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Breeding and selection goals and animal welfare

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ABSTRACT

Contemporary concerns with animal welfare are increasingly being expressed through reference to the Five Freedoms, paraphrased as animal needs. However, in addition to providing for the needs of livestock, breeding animals to suit the environment, especially in extensive farming systems, is an inherent quality of good stockmanship. Although most farm animal breeding goals are directed at increasing productivity, some, for example resistance to disease or ease of giving birth, also contribute to enhanced animal health and welfare. Increasingly societal expectations are shaping the practices of animal rearing and management, and more recently breeding. It is suggested that those responsible for breeding and selection acknowledge the potential animal health and welfare consequences, both positive and negative, of breeding goals. In so doing that they be prepared for the need to articulate those goals in terms of animal health and welfare, or the need for relevant animal husbandry skills and resources. Subsequently, where necessary they incorporate animal welfare objectives into their breeding programmes. In addition, animal welfare interests need to be aware of the limitations of relying solely on the Five Freedoms, or needs of animals, and acknowledge the wider aspects of good animal husbandry which contribute to animal welfare.

Keywords: animal welfare; genetic selection; breeding goals; animal production.

INTRODUCTION

While compassion towards animals has long been a feature of our interactions with animals, a cornerstone of animal husbandry, the keeping of livestock in largely relatively confined and barren environments has brought modern concern for animal welfare. The necessity of caring for animals in traditional husbandry systems has been replaced by regulations in more industrial systems (Rollin, 2008a). This change has seen the evolution of the Five Freedoms, paraphrased as animals' needs in the New Zealand Animal Welfare Act 1999. These needs are proper and sufficient food and water; adequate shelter; the opportunity to display normal patterns of behaviour; physical handling in a manner which minimises the likelihood of unreasonable or unnecessary pain or distress; and protection from, and rapid diagnosis of any significant injury or disease.

An animal's needs can be modified by breeding. In extensive farming systems especially, it is a key component of good stockmanship. In an era of contemporary concerns with animal welfare being expressed through the Five Freedoms, there is little formal acknowledgement or guidance relating to genetic selection. The objective of this paper is to reflect on the relationship between animal welfare, and breeding and selection goals, within the context of improvements in farm animal production.

FARM ANIMAL PRODUCTIVITY

Along with improvements in nutrition, housing and health, farm animals have long been selected for increased productivity. A dairy cow, for instance, produces much more milk than is required to raise a calf. Her production can be two to 12 times more than that of a beef cow. A hen lays over 300 eggs per annum, many more than her ancestor the jungle

TABLE 1: Example of the increases in animal productivity recorded in New Zealand in the last four to five decades.

Animal	Trait	Increase in production	Reference
Chicken	Weight at 42 days of age (kg)	1.2 (1970) to 2.6 (2005)	Cooper-Blanks (1999)
Hen	Eggs laid per annum	130 (1975) to 312 (2008)	M. Brooks (Personal communication)
Pig	Piglets sold per sow per annum	13.6 (1977) to 18.6 (2007)	McIvor (2008)
Dairy cow	Milk fat produced per cow per year (kg)	106 (1948) to 173 (1998)	Holmes (1998)
Sheep	Lambs weaned per ewe joined per year	100 (1991) to 124 (2003)	Davison (2004)
	Wool shorn per head per year (kg greasy)	5.3 (1991) to 5.8 (2003)	

fowl's three to seven eggs per clutch. The domestic sow, partly derived from the wild European boar, can produce at least two litters of 10 or more piglets a year compared with a single litter of two to five young produced by her progenitors. Over the last four to five decades, there have been considerable increases in the productivity of farmed livestock in New Zealand (Table 1).

Many breeding goals are directed at further increasing productivity. For example, the average relative emphasis for selection indices in Holstein dairy cattle calculated over 15 countries was 59.5% for production, 28% for durability and 12.5% for health and welfare (Miglior *et al.*, 2005). Similarly, 52% of papers at two international livestock genetics meetings were related to meat and milk production with less than 2% related to welfare (Kahi *et al.*, 2006). Control over breeding direction is normally limited to a relatively small number of production traits. In dairy farming for example, these include the yield of milk, milkfat, and protein, fertility, udder health and survival, along with 17 traits other than production, that include live weight, management and conformation (Animal Evaluation Unit, 2009). While the effects on animal welfare of the increases in productivity of the last four to five decades are undocumented, and likely to also reflect improvements in management, nutrition and health, it would seem sensible to acknowledge the potential for breeding for increased production to compromise animal welfare.

UNDESIRABLE EFFECTS OF INCREASED PRODUCTIVITY

Increased productivity may come at a cost through changes in traits, management, and the environment. Intensive housing, associated with enhanced production, may also alter animal fitness as the animal's resources allocated to increased production cannot be used for other functions (van der Waaij, 2004). Loss of fitness is particularly evident in increased behavioural problems, ill-health and infertility (see Kjaer & Mench, 2003; Whitehead *et al.*, 2003; Dobson *et al.*, 2008), some 'production diseases' (Payne, 1972; Mulligan & Doherty, 2008) and the result of questionable systems of production (Rollin, 2008b). There are many specific examples in the international literature (Ott, 1996; Grandin & Deesing, 1998; Rauw *et al.*, 1998; Millman *et al.*, 2000; Webster, 2002) including:

- increased muscle growth in Belgian blue beef cattle resulting in difficult calving,
- elimination of the 'unfashionable' dewlap about the throat and brisket of beef cattle reducing the animals' tolerance to heat,

- increased lameness, mastitis and infertility in some high-producing dairy cows,
- skeletal disorders, increased lameness and cardiac failure in some broiler chickens selected for rapid growth and
- high levels of aggression in male broiler chickens, often injuring and killing females as a result of deficiencies in behaviour such as courtship.

The undesirable side effects of selection may require enhanced husbandry skills, resources or effort to realise the potential of selection and, if necessary, to address any adverse impacts on animal welfare. For example, selection for growth in poultry may lead to substantial reductions in the environmental temperature at which different genotypes achieve their potential growth rates (Emmans & Kyriazakis, 2000). Increasingly though, they may also represent a trend towards the breeding of farm animals that are progressively unfit for purpose. Arguably those most becoming so are the broiler chicken and the high-producing dairy cow (Webster, 2006; 2008). Conversely, welfare can be enhanced through selection (see Pryce *et al.*, 1998; Sandøe *et al.*, 1999; Faure *et al.* 2003) and modern biotechnology programmes promise to do likewise (see Laible, 2009).

SOCIETAL EXPECTATIONS

Animal welfare is among the many expectations modern society has of agriculture, albeit one of less importance than aspects such as food safety and quality (Verbeke & Viance, 2000; Eurobarometer, 2004). Consequently, the treatment of animals is increasingly being shaped through legislation, codes, animal welfare monitoring and quality assurance schemes. Although focussing on the methods of animal rearing and management, attention has recently been directed at selective breeding. This is because "genetic distortion [by artificial selection] is no less devastating to chickens than confinement" contributing to morbidity, disability and pain, and death (Tsovel, 2006; see also Jensen *et al.*, 2008). A 2001 headline in *The Independent*, one of the United Kingdom's leading newspapers, stated "Selective breeding is more worrying than GM food." Referring to the broiler chicken, the article began by asking "at what point does the search for ever cheaper food come up against the obstacle of legitimate concern for animal welfare? The answer: some time ago" (Anonymous, 2001). The United Kingdom's Farm Animal Welfare Council (2004) report on animal breeding recommended the development of husbandry systems to support the demands of new genotypes; and an evaluation of the ethical and welfare problems arising from livestock breeding.

Compassion in World Farming, arguably one of the more influential international animal welfare organisations, considers that selective breeding causing suffering is “indefensible on moral and welfare grounds” (D’Silva & Stevenson, 1995). For example, the present range of unintended consequences in modern pig farming include increased hunger, metabolic stress, and weaker legs and backs. Future breeding could be used to increase resistance to stress and disease, reduce aggression, and produce sows with better maternal qualities (Arey & Brooke, 2006). There may also be limits to breeding. The European Food Safety Authority (2007) recently indicated that average litter size should not exceed 12 piglets born alive.

The above views are reflected in the international literature. For example, pig breeding programmes should pay more attention to ‘societally important traits’ such as animal health and welfare and the ecological effects of production, as well as the traditional focus on productive and reproductive traits (Kanis *et al.*, 2005), or that animal breeding should consider its impact on genetic diversity, the environment and society (Olesen *et al.*, 2000). The term ‘robustness’ to describe the inclusion of traits related to health and welfare in breeding programmes, has now entered breeding vocabulary (Star *et al.* 2008; Klopčic *et al.*, 2009). Within modern biotechnology, there is an expectation that animals should be no worse off for having been genetically modified, the principle of conservation of welfare (Rollin, 1995). In contrast, Vanhonacker *et al.* (2009) surveyed citizen’s farm animal welfare concerns finding that genetic selection was of little concern, at least compared with the space available to animals.

Society’s expectations are also reflected in legislation, for example the United Kingdom’s Animal Welfare Act 2006. A requirement to take reasonable steps to ensure animals’ needs to be protected from pain, suffering, injury and disease, logically includes the impacts of breeding and selection on, for example, strains of broiler chickens predisposed to leg injury and consequent chronic pain (Knowles *et al.*, 2008). Legislation could thus require breeding companies to produce genotypes which are fit for purpose.

INCORPORATING ANIMAL WELFARE INTO BREEDING GOALS

Since societal expectations are increasingly shaping farming practices, including breeding, it is suggested that those responsible for breeding and selection may have to formally address them as with recent initiatives by the European Forum of Farm Animal Breeders (2006) and New Zealand’s Livestock Improvement Corporation (Fisher &

Mellor, 2008). Firstly, this could include acknowledging the potential animal health and welfare consequences, both positive and negative, of breeding goals. Although most farm animal breeding goals may be directed at increasing productivity, some, such as resistance to disease and parasites and tolerance to cold, also contribute to enhanced animal health and welfare (Scobie *et al.* 1999; 2007; Lawrence *et al.* 2004; Morris *et al.* 2004; Forrest *et al.* 2007). Secondly, industries could be prepared for the need to articulate breeding goals in terms of enhanced animal health and welfare, or at least the need for relevant animal husbandry skills and resources to match any loss of fitness. In extreme cases, animal husbandry may be unable to keep pace with genetic improvement. Finally, and if and where appropriate, traits ensuring or enhancing animal welfare may need to be incorporated into breeding programmes. In a country dominated by extensive pastoral farming, this may mean ensuring animals have or retain the capacity to adapt to their environment (see Faure *et al.*, 2003; Korte *et al.*, 2007). Breeding should not increase an animal’s sensitivity to environmental factors such as the weather, without the ability of the animal to cope, or without the provision of suitable additional resources or husbandry for the animal.

In summary, in addition to providing for animal’s needs, those responsible for the care of animals need to ensure those animals are genetically suited to current and future environments and production systems. However, if animal welfare can be compromised by genetic changes aimed at increasing production, it seems irresponsible to do so without at least justifying why those genetic changes are being made.

RESPONSIBILITY BEYOND THE FARM GATE?

On the face of it, societal expectations to maintain or enhance animal welfare in breeding programmes may be viewed as yet another example of “those who want to manage a farmer’s resources at no cost or risk to themselves” (Reynnells, 2007). This is especially since productivity and welfare are often inversely linked. In some systems welfare may decline as breeding objectives redirect an animal’s resources (Phillips, 1997).

However, and as has been repeatedly alluded to (Kilgour, 1985; Appleby, 1999; Webster, 2005, 2008) responsibility for animal welfare does not rest with farmers alone but also with wider society. Increases in animal productivity add to human wealth, health and well-being. As Kant stated “he who wills the end wills the means also” (Midgley, 1983). Increasing an animal’s productivity is essentially a means of maintaining the economic

viability of farming in the face of falling food prices and farm returns. It would therefore seem irresponsible to continue to do so without a wider societal understanding of these pervasive influences. "Can we escape the mentality that bigger [more productive] is always better?" (Cheeke, 1999). Society may need to fully explore and develop the means of facilitating and encouraging those entrusted with the genetic resources of our domestic farm animals to protect and enhance their welfare.

One mechanism is for consumers to pay more for higher welfare (Webster, 2009). This is increasingly occurring in Europe as sales of perceived high welfare products, such as free-range eggs are reportedly stronger than other perceived high value products such as organically grown foods (Food Ethics Council, 2009). Under pressure from the popular media and, especially, celebrity chefs, supermarkets are competing to promote audited, high animal welfare products. Consequently, producers are keen to get contracts with premium prices in return for compliance with welfare standards defined and audited by the supermarkets. Supermarkets have also been instrumental in developing slower growing strains of poultry with a lower prevalence of leg weakness. Increasingly, such initiatives are being publicly recognised. As an example the Compassion in World Farming Compassionate Supermarket Award reflects performance in key areas of farm animal welfare. The United Kingdom's Royal Society for the Prevention of Cruelty to Animals (RSPCA) Good Business Award similarly recognises companies in food and other industries attaining higher standards of animal welfare. Another mechanism is subsidised support for animal welfare such as the Scottish Government's Rural Development Programme supporting, among other things, veterinary involvement and membership of quality assurance schemes (Scottish Government, 2007).

CONCLUSIONS

Breeding domesticated farm animals has been likened to 'playing God' with the future in our hands (Sandøe *et al.*, 1999). In addition to increasing animal productivity, selection is also a means of eliminating harmful characteristics and promoting desirable ones. Future breeding programmes should not only be used to increase production and production efficiency, but also consider, and if necessary alleviate, any adverse impacts on animal welfare, especially those likely to become unacceptable to an increasing number of people. Finally, these sentiments should not be restricted to farm animals but widened to include any animal, including companion, sport and research animals, whose genetic makeup is being altered.

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