APPLICATION OF NUCLEUS BREEDING SCHEMES IN A CORPORATE SETTING:
SHEEP, BEEF CATTLE AND DEER.

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SUMMARY

Effecting the improvement of industry breeding programmes is complicated by the fact that breeders and producers view the merit of programmes differently. Corporate breeding programmes, however, are viewed from a single-ownership perspective that is commercially oriented. Centralised decision making improves control of the programmes, operating them with the total livestock population in mind. Corporate programmes also offer advantages of an improved animal breeding structure, more disciplined integration of breeding, production and marketing, and flexibility to adapt to changes in production and marketing environments.

INTRODUCTION

Landcorp Farming Limited is a subsidiary of Land Corporation Limited, a New Zealand State Owned Enterprise formed in 1987 from the former Government Department of Lands and Survey. Landcorp Farming Ltd commercially farms sheep (1,000,000 ewes), beef cattle (60,000 cows), deer (9,000 hinds) and fibre goats (27,000 does) on over 150 properties, covering some 450,000 ha throughout New Zealand. These populations are supplied with sires bred in 12 open and 14 closed nucleus breeding programmes, recording a total of some 15,000 ewes, 1,800 beef cows, 500 hinds and 1,300 does. The present paper discusses the approaches available to effect livestock genetic improvement and how these are applied through the application of nucleus breeding schemes within Landcorp Farming Ltd's corporate framework.

SINGLE OWNERSHIP ADVANTAGES

Industry breeding programmes are designed to disseminate improvement down an often multi-tiered hierarchy from relatively few breeders to ultimately many commercial producers. The structure of industry breeding programmes is such that breeders and producers often view the programmes from different perspectives and by different criteria (Hill, 1981). Corporate breeding programmes, on the other hand, are viewed from a single ownership perspective that confers several advantages to the system, including the control of policy decisions, improving the structural aspects of animal breeding, closer vertical integration of breeding, production and marketing, and selection flexibility.

POLICY CONTROL

The profit motivation in a corporate setting results in a more formal decision making process. Decisions on breeding objectives, selection criteria, recording systems, mating policies, etc., can be centralised for coordinated control of the breeding programmes.
For example, the breeding objectives for corporate breeding programmes can be confined to those that support the commercial direction of the corporation. Thus, operating under a commercial pastoral farming system, Landcorp Farming Ltd's overall breeding objective is to increase net returns per female wintered; this coincides with the Corporation's commercial goal. With a predominance of maternal breeds of sheep (Romney), beef cattle (Angus) and deer (Red deer), Landcorp Farming Ltd's breeding objective includes cost and return components of both female fertility and individual productivity (wool, meat). Terminal sire breeding programmes are operated under a modification of the above objective, since their contribution to base female returns is derived from the slaughter of (crossbred) progeny. Corporate breeding programmes can therefore be coordinated to define objectives according to their commercial role in the total animal production system. In this way, corporate breeding programmes operate from the perspective of the total population.

**STRUCTURAL ASPECTS OF ANIMAL BREEDING**

Single ownership of both land and livestock provides corporations with the opportunity to establish their own population structures and breeding plans without the propertial problems that may beset other industry programmes. As Richard (1987) noted, an emphasis on improving the structural aspects of animal breeding may be more useful than elaborate statistical/computing aids or testing facilities to keep less efficient structures in existence.

In Landcorp Farming Ltd's case, two-tiered, open nucleus breeding structures have been adopted to maintain each of its sheep, beef cattle and deer populations. Under extensive pastoral-based conditions, such structures exploit the genetic contribution from the base populations while concentrating objective selection effort in the nucleus flocks and herds. The genetic principles of nucleus breeding systems, and their relative advantages over more traditional breeding systems have been well documented (eg, James, 1977). However, documentation of breeding schemes in practice has been limited to those aspects where adequate information has existed in both the nucleus and base populations. Predominantly, these analyses have involved Landcorp Farming Ltd's Waihora Romney and Angus Breeding programmes.

Nicoll and McArthur (1988) reported an expected return of $21.7m (1988 $) over a 50-year time horizon in the Waihora Romney Breeding Programme. The study valued theoretical expectations of asymptotic genetic gains based on actual transfer and selection rates in the system. From the perspective of the base flocks in this breeding system, Nicoll (1989) compared the physical and financial records of two flocks generated over 14 years by continually backcrossing to either average-merit Waihora nucleus-bred rams or to representative industry-bred rams. The Waihora-bred ewe weaned 0.129 more lambs (P<0.01) and annually earned an additional $2.11 compared with the industry-bred ewe.
In the nucleus of the Walhora Angus Breeding programme, primary selection is applied to replacements using a selection index combining the individual's data and dam's updated data. Over a 9-year period (1976 to 1984), the cumulative selection differential for the index had reached 1.9 standard deviations in the final year, with similar values also for three of the four component traits (Nicoll and Johnson, 1986a). Positive estimates of genetic trend in weaning weight (1.1 kg/year) and yearling weight (1.3 kg/year), both being components of the index, have also been reported (Nicoll and Johnson, 1986b). From the perspective of the base herds in this system, Walhora-sired cows weaned an additional 5.3 kg of calf weight compared with industry-sired contemporaries (Nicoll and Johnson, 1986b).

Such analyses have indicated that Landcorp Farming Ltd's open nucleus flocks and herds are genetically improving, and that the sires disseminated to the commercial levels are transferring productive (and hence financial) improvement. Emphasis on objective selection, selection intensity and generation interval in the nucleus, and an efficient dissemination structure, is considered to benefit the total corporate population.

VERTICAL INTEGRATION

Corporate ownership results in a more disciplined integration of breeding, production and marketing environments. Flexibility to quickly accommodate new or changed market requirements can be deliberately exploited. For example, a new market for heavyweight lambs indicated that Landcorp Farming Ltd should produce improved terminal sires for its commercial properties. The decision was made to establish two open nucleus synthetic ram breeding programmes, initially screening in young ewes on the basis of liveweight. Within three months, some 250,000 yearling ewes on the Corporation's properties throughout New Zealand had been individually weighed, with 2500 screened into the two nucleus flocks to commence first-phase matings. During this time, breeding plans for the two nucleus flocks and appropriate flock mating systems for the commercial properties, had also been outlined.

Vertical integration of breeding, production and marketing also enables corporate properties to be operationally stratified. In Landcorp Farming Ltd's case, the most extensive properties are used as replacement generators for less-extensive rearing properties. These in turn generate either two-breed or three-breed crosses for finishing on the more intensively managed lowland holdings. It is noted that the Corporation's maternal breed nucleus flocks and herds are located in the more extensively-operated areas, in order to breed sires in the environment in which their progeny will perform. Correspondingly, the terminal breed nucleus units are generally located in the Corporation's more intensive regions.

In association with this operational stratification, corporate production systems can exploit both within- and between-breed variation. In beef cattle for example, Landcorp Farming Ltd's predominantly Angus base population is maintained using its Angus bulls bred in three (sire-linked) open nucleus breeding programmes.
Nucleus herd numbers total 1000 recorded cows, disseminating some 200 bulls annually. Surplus females in the base are either directly mated to terminal sire breeds, or to bulls of a second maternal breed, the female progeny of which are subsequently mated to terminal sires. Charolais, Simmental and Santa Gertrudis bulls are used as the major terminal sire breeds, being bred on Landcorp Farming Ltd’s four performance-selected nucleus breeding herds (totalling 550 cows). Similar systems are now being established for the Corporation’s sheep and deer populations.

With all species and at all levels in the stratification, using performance-selected sires from Landcorp Farming Ltd’s own breeding programmes enables continued improvement to be achieved above that expected from heterosis per se.

**SELECTION FLEXIBILITY**

A variety of species, breeds and strains involved in corporate breeding programmes can increase the likelihood of productive suitability to local physical and economic environments. For example in the northern region of New Zealand, Landcorp Farming Ltd operates a nucleus breeding programme for facial eczema-tolerant Romney rams to sire commercial progeny less susceptible to this disease in the autumn-humid conditions prevalent on its properties in this area.

Genotypic variety also provides flexibility to accommodate future changes in physical or financial environments. A developed Chevon industry in New Zealand for example, would enable Landcorp Farming Ltd’s imported Boer goat bucks to be used as terminal sires over its surplus commercial fibre-producing does.

**CONCLUSIONS**

Centralised decision making, emphasis on structured animal breeding, and control of the breeding, production and marketing functions, confers advantages to corporate-based breeding programmes. It is noted however, that such advantages are most likely to arise where the corporation’s profit is primarily derived from the sale of commercial livestock products.

**REFERENCES**