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Comparison of three systems for concurrent production of lamb meat and wool

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Abstract

An innovative lamb-feeding facility with a raised-slatted floor (RF) was designed and built for the purposes of concurrently producing high-quality, high-value wool and large, lean lamb carcasses. A ration was formulated to provide a low rate of gain in order that lambs attained slaughter weight (59 kg) when they were approximately 12 month of age because a 12-month fleece is a prerequisite for high value in the targeted hand spinning niche wool market. A study was conducted to compare production and quality of wool and meat and associated economics of feeding lambs housed in the RF system versus two conventional systems, a feedlot (FL) and supplementation on pasture (P). For this purpose, 143 5-month-old, male, castrated Rambouillet lambs were obtained and assigned to a production system. Half of the lambs in the RF and FL systems were fitted with protective coats. As planned, daily gain was greater and days to slaughter were less in the FL versus the RF system, with P being intermediate. Final shorn bodyweights were similar in each system, but RF dressing percentage was considerably lower than those in the FL and P systems. This anomaly was likely due to the greater gut fill of RF lambs compared to those in the other two systems. Leaner carcasses were produced in the RF and P systems compared to the FL system. The RF fleeces were heavier than those produced in the FL system with P fleeces being intermediate. Average fiber diameter and variability did not differ among treatments. Though considerably longer than FL staples, wool produced in the RF system was more uniform (CV%) in terms of fiber diameter measured along the staple length. Importantly, coats did not affect rates of gain in either the FL or RF system and had minimal effects on other measured properties. Coated fleeces were only arithmetically higher yielding than uncoated fleeces (55.2% versus 53.4%), but the coated fleeces were visually cleaner and brighter than uncoated fleeces, which is very important for the targeted niche market. Price obtained for coated RF wool sold into a niche market was five times higher than conventionally marketed FL and P wool prices. Net income per head was negative for all three systems (−US$ 0.11, −US$ 2.20, and −US$ 5.57 per head for FL, P, and RF, respectively). In this study, the substantially higher returns from the niche wool market did not compensate fully for the extra cost of production and the extra effort required for niche marketing.

Keywords: Lamb meat; Niche market; Production system; Rambouillet lambs; Wool

1. Introduction

Low wool prices, production of over-fat lambs, and unpredictable, erratic prices for lamb meat are some of the problems faced by U.S. sheep producers. Because wool is an international commodity dominated by the

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major producing countries, Australia and New Zealand, a U.S. wool producer has only limited influence on the value of his clip unless he is able to grow a specialty product and sell into a niche market. To maximize income from wool, a producer would normally raise a fine-wool breed of sheep such as the Merino or Rambouillet. In the United States, the Rambouillet is the dominant fine-wool, dual-purpose breed. Some exceptionally high-value, ultra-fine wool is being produced in Australia by Merino wethers fed maintenance rations and held permanently indoors. This production system was studied by Cottle (1986) and described by Scarlett (1991). In 2004, one bale of this type of extremely fine wool sold for more than US$ 5500 kg^{-1}, clean (Byrns, 2004). After evaluating the economics of this type of production system in a U.S. environment, we decided instead to investigate a system that utilized fine-wool lambs from which three products (rather than one) would be available by the time the animals attained 1 year of age: high quality wool, skins, and lean lamb meat. When fine-wool lambs are fed to slaughter weight in a traditional feedlot, the value of the wool is invariably low due to excessive dirt content and short staple length. Feedlot rations are designed to maximize rate of growth and minimize the number of days on feed. Rarely is consideration given to nutritional effects on fiber quality (average fineness and uniformity, for example). Much has been studied and documented concerning the feeding of lambs (NRC, 1985) and feeding systems for lambs (Kemp et al., 1981) but the search for a cost-effective method to consistently produce large, lean, slaughter lambs continues (Borton et al., 2005). Theoretically, if wool from feedlot lambs could be kept clean and allowed time to grow to ~9 cm in length, its value would be similar to or even greater than wool from adult sheep maintained traditionally on rangeland. This article describes a study with lambs in which we compared wool and meat production and their quality attributes when lambs were fed in a raised-floor (RF) facility with more conventional production in a feedlot (FL) and supplementation on pasture (P). A spreadsheet was developed to facilitate economic comparisons among the three production systems, and a web site was established to advertise and sell the high-quality wool produced in the RF system.

1.1. High-quality wool

"High-quality" is a vague term that is defined here in terms of measurable (objective) and subjective characteristics of wool. The term implies high yielding (>60%), long staple (>90 mm), vegetation free (<0.3%), white wool containing no weak points in the staple (strength > 30 N/ktex) and having very clear crimp definition. It also implies fine (<23 μm), uniform (particularly in terms of fiber diameter and staple length) wool.

1.2. High-quality lamb meat

Marketing surveys of U.S. lamb consumers have shown that most favor a large, rather than a small lamb chop. Though ribeye area is quite variable even within a breed and within a narrow weight range, we selected a target slaughter weight of 59 kg in an attempt to ensure adequate sized market cuts. The challenge was to produce a lamb of this size that was not too fat. Other target specifications were ≥29.5 kg carcass weight, ≤5 mm back fat thickness, and ≤2.0 yield grade.

1.3. Systems

Each of the three systems being compared in this study include the facilities in which the lambs were fed (3), the diets (3), the methods used to sell wool (2), and the methods used to sell hides (1) and meat (1).

2. Materials and methods

2.1. Feeding facilities

A native pasture in West Texas and a drylot were used to feed two groups of lambs. As one component of our attempt to produce high quality wool and lean lamb, a 168 m^2 facility was designed and constructed that consisted of an open-sided, covered shed with a raised, wooden, slatted floor constructed over a concrete slab. This provided adequate space to feed 200 lambs. The slatted floor was designed to release fecal material and urine and was constructed 1.2 m above ground to facilitate removal of manure and provide adequate ventilation. Feeding and watering systems were custom designed to provide adequate access to the livestock while preventing them from contaminating the feed and water with fecal material and urine. An automated feed system was designed to deliver feed by auger into a central feed bunk from an adjacent bulk feed tank. The facility was designed to have a low labor requirement. One person can operate the system for 10 min delivering enough feed for 2 days. In order to evaluate available genetics and develop management practices necessary to produce uniformly fine, strong, and clean fleeces and large, lean carcasses from lambs fed a low-energy diet, several feeding studies (Lupton et al., 1998, 1999, 2000) were conducted in this facility over a 3-year period prior to initiating the study described here.

2.2. Experimental design

Recently weaned, unshorn Rambouillet male castrated lambs ($n = 143$, age = ~5 months) were vaccinated for entero-