Small Ruminant Research xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Research paper

The effects of nutrition and parity on the development and productivity of Angora goats: 2. Effects of six combinations of mid pregnancy and postnatal nutrition on energy intake and doe live weight, body condition and mohair production

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ARTICLE INFO

Keywords:
Feeding
Breeding
Management
Energy requirement
Mohair quality

ABSTRACT

There is little research on the nutrient requirements and the effects of nutrient manipulation on the productivity of lactating Angora does. The study design investigated the combined effects of 3 levels of mid pregnancy nutrition (MPN) × 2 levels of postnatal nutrition during lactation (PNN) with both single and twin bearing does, providing 6 nutrition patterns. Following artificial insemination and pregnancy scanning, does were fed pelleted rations in individual pens in an outdoor feedlot from day 47 of pregnancy until 13 weeks following kidding. MPN treatments commenced from day 47 as follows: Control (C), fed to lose live weight (–67 g/day); Maintenance (M), does fed to maintain live weight; Supplemented (S), does fed to gain live weight at 102 g/day. From days 105 of pregnancy until 4 days *postpartum* the feeding level was *ad libitum* for all treatments. From 4 days *post-partum* PNN treatments were: *ad libitum* (AL) to allow maximum ME intake; Restricted (R) to 70% of AL. This report is concerned with the responses from kidding to weaning for energy intake, live weight, body condition score (BSC) and mohair production. In AL treatments, maximum ME intake was reached during weeks 5–10 of lactation as follows: twin rearing does 3.88 × maintenance; single rearing does 3.25 × maintenance. No interaction occurred between MPN and PNN in affecting doe live weight. PNN significantly affected doe live weight from week 2 until weaning with AL does gaining 97 g/day from kidding to week 5 and thereafter 28 g/day. R fed does lost 40 g/day from kidding to week 10 and thereafter gained 38 g/day. By week 4 of lactation twin rearing does were 4 kg lighter than single rearing does. The change in BCS from just prior to kidding to day 90 of lactation was affected by an interaction between MPN and PNN. BSC of does fed M-R and S-R declined to a greater extent than does fed C-R, while the BCS for C-AL and M-AL increased to that of S-AL, which had remained constant at a high BCS. By day 21 of lactation the effects of PNN were significant, with AL does having significantly higher BCS than R does and the differences increased as lactation progressed. The BCS of single rearing does fed AL increased progressively, while the BCS of all other does declined. By the end of lactation, R does had significantly lower BCS than twin rearing does fed AL, which in turn had a significantly lower BCS compared with single rearing AL fed does. Significant interactions between MPN and PNN affected mohair growth, clean washing yield, mohair fibre diameter, incidence of medullated non kemp fibres and staple length. For fleece weight, S-AL and M-AL had heavier greasy and clean fleece weight compared with S-R and M-R with the other treatments intermediate. Similarly, the mean fibre diameter of S-AL was 2.4 μm coarser than that of M-R, with other treatments being intermediate. For both greasy and clean fleece weight, twin rearing does produced 14% less mohair than single rearing does. For R fed twin rearing does, the mohair had greater fibre diameter variability compared with other does. Overall, PNN had a greater number of and larger effects on measured parameters than MPN. Restricting nutrition in lactation was shown to depress doe live weight, BCS and the growth of mohair. Lactating Angora does rapidly changed their live weight and BCS in response to ME provision. To maintain live weight during lactation ME intakes of 3 × maintenance were required. Twin rearing does required an additional 0.5 × maintenance ME requirement compared with single rearing does. Does can gain live weight and BCS during lactation provided they are fed sufficiently. The preferred nutritional practice should allow maximum ME intake at least until week 6 of lactation.

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http://dx.doi.org/10.1016/j.smallrumres.2017.08.014
Received 24 April 2017; Received in revised form 29 June 2017; Accepted 17 August 2017

Please cite this article as: McGregor, B.A., Small Ruminant Research (2017), http://dx.doi.org/10.1016/j.smallrumres.2017.08.014

1. Introduction

Recommendations for the scientific management of the nutrient requirements of breeding sheep are summarised in major reviews and national standards based on hundreds of scientific reports (MAFF, 1984; NRC, 1985; SCA, 1990). While significant progress has been made in the nutrient management of dairy goats (Cannas et al., 2008), little empirical research has been conducted on the nutrient requirements for breeding Angora goats. Recommendations for the nutrient management of Angora goats are mostly based on theoretical calculations, often with useful practical recommendations for particular environments such as Huston et al. (1971) in Texas, van der Westhuysen et al. (1988) in South Africa and more generally NRC (1981) and Luo et al. (2004). In their intensive analysis of the nutrient requirements for Angora goats, Luo et al. (2004) specifically excluded lactating Angora does from their modelling given the dearth of information. Both van der Westhuysen (1980) and Snyman (2010) reviewed the literature from a South African perspective concluding that poor nutrition was implicated in the poor performance of Angora breeding flocks. Tuncel (1987) described the climate for Turkish Angora goats as mostly semi-arid with dry hot summers and cold winters. In the grazing season, the goats fed on short poor-quality grasses and cereal stubble and does were wintered for 3–5 months and fed cereal straw and poor-quality hay. While Huston (1994) investigated the voluntary feed intake responses to supplementary feeding of Angora does grazing low quality range in Texas, production responses were omitted. A farm study of the economics and productivity of Australian mohair enterprises identified widespread depressed reproductive performance and low fertilizer use indicating low pasture production (McGregor and English, 2010). However, none of these reports provides a description of ideal nutritional management, nor quantifies the production penalties for restricted nutrient provision for Angora does. In summary, very little research has been conducted on the specific nutrient requirements and the effects of nutrient manipulation on the productivity of breeding Angora does.

It is clear from studies with breeding sheep that energy intake is the prime factor affecting productivity (SCA, 1990). Research in southern Australia on annual pastures has shown that non-breeding Angora goats face energy restrictions from summer to winter (January–August), and even at moderate stocking rates they grow very slowly during winter (McGregor, 2010). Given that most Angora goats are managed to kid during the winter and spring period (May to September in Australia), it is highly likely they will experience severe energy restrictions given the physiological requirements for pregnancy and lactation. A similar conclusion was reached in Texas with breeding Angora does (Huston, 1994), and based on Tuncel's (1987) observations, Turkish Angora goats would experience similar nutritional restrictions. Consequently, a series of investigation into the effects of nutrient provision during mid pregnancy and lactation on the productivity of does and kid development has been undertaken using a controlled replicated experiment. Earlier, the effects of mid pregnancy nutrition on doe energy intake, doe production, placenta development, kid birth weight and kid survival were reported (McGregor, 2016). In this report the combined effects of nutrition during mid pregnancy and lactation on doe energy intake, live weight, body condition and mohair production and quality are investigated. Subsequent reports will investigate lactation, kid growth and kid fleece development.

2. Materials and methods

2.1. Design and nutrition treatments

For some of these methods fuller details are provided elsewhere (McGregor, 2016). The design was 3 levels of mid pregnancy (MPN) × 2 levels of postnatal nutrition (PNN) to provide 6 individual treatment combinations. Replicates were 17 randomised live weight and parity blocks each of 6 does. Does were randomly allocated to one of the 6 treatment combinations prior to the experiment commencing. The total of 102 does included 24 twin bearing does. MPN treatments were implemented from days 47–105 after conception as follows:

Control (C) − fed to mimic the usual live weight loses of goats and sheep grazing annual pastures, typical of the wheat-sheep agricultural zone in southern Australia, during summer and autumn. This achieved a gradual live weight loss of 2 kg (−67 g/day) and required energy intake to be reduced to 0.5 × maintenance requirement. Larger live weight losses in goats and sheep are often observed during summer and autumn in wheat belt areas of Australia.

Maintenance (M) − does fed to maintain live weight, which may be achieved by farmers providing small amounts of supplementary feeding during summer and autumn. Live weight maintenance is not normally achieved on farms as the practice is recommended only during long droughts and then only after animals have lost considerable live weight.

Supplemented (S) − does fed to enable moderate live weight gains of 102 g/day. This level of feeding in mid pregnancy has been regarded as uneconomic on commercial sheep farms but sometimes occurs in years of above average pasture growth in wetter years, or where special fodder crops are produced.

From days 105 of pregnancy until 4 days *postpartum* the feeding level was *ad libitum* for all MPN treatments following best practice recommendations for sheep (SCA, 1990). PNN treatments began 4 days *postpartum* and finished 13 weeks *postpartum*. The main PNN treatments were:

***Ad libitum* (AL)** − does fed to appetite, reflecting an 'ideal' feed supply during lactation. This should have allowed maximum energy intake, reflecting excellent spring pastoral conditions.

Restricted (R) − does fed 70% of AL reflecting nutrition restriction such as from heavy grazing, drought, parasitism, adverse weather, competition with another herbivore, or winter kidding.

The 6 individual PNN treatments are described using the combination of the MPN and PNN treatment abbreviations as follows: C-AL; C-R; M-AL; M-R; S-AL; S-R. The method for randomly allocating animals prior to the experiment commencing is described in the following sections.

Following removal from the feedlot at 13 weeks of age, does and kids grazed a perennial ryegrass/subterranean clover pasture until weaning at 16 weeks of age. Does were then grazed on annual pastures until shorn 6 months after kidding.

2.2. Animal source and reproduction

Prior to the experiment adult does were purchased from commercial Australian Angora Studs. Does (n = 250) were placed in an artificial insemination program and on the basis of live weight and fleece weight were randomly divided into 2 equal groups. Does were synchronised using chrono-gest intravaginal sponges (40 mg Flugestone acetate: Intervet International BV, Boxmeer, The Netherlands) which were removed 16 days later and does injected with 200 iu PMSG. Two days later does in oestrus were artificially inseminated with fresh semen. To detect any return to service and to achieve maximum conception rates does were then grazed with the buck (with mating crayons) used in the AI program. All does were scanned by ultrasound at 43 days after insemination or mating, by an experienced sonographer, and identified as either single, twin bearing, or non-pregnant. Normal animal health practices were followed. Does were dosed with an effective anthelmintic (based on faecal egg count monitoring) to remove gastrointestinal parasites prior to mating and on entry to the feedlot. Does were given a 2 ml booster vaccination (enterotoxaemia-tetanus) 1 month prior to kidding. Does were foot parred prior to entry to the feedlot, prior to kidding, and on release from the feedlot.