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Performance of purebred Welsh Mountain and crossbred ewes in a hill environment

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ABSTRACT

The aim of this study was to compare the body weights, body condition scores, survival and litter weights of lamb produced by pure Welsh Mountain ewes with those of crossbred Cheviot, Lleyn, Poll Dorset and Texel ewes in a hill environment. Ewes were mated to Suffolk rams and recorded over the first 3 seasons of production. Between lambing and weaning, ewes rearing single lambs grazed semi-natural hill swards (1.5 ewes/ha) and those rearing twins grazed improved enclosures (10 ewes/ha). Cross-breeding significantly ($P<0.001$) increased body weights at all ages, with values for four-year old ewes of 45.9, 57.2, 51.6, 57.8 and 58.5 kg in purebred Welsh Mountain and Cheviot, Lleyn, Poll Dorset and Texel crossbred ewes respectively. Individual lamb growth rates from birth to 8 weeks and from 8 weeks to weaning were significantly higher in the progeny of crossbred ewes ($P<0.001$) with highest growth rates for lambs reared by Poll Dorset and Texel cross ewes. Individual lamb weaning weights were 27.0, 29.4, 29.2, 30.4 and 30.7 kg for lambs reared by purebred Welsh Mountain and Cheviot, Lleyn, Poll Dorset and Texel crossbred ewes respectively. Survival rates to third mating were 0.73, 0.77, 0.83, 0.72 and 0.75 ($P<0.05$), litter size reared was 1.22, 1.33, 1.49, 1.43 and 1.25 ($P<0.001$) and litter weights at weaning were 37.1, 43.5, 46.1, 46.5 and 44.2 ($P<0.001$) for purebred Welsh Mountain and Cheviot, Lleyn, Poll Dorset and Texel crossbred ewes respectively. Efficiency expressed as kg litter weight/kg ewe pre-tupping weight$^{0.75}$ was significantly improved ($P<0.001$) by crossbreeding. Total litter weight at weaning over three lamb crops per ewe entering the flock was increased from 78.4 kg in purebred Welsh Mountain ewes to between 97.1 kg in Cheviot and 109.7 kg in Lleyn crossbred ewes. It is concluded that where feed resources are adequate, the retention of crossbred ewes in the hill flock can give significant improvements in productivity.

1. Introduction

Approximately 40% of ewes in the United Kingdom are maintained in the hills and uplands (Pollott and Stone, 2006) and are adapted for survival on extensive grazing of unimproved, semi-natural pastures, in difficult climatic conditions. Typically, the ewes are purebred, are of low mature body size and produce slaughter lambs with light weight carcasses and poor conformation scores (Kempster and Cuthbertson, 1977). Within the stratified breeding system of the UK, hill breeds make a large genetic contribution to lamb meat production (Pollott and Stone, 2006), in

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part, through the direct slaughter of lambs produced by purebred hill ewes and, in part, through the contribution hill sheep make to the crossbred ewe populations maintained in the lowlands. Consequently, attempts to improve the genetic merit of hill ewes for maternal and meat characteristics are likely to have industry wide impact on the amount and quality of lamb meat produced. However, although within breed genetic improvement has been demonstrated to be effective in increasing mature size, maternal productivity and lamb growth and carcass quality (Ap Dewi et al., 2002; Conington et al., 2006; Lambe et al., 2005, 2008), progress is restricted by the low number of recorded progeny involved in breed improvement schemes (Amer et al., 2007).

Crossbreeding offers the potential for more rapid change in ewe and lamb productivity than can be achieved by within breed selection and may bring enhanced performance due to heterosis. However, crossbreeding is little used in the hill environment (Rodriguez-Ledesma et al., 2011) due to the difficulties of managing the breeding programme on unfenced pastures. Nevertheless, the effects of heterosis on ewe fertility, the survival and weaning weights of lambs (Nitter, 1978) justifies attempts to manage crossbreeding in these harsh environments. The relative benefits of complementarity and heterosis have been demonstrated for crosses of a range of hill breeds with local Scottish Blackface stock (Al-Nakib et al., 1997). Evaluations of more extreme crosses (including Lleyn and Texel) demonstrated enhanced individual and lifetime performance relative to the purebred Scottish Blackface (Annett et al., 2011a, 2011b) without apparent detrimental effects on ewe mortality or lamb survival. The knowledge gained from such crossbreeding studies may be applied directly to improve productivity in regular crossbreeding systems, or indirectly in the creation of composite breeds which may bring benefits in terms of ease of management, a planned mix of complementary traits, retained heterosis and flexibility in future breeding plans.

The Welsh Mountain is numerically the second largest UK breed and represents approximately 10% of the UK ewe flock (Pollott and Stone, 2006). The mature size of the Welsh Mountain ewe is the lowest of the commercial breeds in the UK although this varies widely with strain differences (Friggens et al., 1997) that reflect local variations in pasture quality. Changes in subsidy payments from headage-based to area-based schemes, has encouraged a reduction in stocking rates and raised the potential for the introduction of larger, more productive ewes based on within breed selection, breed substitution or crossbreeding (Rodriguez-Ledesma et al., 2011), which may reduce dependence on subsidy payments (Ripoll-Bosch et al., 2013). The aims of this work were to compare the performance and survival of purebred Welsh Mountain ewes and Cheviot, Poll Dorset and Texel crossbred Welsh Mountain ewes in a hill environment. Cheviot rams were chosen to increase body size whilst retaining hardiness, the Lleyn for maternal characteristics, the Dorset for its longer breeding season and earliness of maturity, and the Texel for its carcass qualities and current, commercial use as a component of crossbred ewes in the upland environment.

2. Materials and methods

This work was conducted at Pwllpeiran farm in the Cambrian mountains of West Wales, UK. The farm extends to 1346 ha of grazing land between 200 and 625 m above sea level. Annual rainfall ranges between 1700 mm and 2200 mm depending upon elevation. Approximately 29% of the farm area is improved perennial ryegrass (*Lolium perenne*) based swards which are used for silage conservation, grazing of twin rearing ewes and lamb finishing. The remainder of the farm provides semi-natural rough grazing, consisting of mosaics of sown fine leaved grasses and degraded areas dominated by *Nardus stricta*, *Juncus effusus*, *Vaccinium myrtillus* and *Calluna vulgaris*.

The work was carried out in two phases with the production of crossbred ewes from Welsh Mountain dams in the first (McLean et al., 2006), and the evaluation of crossbred ewe performance in the second. Over three years (2000–2002) Cheviot, Poll Dorset, Lleyn and Texel rams were selected from the top 20% available from breed-wide sire reference schemes and mated to 600 Welsh Mountain ewes per year using laparoscopic AI. Overall, eight rams were used per breed: two in year one and three/year subsequently. Single born crossbred lambs were reared on semi-natural rough hill grazing and twins on improved pastures until weaning at 16 weeks of age. At weaning, 50 ewe lambs per crossbred type per year were retained for breeding. Pure Welsh Mountain ewe lambs were selected from the parent Welsh Mountain flock at weaning and run with the crossbred ewe lambs as a single group on improved swards of perennial ryegrass dominant pastures until October. In October all ewe lambs were sent to lowland swards of perennial ryegrass for wintering until late March. Subsequently, they grazed hill pastures until 3 weeks before mating, when they were moved to improved pastures for flushing.

During 2002–2006, all ewes in the crossbred evaluation phase of the trial were allocated to mating groups at random within crossbred ewe type and age group. Ewes were mated by natural service using Suffolk rams at a ratio of 50 ewes per ram (10 ewes per crossbred ewe type) over an approximately twenty eight day breeding period. Ewes that did not conceive during this period were covered by Texel sweeper rams and excluded from the data base for that season of production. Ultrasonic pregnancy diagnosis was undertaken in January each year. All ewes in their first parity (two years old) were housed for the final 6 weeks of pregnancy and fed grass silage and concentrates according to predicted litter size. In subsequent parities only twin and triplet bearing ewes were housed. Single bearing ewes were maintained on pastures and fed grass silage supplemented with feed blocks until lambing. After lambing, single bearing ewes were grazed on semi-natural hill pastures at 1.5 ewes per ha, whilst twin rearing ewes were retained on improved perennial ryegrass (*L. perenne*) based swards at up to 10 ewes per ha until lambs were weaned at 18 weeks of age.

Pre-mating and post-weaning live weights and body condition scores (measured to the nearest 0.25 units on a scale of thin (1) to fat (5)) were recorded for the ewes (Russell et al., 1969). All lambs were weighed at birth, eight

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