattle twins mildly restricted until weaned at 6 months of age and then liberally fed had only slightly better gains (Harte, 1968a) and there were no significant differences in carcass composition (Harte, 1968b). Extending the period of restriction from 4 to 8 weeks and again from 8 to 16 weeks after birth adversely affected subsequent growth rates of monozygous cattle twins (Everitt & Jury, 1977). With cattle that were underfed from 0 to 16 or 16 to 32 weeks of life, compensatory gain was manifested only in the latter group (Morgan, 1972).

The data in Table 3 show how many days are needed, post-weaning, to produce lambs that will reach a target slaughter mass of 45 kg at an average daily gain of 160 g/day. It is clear from the information in Table 3 that the higher the pre-weaning stocking rate, the longer it will take to reach the ideal slaughter mass. It is also interesting to note (Table 3) that it would take a twin lamb about 25 days longer to reach the target slaughter mass than a single lamb.

From this data it can be concluded that on ryegrass small lambs are unable to eliminate the mass advantage shown by larger lambs at weaning. Thus, small lambs on Italian ryegrass pastures that emanate from heavy stocking rates do not appear to have the ability to catch up, in terms of mass gain, and achieve acceptable slaughter mass within a reasonable period of time. Owing to the significant ($P = 0.001$) relationship between the weaning mass and the final mass, it is critical that pre-weaning stocking rate for ewes and lambs be set according to the anticipated date of marketing the lambs.

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Table 3 Days needed post-weaning to reach a live mass of 45 kg with an average daily gain of 160 g/day and stocked at 50 lambs/ha

	Pre-weaning stocking rate (ewes with lambs/ha)				
	20	24	28	32	36
Weaning mass[1]:					
Single lambs	24.4	24.3	21.2	20.8	19.2
	±0.86	±0.68	±0.78	±0.73	±0.75
Twin lambs	20.8	20.1	18.6	18.2	15.0
	±0.53	±0.57	±0.65	±0.57	±0.53
Days needed[2] to reach the target slaughter mass:					
Single lambs	129	129	149	151	161
Twin lambs	151	156	165	168	187

[1] De Villiers *et al.* (1993)

[2] (Final mass – weaning mass) ÷ 160 g/day

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