# OPTIMUM REPLACEMENT STRATEGIES FOR SUCKLER COW BEEF HERDS

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## INTRODUCTION

Traditionally many UK suckler beef herds have relied on beef x dairy heifers from the dairy herd as replacements. The availability and beef merit of these animals has declined over the last decade, due to a reduction in the size of the dairy herd and increased use of Holsteins. This has led to a need to explore alternative strategies.

Given the large number of beef breeds and the wide variety of breeding systems available it is not easy to identify the best combination of breeds and the best system for individual beef producers. The aim of this paper is to study the impact of the implementation of such a change in breeds and breeding system on a hypothetical beef enterprise. The identification of the optimum replacement strategy is achieved by using a bio-economic model that combines the changes in performance due to a chosen shift in breed or breeds and/or mating systems. The model uses the associated population dynamics of a cow herd over a given planning horizon to allow us to identify optimum replacement strategies.

## MATERIALS AND METHODS

Recently, we have developed software called BREEDS which implements a bio-economic model to calculate the performance of beef breeds and breeding systems in different production systems (Roughsedge *et al*., 2002). A detailed description of the physical and financial performance of the hypothetical current enterprise and also the genetic make-up of the current cow herd was input to the model. Key descriptors of the enterprise being investigated in this paper are seen in Table 1. The genotype of the current herd is pure-bred Angus. Breeding system and potential future breeds and systems studied can be seen in Table 2. The enterprise is a 100 cow spring-calving herd. Grass is available to all animals to appetite during the grazing season and silage is provided during winter housing.

Three future systems considered are, 1) maintain the pure bred Angus herd; 2) use of a composite bull to grade up the current herd; and 3) rotational cross breeding to grade up the current herd. The same three breeds (South Devon, Red Poll and Belgian Blue) are considered in systems 2 and 3. The composite system is based on the assumption that a stabilised three breed composite bull is available to grade up the current herd. The rotation brings in bulls of the three breeds in successive generations.

Underlying the software is a database of average breed trait values from Roughsedge *et al.*, (2001). The software develops scaling values between the described performance of the current genotype and the underlying database prediction. These scaling factors are then used to predict the physical performance of future generations. The software includes a population dynamic model (Amer *et al.*, 2002) which predicts the age and breed structure of the herd over time and this information is combined with the physical production information to produce a prediction of economic change due to the change in breeds and mating strategy.

**Table 1. Model input parameters describing current enterprise**

| Reproduction | |
|---|---|
| Heifers Calving at 2 Years Old (%) | 50 |
| Heifers Calving at 3 Years Old (%) | 50 |
| Cow Survival To Next Calving (%) | 85 |
| Cows With 1 Year Calving Interval (%) | 95 |
| Cows With 2 Year Calving Interval (%) | 5 |
| Weights | |
| Birth Male (kg) | 44 |
| 3 Year Old Cow (kg) | 520 |
| Mature Cow (kg) | 570 |
| Slaughter Heifer (kg) | 505 |
| Slaughter Steer (kg) | 580 |

**Table 2. Breeds and breeding system choice for the three options investigated**

| Future Breeds | Future Breeding System | Terminal Sire |
|---|---|---|
| Aberdeen Angus | Pure | No |
| South Devon | Composite | No |
| Red Poll | Grading Up Current Herd | |
| Belgian Blue | | |
| South Devon | 3 Way Rotation | No |
| Red Poll | Grading Up Current Herd | |
| Belgian Blue | | |

**RESULTS AND DISCUSSION**

A detailed prediction of future performance is generated by the model and Figures 1 to 3 show a sample of this information. Figure 1 shows four aspects of physical performance: cow weight, steer liveweight at slaughter, age at first calving and involuntary cull rate. This information is shown by generation and demonstrates how performance varies as the proportion of the contributing breeds and level of heterosis varies between rotational breeding and composite usage. At any time overlapping generations exist. With the rotational approach we see changes in performance over time in both directions, however, the use of composite sires to grade up the pure Angus provide a smooth transition over generations to the new production level. It is predicted that weight of cows will increase and the slaughter weight of steers will increase at a given age. Also seen is a fall in average age at first calving, indicating a fall in the age at sexual maturity. A fall in the predicted survival of the future generations is also predicted.

Figure 2 shows the breed proportions present in the cow herd over time. At any one year of the planning horizon these breeds may be represented by several overlapping generations. Figure 2 demonstrates the time taken to completely upgrade the original breed. It can be seen that there are very different consequences for the two breeding schemes in the breed proportions present over time. The composite system delivers very smooth breed proportions over time, but with the rotation we see a greater influence over time of the first breed of the rotation. This means that when implementing a rotational system, given the time-scale involved, it is important to get the order of the rotation correct.

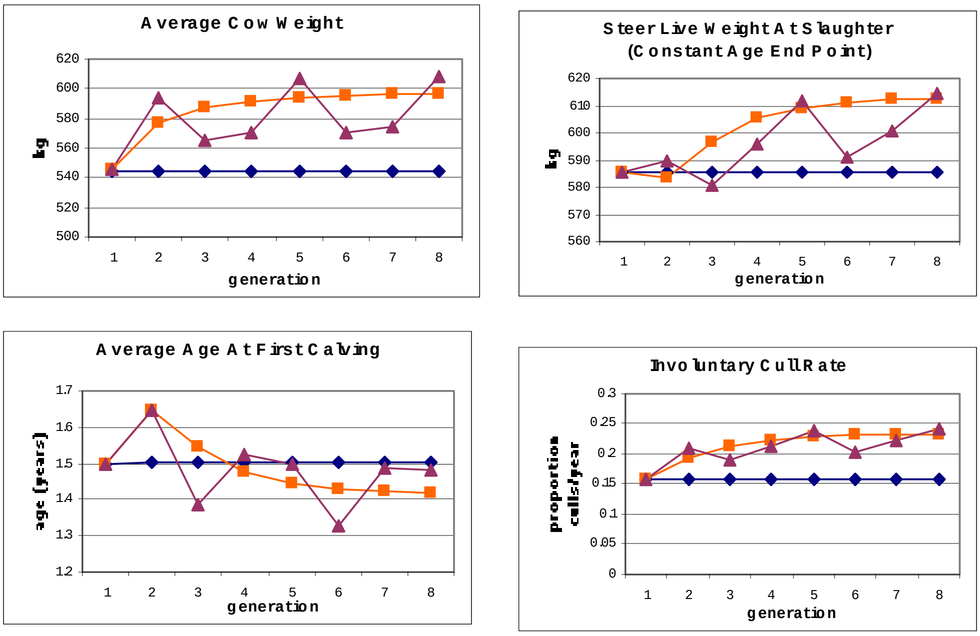


**Figure 1. Predicted performance of alternative breeding strategies starting from a pure Angus herd. (♦ = Pure Angus, 4 = 3 breed composite, ˥ = three way rotation)**

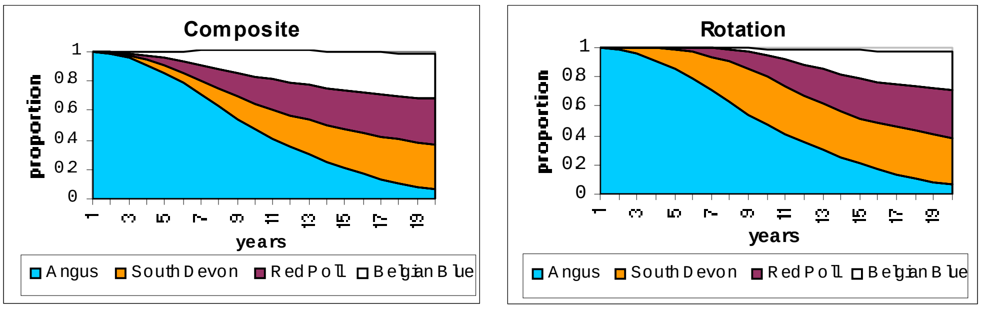


**Figure 2. Proportion of breeds present in cow herd over 20 years grading up a pure Angus herd with a 3 breed composite and a 3 breed rotation, both involving South Devon, Red Poll and Belgian Blue breeds**

Figure 3 shows the percentage changes in costs and returns from the three enterprises. With the two chosen schemes, very similar changes in costs and returns are predicted. Little change is seen in the first seven years, illustrating the long term nature of breeding policy decisions. From seven years until the end of the twenty year planning horizon an increase in both costs and returns is seen for both new systems. The costs rise at a slower rate than returns and indeed costs have stabilised by year 17, while returns are still increasing.

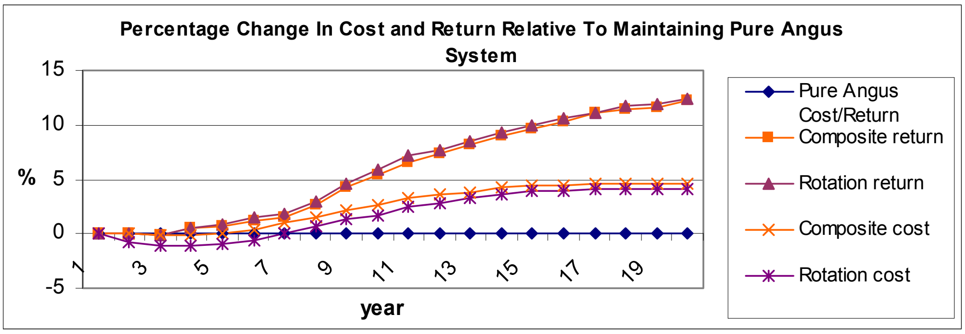


**Figure 3. Predicted change in cost of production and return on production when moving to a three breed composite or rotation as a percentage of cost and return of maintaining pure Angus production**

## CONCLUSIONS

Using a bio-economic model to study the effects of changing breeds and mating systems, on the future output of a beef enterprise, helps us to identify the consequences on costs and returns of such decisions. It also helps us to understand the variation in performance underlying the economic changes. The example used in this paper was chosen purely as an illustrative exercise but demonstrated a potential improvement in return. The best system and breeds will be different for different resources.

## ACKNOWLEDGEMENTS

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## REFERENCES

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