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SHEEP IN THE HUMID TROPICS - Evolution of the Fiji Sheep

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ABSTRACT

The wet tropical conditions that prevail throughout the Fiji islands are conducive to major problems with nematode parasites in grazing small ruminants. Early efforts to increase sheep meat production in order to reduce reliance on imported products were hampered by the reliance on British sheep breeds which failed to thrive under the hot humid conditions and inappropriate management systems which were often exacerbated by massive parasite infections. To overcome these difficulties, a foundation flock of 37 Barbados Blackbelly sheep was imported from the USA in 1980. These were crossed with Wiltshire, Poll Dorset and Corriedale ewes. It was soon apparent that the Barbados Blackbelly Wiltshire cross was the most desirable type because of their fleece shedding ability, rapid growth rates and higher reproductive rates compared to the other crossbreeds. Subsequent selection within the desired phenotype has resulted in the development of a breed of hair sheep with good growth rates and more recently, parasite resistance has been included in the selection criteria. The estimates of heritability of parasite resistance for this tropically adapted sheep genotype is approximately 30% and strong demand for the sheep both locally and within the South Pacific region is now being expressed

INTRODUCTION

Sheep have been in Fiji continuously since 1888, however, they have not thrived due to the use of inappropriate breeds and management systems. These factors combined to produce a characteristic pattern of declining sheep numbers after each importation of sheep with numbers falling to around 50 head by 1963.

The introduction of tropical hair sheep into Fiji was first suggested in 1953. However, quarantine difficulties resulted in the idea being postponed. It was not until 1980 that a flock of 37 Barbados Blackbelly (BBB) sheep were imported from the United States of America and placed under 10 years of high security quarantine on the island of Makogai. Diseases of concern were: Bluetongue, Brucella abortus, Maedi-visna, Jaagsiekte, Contagious Caprine Pleuro-pneumonia, Caseous Lymphadenitis and Scrapie[1].

In 1982, a flock of 51 Wiltshire Horn crossbred (W) ewes was imported from New Zealand. These sheep together with a group of Corriedale (C) ewes from a flock maintained by the Fiji government at the Nawaicoba Quarantine Station, joined the BBB flock to begin the cross breeding programme. In the same year they were joined on the island by a flock of 200 Poll Dorset (PD) stud ewes from Australia. The breed development programme is described.

THE FIJI ISLANDS

The Fiji Island group consists of more than 330 islands with a total land area of 18,378 km^2 scattered over 709,660 km^2 of ocean, between latitudes 15°S and 22°S and longitudes 174°E and 177°W. Of the total land area, 87 percent is made up of the two main islands Viti Levu (57%) and Vanua Levu (30%). The topography of the large islands is one of coastal flats and plains (11% of total land area) rising through moderately sloping land (14% of total land area) to a mountainous backbone (75% of total land area) [2].

The major climatic influences on Fiji are the South East Tradewinds and the maritime environment that moderates ambient temperatures. The mountainous nature of the main islands, and the prevailing trade winds combine to create three climatic zones: a wet zone without a marked dry season in the windward areas, a dry zone with a distinct dry season in the rainshadow areas and an intermediate area in the transition zone between the wet and dry areas. Annual rainfall ranges from 1800 - 3200 mm depending on location within the climatic zones.

THE BREED DEVELOPMENT PROGRAMME

For the first two years, a random breeding programme with full pedigree records was followed. This involved the mating of all ewe breeds to BBB rams and the evaluation of the performance of the crossbred offspring. The initial evaluation was on two main characteristics viz. the growth rates and woollessness of the offspring.

Reproductive Performance of the Ewe Breed

The reproductive performance of the temperate ewe breeds used in the breeding performance was highly variable with the Poll Dorset and Corriedale ewes exhibiting lower lambing percentages than the BBB and W ewes. The variability in reproductive performance was the result of a number of factors, some of which are discussed below.

Management

Until 1983 the flock was managed by local officers with no experience of sheep management. This undoubtedly contributed to the poor performance of the introduced ewes. It was not until 1983 that experienced sheep managers namely an Australian Project Manager and a New Zealand volunteer, were involved in the project.

Ram Preference

During the first two years of the cross breeding programme the reluctance of the BBB rams to mate the wool sheep was a major problem. There can be little doubt that the BBB rams were shy of the C and PD ewes. However, no such reluctance was seen in matings with BBB and W ewes and this undoubtedly affected their lambing performance. The introduction of Wiltshire Horn (WH) rams to the flock resulted in an improvement in the performance of the C and PD ewes.

Ewe Nutrition.

There was also evidence that the PD ewes suffered a setback in their growth upon arrival in Fiji. Investigations into the causes of infertility on Makogai found a higher proportion of barren ewes (60%) in ewes under 45 kg live weight than ewes over 45 kg (40%) at mating.

Ewe Body Temperature

Investigations also revealed a relationship between ewe body temperatures and lambing rate, with the lower rectal temperatures of the BBB and W ewes being associated with higher lambing percentages.

It is apparent from an investigation of mating records that oestrous detection failure and silent oestrous or anoestrous in a number of the ewes may have contributed to the problem. The high proportion of ewes returning to service and the absence of a significant difference in oestrous cycle length, indicates that the cause was largely one of failure of conception rather than early embryonic mortality.

The Performance of the Offspring

The performance of the various offspring was compared on the basis of growth rates degree of wool cover (Wool Shedding) to formulate a breeding policy for the future of the project in 1983.

Liveweights.

Liveweight differences between the BBB and various crossbreeds are presented in Table 1 below.

Table 1: Comparison of the Performance of BBB Crossbreeds on Makogai in 1982.

Breed	Birth Weight. kg. (n)	Six Month Weight kg. (n)	Twelve Month Weight kg. (n)
BBB	2.3^{A} (53)	18.5^{A} (39)	26.9^{A} (46)
BBB x C	1.9^{A} (8)	22.7^{B} (8)	31.7^{B} (8)
BBB x PD	2.5^{A} (10)	23.9^{B} (10)	33.2^{B} (10)
BBB x W	4.0^{B} (26)	26.0^{C} (25)	37.0^{C} (24)

Note: 1: means in the same columns with different superscripts differ significantly ($p<0.05$)

The BBB x W lambs were significantly heavier at birth than pure-bred BBB, or the C and PD crossbred offspring. At 6 months of age they remained heavier than the other crossbreeds both of which were heavier than the pure-bred BBB lambs and that the significance was still significant at 12 months of age.

Wool Shedding Ability

It was apparent from the appearance of the crossbred offspring that the BBB x W crossbreeds had a greater wool shedding ability than the BBB x PD and the BBB x C offspring with 22 percent of the BBB x W crossbred offspring shedding their fleeces completely.

FORMULATION OF THE BREEDING PROGRAMME

As a result of the observed differences in the characteristics of the various cross breeds a meeting in June of 1983 developed a breeding policy that defined the target animal as follows:

- The animal should not require shearing
- The animal should exhibit good growth rates under Fiji conditions (a target of 35 kg live weight at 6 months of age was set).
- The animal must be fertile and be a non seasonal breeder.
- The animal should not suffer from conformational faults.
- The animal exhibit reasonable tolerance to internal parasites and footrot and exhibit general hardiness.

The general aim of the breeding programme was to develop a non-seasonal easy care sheep suited to local environmental conditions and management systems.

The superior performance of the BBB x W resulted in the BBB x W becoming the basis of the breeding programme. In order to maximise the number of W ewes for crossing with BBB rams, more W crossbred ewes were imported. Wiltshire Horn Rams were also imported for crossing with the C and PD ewes to generate W ewes which were mated to BBB rams.

The BBB x W forms the basis of the Fiji Sheep, though preference has been more towards the selection of a white hair sheep rather than one that sheds its wool, as the shedding animals were found to be more susceptible to sunburn than were hair sheep.

The results of the 1982 cross breeding were subsequently confirmed by the performance of the lambs born during 1983. The BBB x W crossbreeds again exhibited superior liveweights than the pure-bred BBB ewes and the C and PD crossbreeds (see Figure 1 below).

The Performance of the Ewe Flock

The comparative performance of the various ewe breed and crossbreed is presented in Table 2 below. The BBB x W ewes have consistently outperformed all other breeds and cross breeds.

Figure 1. Comparative growth rates BBB and crossbreds

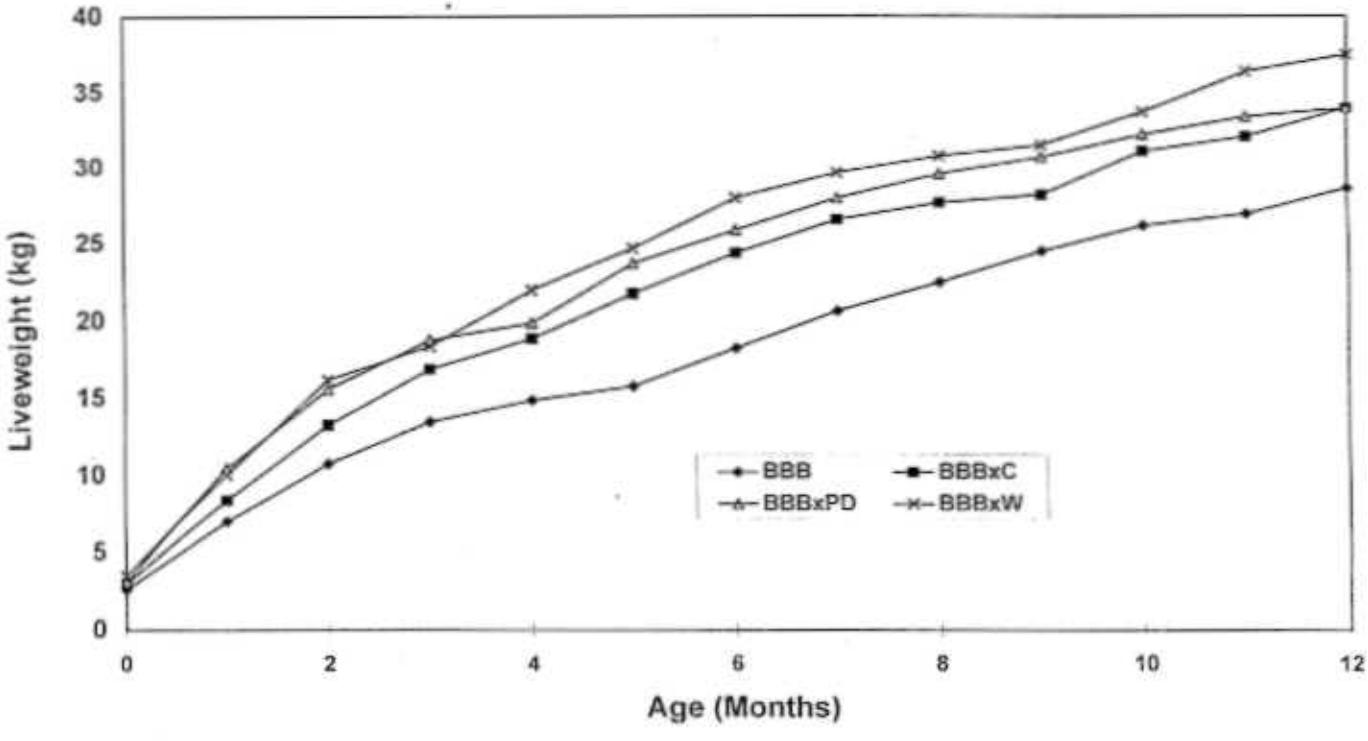

Table 2: Comparison of the Productivity of Pure-bred and Crossbred Ewes at Makogai

EWE BREED	Pre-Mate Wt (kg)	Sire Breed	Conception Rate (%)	Lambing Percent	Weaning Percent	Flock Mortality (%)
BBB	31.5	BBB	86	111	95	16
C	48.9	WH	48	57	48	5
PD	49.2	WH	49	61	53	10
W	46.9	BBB	83	103	97	}
WH x PD	37.7	BBB	49	58	54	130
WH x C	37	BBB	36	58	66	}
BBB x C	38.5	WB	88	113	103	5
BBB x PD	40.4	WB	87	110	101	5
BBB x W	38.5	WB	89	133	116	6

Note: Figures presented are 3 year means.

Health Problems

The major health problem faced in sheep flocks in Fiji is helminthosis with the moderate climatic conditions providing near optimal conditions for larval growth throughout the year [4]. In government sheep flocks, helminthosis contributes to 53 percent of total mortality on an annual basis [5]. Traditional control programmes relied upon chemotherapy with three to four weekly drenching being recommended [6,7]. However, with the threat of anthelmintic resistance, [8] it is apparent that there is a need for the development of alternative control methods.

The use of a 28 day 8 paddock rotational grazing system has been shown to provide good parasite control in sheep under Fiji conditions with the need for drenching being reduced to 2 - 3 times per year [9,10].

Positive responses to improved nutrition have also been recorded with supplementation of ewe hoggets with a urea molasses feed block resulting in a 66% increase in lambs born at first lambing and an 82% increase in the total weight of lambs weaned. The addition of fenbendazole to the block has resulted in even greater production increases of 83% and 138% respectively [11].

Attempts to increase the levels of host resistance to parasites are in progress and good progress is expected due to the moderate heritability of faecal egg count in the local sheep (0.27 ± 0.07) [12]. Selection of replacement rams now requires the inclusion of faecal egg count as a selection criteria.

A new area of investigation currently being pursued is the biological control of the free-living parasitic stages on the pasture with three species of *Oligospora* being isolated recently. Investigations into biological control are ongoing and attempts to isolate the nematophagous fungus, *Duddingtonia flagrans* in Fiji, are continuing.

DISCUSSION

The breeding project, after overcoming early difficulties associated with the reproductive performance of the temperate ewe breeds, has successfully developed a breed of sheep suited to local conditions. The exact causes of the reproductive difficulties are unknown though it is likely that they are the result of a combination of factors which include aspects of management, ram preference and breed adaptability. The selected Fiji sheep exhibits good reproductive performance and growth rates under Fiji conditions, however, further selection is required to meet the target growth rate of 35 kg. at 6 months of age, and host resistance to parasites.

The main problem faced by smallholder farmers at present is that of internal parasitism. Research into alternative methods of parasite control is the major aim of the current research programme.

At the end of quarantine in 1991 the local breed was released to farmers for the first time. Currently there are 71 smallholder sheep farmers who raise sheep. Whilst the performance of the sheep on farms varies between farms, their performance is

encouraging and there is little doubt that there is a future for the local breed of sheep in Fiji.

The success of the Fiji sheep has resulted in a number of enquiries being received from neighbouring countries wishing to purchase the breed for evaluation under their own conditions with the aim of developing their own sheep industries. However, the government priority at present is to develop the local sheep industry first with exports receiving a low priority.

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