THE MEAT ELITE PROJECT: ESTABLISHMENT AND ACHIEVEMENTS OF AN ELITE MEAT SHEEP NUCLEUS

R. Banks
Animal Science, University of New England, Armidale, NSW 2351

SUMMARY
The Meat Elite program was established to evaluate advanced measurement technology through an elite nucleus flock within the Poll Dorset breed. The program generated high rates of genetic progress for a terminal sire sheep breed, generated an excellent research database, and enhanced adoption of LAMBPLAN by meat sheep breeders. Problems inherent in multi-owner nucleus programs meant that this scheme has evolved to using a young sire referencing system in place of a single elite nucleus flock. This will maintain or increase rates of genetic gain, but at higher cost per unit of gain and without exploitation of Computer Tomography (CT) technology in a systematic way.

Keywords: Meat sheep, nucleus programs, measurement technology

INTRODUCTION
Prior to the late 1980’s, genetic progress in lean meat production in sheep was retarded through a combination of poor market signals and limited technology for assessment of fatness on live animals. During the 1980’s, ultrasound equipment was evaluated for measuring backfat and BLUP technology became increasingly available and accepted for use in animal breeding. With the introduction of LAMBPLAN and signs that commercial producers would actively seek out genetically superior seedstock, a foundation was established which could support investment in advanced measurement technology and elite breeding flocks.

Recognising this foundation, and having access to a Computerised Tomography (CT) scanner, scientists at the University of New England initiated a nucleus breeding program in 1989/90, centred upon use of the CT Scanner and employing full animal model BLUP. This became the 1st stage Meat Elite program.

THE MEAT ELITE PROGRAM - STAGES IN DEVELOPMENT
Meat Elite I. The first stage of this project (Meat Elite I) involved only 7 Australian terminal sire breeders, with LANDCORP Farms as a corporate member. This stage successfully established a nucleus flock and carried out one mating and scanning cycle, but thereafter was disbanded. The main weakness of the venture at this stage was the heavy reliance on 1 breeder, who managed the nucleus flock and supplied 50% of the nucleus ewes. Ironically, during Meat Elite I, progeny of Carwell Poll Dorset sires were identified as having extreme muscling, which subsequent investigation has suggested is due to segregation of a single gene. Animals descended from those identified during Meat Elite I have performed extremely well in Meat Elite II and across the Poll
Dorset breed. It is also ironic that LANDCORP Farms have recently purchased their own CT Scanner for use in a terminal sire breeding program.

Meat Elite II. Upon disbandment of Meat Elite I, considerable effort was put into maintaining the program but with wider membership and a clear and separate role for management of the nucleus flock. This resulted in the establishment of a nucleus of 330 Poll Dorset ewes contributed by 65 breeders, on a property at Walcha, NSW. Contributed ewes were where possible selected on LAMBPLAN information, and the initial sire team was drawn from across the Poll Dorset breed, including some sires that had performed well in LAMBPLAN Central Progeny Tests.

In this stage of the program (Meat Elite II), Meat Research Corporation (MRC) funding was extended to cover CT scanning and nucleus management costs, and the funding goals were set as:

- to evaluate the effect of LAMBPLAN Selection Indexes on carcase traits
- to evaluate CT Scanning as a tool for terminal sire meat sheep breeding
- to demonstrate the value of elite nucleus breeding flocks for applying advanced technologies and achieving high rates of genetic gain.

Operation and Achievements of Meat Elite II. Operation of the nucleus flock can be summarised as follows:

- the nucleus was closed to female introductions for the first 3 years,
- the aim was to use 15 sires per year: 12 new young sires and 3 older sires,
- all progeny had birth weight, weaning weight, post-weaning weight/fat/eye muscle depth, and a range of CT measures recorded, in addition to a series of subjectively assessed traits,
- ewes were randomised by weight and fat (phenotypically) for allocation to sire groups,
- rams were first used at 7 months of age, and all rams were used equally,
- over 3 joinings, 42 sires (bred in 21 flocks) and over 500 dams were used,
- selection was primarily based on LAMBPLAN EBVs and Index values, with consideration given to maintaining a spread of grand-sires of each successive drop.

This selection and measurement protocol ensured a balanced design for parameter estimation and that within the categories sires, dams, young males and young females, all candidates for selection had very similar accuracies. The practical effects of this became more noticeable in the 2nd and 3rd progeny drops, as the breeders involved in selecting replacements relied more and more on EBVs and Index values. Genetic trends in Meat Elite II were positive for weight, fat and muscle, and resulted in 3 progeny drops that were well above breed average on LAMBPLAN Index value (Figure 1).

Figure 1 suggests that initial selection of nucleus sires and dams was successful. Closer examination of the data reveals that the superiority of the 1992 drop animals was entirely due to sire selection: contributed females were breed average on Index, most likely reflecting reliance on aspects other than EBVs in selection of contributed ewes. The decline in average Index value between the 1992 and 1993 drops reflects selection on aspects other EBVs, a relatively limited
pedigree database for the flock, and uncertainty about the breeding objective for the flock. By contrast, sires of the 1994 drop were selected almost entirely on EBV/Index and using an Index similar in emphasis to the LAMBPLAN 60:-20:20 index, and this is reflected in the gain of over 4 index points (0.4 genetic standard deviations) between the 1993 and 1994 drops.

![Genetic trends in index value in Meat Elite II and the Poll Dorset (PD) breed.](image)

Figure 1. Genetic trends in index value in Meat Elite II and the Poll Dorset (PD) breed.

Success of Meat Elite II is evident from across-flock evaluations for the Poll Dorset breed, where (at November 1995) 7 of the top 10 sires on Index were bred in the Meat Elite II nucleus flock. Evidence of breeder acceptance of the results of the program is shown by average progeny number for all Meat Elite-bred sires being nearly twice the average for all Poll Dorset sires (up to November 1995).

**Meat Elite III.** MRC funding for nucleus management and CT scanning ceased in 1995 (with the scanning of the 1994 drop). At this point, members of Meat Elite II had to decide whether to raise the c. $100,000 pa for program management and retain the nucleus, or disperse and decide what (if any) form of cooperative breeding program to maintain.

The outcome is a young sire progeny testing program across 45 Poll Dorset flocks, involving cooperators using semen packages from 3 young sires to produce c. 50 progeny per flock. Semen
packages are randomised across cooperators to ensure even linkage between all flocks and minimum variance in package mean genetic merit. The initial “young sire team” comprises 18 rams (14 1995 drop, plus 4 older sires), and averages 139 on LAMBPLAN 60:-20:20 Index (compared to the 1995 Poll Dorset drop average of 105.5).

This extension of the Meat Elite program has appealed to breeders because it carries no marginal cost for maintaining a nucleus, and offers greater individual flexibility and involvement in the overall breeding program, while maintaining high commitment to genetic progress. There is a trade-off involved: selection of male and female replacements from a total pool of over 12,500 animals against the lower accuracy of ultrasound scanning compared to CT and greater variation in accuracy of EBVs due to different attention to recording amongst members.

MESSAGES FROM MEAT ELITE I, II, AND III
The Meat Elite program has been successful in a) establishing a research database for evaluating CT scanning, b) demonstrating the capacity of an elite nucleus flock (and LAMBPLAN itself) to deliver high rates of genetic gain, and c) developing a working relationship between scientists and breeders. The stages in the program reflect many of the operational problems of multi-owner cooperative breeding schemes, and of managing investment in genetic improvement in an environment of sub-optimal flow of signals from consumer to breeder and resultant restricted returns for seedstock.

Other studies have shown that nucleus systems are ideal for capturing benefits of advanced measurement and reproductive technology (Thompson et al, 1995), but that tight vertical integration is necessary to capture benefits, and hence to support the investments required. The Meat Elite III program offers an alternative approach in which greater involvement and spread of responsibility must be weighed against potentially greater financial efficiency of a nucleus-based scheme. It is entirely possible that if Meat Elite III members can build market share and strengthen their returns from ram breeding they will be in a position to reconsider use of nucleus flocks within the near future.

ACKNOWLEDGMENTS
Meat Elite I and II were supported by the Meat Research Corporation, and involved significant inputs from UNE and NSW Agriculture staff.

REFERENCES