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Sentience, animal welfare and sustainable livestock production

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Summary

Consumer-driven pressures are now leading to rapid change in agriculture. More and more of the public think of livestock on farms as sentient beings and have concerns about animal welfare and the local and world environment. There has been rapid development of animal welfare science, including pain assessment, and consumers are requiring that animal welfare be considered in all food production. Truly sustainable animal production systems are urgently needed. A system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action. A production system might be unsustainable because of: inefficient usage of world food resources; adverse effects on human health; poor welfare of animals; harmful environmental effects such as low biodiversity or insufficient conservation; unacceptable genetic modification; not being “fair trade” in that producers in poor countries are not properly rewarded; or damage to rural communities. Any of these inadequacies could result in the quality of the product being judged as poor.
Silvopastoral systems are becoming important in livestock production as they are sustainable. Particularly valuable examples of silvopastoral systems include three-layer plant production, with pasture, shrubs with edible leaves and trees that may also have edible leaves. The production of leaves and other material that can be eaten by the animals is much greater than can be achieved by pasture-only systems. Results presented from tropical and sub-tropical studies show that cattle production can be better, biodiversity much increased, animal disease reduced, and animal welfare improved by better availability of shade and other conditions selected by the animals. There are also possibilities for feeding tree and shrub leaves to pigs, poultry or farmed fish.

Key words sustainability, animal welfare, sentience, silvopastoral, livestock, disease control

Consumers and sentience

Consumers can demand from retail food companies that they use ethical production systems. Most now think of livestock on farms as sentient beings,

as well as having concerns about their local environment, global warming and other climate change. The idea that animals used by people should not be treated like inanimate possessions but should be protected from actions that might cause suffering, is very old and widespread in human society. However, the term 'sentient' is now used in legislation about animals. The European Union Treaty of Lisbon, (European Union 2007), says in the course of a statement about animal protection and welfare (Article 6b), "since animals are sentient beings…". This wording had the intention to protect the animals commonly used by man, for example on farm, in the laboratory, or as companions.

The term sentience has generally been used to mean that the individual has the capacity to have feelings (DeGrazia 1996, Kirkwood 2006). This capacity involves awareness and cognitive ability so is principally in the brain. Sentience implies a range of abilities that are required to have feelings, not actually having the feelings. A definition of a sentient being is: one that has some ability: to evaluate the actions of others in relation to itself and third parties, to remember some of its own actions and their consequences, to assess risks and benefits, to have some feelings and to have some degree of awareness (Broom 2006, 2014).

How clever are farm animals? Many people assume that cows, sheep, pigs, chickens and farmed fish have very limited cognitive ability but those who work with farm animals know that they often demonstrate their cognitive ability in their interactions with people, their own species and their physical environment. Studies in domestic animals of: individual recognition (Kendrick et al 1995), maze learning (Kilgour 1987), remembering formerly visible objects, preparing for possible future problems (Held et al 2000), using information from mirrors (Broom et al 2009) and showing emotional responses to their own learning (Hagen and Broom 2004) or to potential reward situations are reviewed by Broom (2014).

The development of animal welfare science

Scientists and legislators now use animal welfare as a term that is a scientific concept describing a potentially measurable quality of a living animal at a particular time. Such usage has rapidly become widespread during the last thirty years (Broom 2011). However, the use of the term animal welfare was not always as a scientific concept, and indeed there are still many people who are not aware of the modern approach to the subject.

The author's (Broom1986) definition of the welfare of an individual as its state as regards its attempts to cope with its environment refers to all coping systems and so includes feelings and health. It is now used by most welfare scientists and is also, in modified form, by the O.I.E. (World Organization for Animal Health). As explained by Broom (2014) p.28, the O.I.E. text reads like a committee document so has some imprecise parts in it: (a) welfare is not "how an animal is coping" but is a state that reflects how well it is coping; (b) the animal has to cope with its whole environment and "the conditions in

which it lives" might not mean that to all people; (c) the term "innate" would not be used by any modern animal behaviour scientist as it implies uninfluenced by the environment and no behaviour is uninfluenced by the environment.

Welfare can be assessed using a wide variety of behavioural, physiological, clinical, brain function and other measures. Measures of animal disease are often important because health is a key part of welfare. Other measures, for example of behaviour, physiology, immune system function, body damage, etc. are described by Broom (2014) and Broom and Fraser (2015). Welfare is always poor when animals are diseased but pain and other aspects of poor welfare vary with severity of pathological effects and can be measured (Corke 1997, Corke and Broom 1999, Corke et al 2014). Pain systems are clearly demonstrated to exist in all vertebrate animals and a few invertebrates (Sneddon et al 2014). Facial expression scoring systems for pain assessment have been recently developed for use in rodents, rabbits, sheep, goats and horses (Dalla Costa et al., 2014; Langford et al., 2010; Leach et al., 2012, McLennan et al in prep, Broom 2015). The welfare of animals kept extensively can be poor because of heat-stress, parasitic and other infectious disease and low nutrient availability with associated competition (Petherick 2005). The welfare of animals in feed-lots is often worse than that of extensively-kept animals.

It is important to assess how good the welfare is as well as to evaluate poor welfare. The major changes in animal welfare science during the last 30 years have been the refinement in direct measures of animal welfare and the development of welfare outcome indicators that can be used by veterinary and other inspectors, as well as by those who use animals. Welfare outcome indicators have been developed by many scientists, including those involved in the E.U. Welfare Quality and Animal Welfare Indicators (AWIN) projects. Information on the subject is available at the Animal Welfare Science Hub www.animalwelfarehub.com.

Sustainability

A definition of sustainability is: a system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action (modified after Broom 2001, 2010).

What might make an animal usage system unsustainable? The system might involve so much depletion of resource that it will become unavailable. Alternatively, a product of the system might accumulate to a degree that prevents the functioning of the system. However, any effect which the general public find unacceptable makes a system unsustainable. Members of the public in all parts of the world, particularly in developed countries, are now insisting on transparency in commercial and governmental activities and on changes in methods of producing of various products. A production system might be unsustainable because of: inefficient usage of world food resources; adverse effects on human health; poor welfare of animals; harmful

environmental effects such as low biodiversity or insufficient conservation; unacceptable genetic modification; not being “fair trade” in that producers in poor countries are not properly rewarded; or damage to rural communities. Any of these inadequacies could result in the quality of the product being judged as poor. In future, consumers are likely to demand that sustainable systems are used. If they are not, retail companies, production companies and countries that do not produce good quality, sustainable products are likely to be boycotted and hence forced to change (Bennett et al 2002, Broom 2014).

Breeding practices and sustainability

Many of the greatest animal welfare problems in the world at present are a consequence of conventional breeding with insufficient concern about the adaptability of the animals. Chickens, and some other animals reared for meat production, often grow in body size too fast for their legs and have severe leg and other problems. Cows selected for high milk yield often have major leg disorders, mastitis and reproductive disorders as a direct consequence of the high yield (Broom 2014, Broom and Fraser 2015). These problems may be exacerbated by genetic modification, but need not be. Cloning procedures cause such poor welfare in farm animals that the European Union does not allow their use.

In some countries, genetically modified plants are not accepted because of ethical concerns, the issue being whether or not living things should be modified in the laboratory as opposed to genetic changes that occur naturally. There is also concern because protein changes can cause allergies. Genetic modifications in animals can: benefit the animals (e.g. confer disease resistance), or help to treat human disease (e.g. a blood clotting factor in the milk of a sheep), or develop new products for other purposes, or increase efficiency of animal production. Some people accept all of these but others accept some or none as sufficient justification for genetic modification. A major reason for this is that, in some cases, animal welfare may be poorer as a result of the modification. The conclusion of many people is that any production of genetically modified animals should occur only if it has been demonstrated by scientific studies of animal welfare that the welfare of the animals is not poorer than that of unmodified animals as a consequence (Broom 2014).

Sustainable system example: silvopastoral three level systems

Three-level plant production, including pasture, shrubs with edible leaves and trees that may also have edible leaves are an example of a silvopastoral system. A cattle production system whose characteristics and aims include: using three-level or other multi-level production of edible plants, managing the soil taking account of worms and water retention, encouraging predators of harmful animals, minimising greenhouse gas emissions improving job-

satisfaction for stock-people, reducing injury and stress in animals and maximising good welfare, considering how to encourage biodiversity using native shrubs and trees, and utilising the potential for obtaining wood from trees is explained by Murgueitio et al (2008, 2011), Giraldo et al (2011), Naranjo et al (2012), Broom et al (2013).

The production of leaves and other material that can be eaten by the animals is much greater in slivopastoral systems than can be achieved by pasture-only systems. Results presented from tropical and sub-tropical studies show that cattle production can be better, biodiversity much increased, animal disease reduced, and animal welfare also improved by better availability of shade and other conditions selected by the animals. There are also possibilities for feeding tree and shrub leaves to pigs, poultry or farmed fish. Worker satisfaction is generally high in such systems. The biodiversity may be greater than that in natural forest but some wild species can only be conserved by the use of nature reserves.

The welfare of animals in silvopastoral systems has been demonstrated to be better in various ways than that on pasture-only systems (Table 1 where references are quoted). The beneficial effects of shade are substantial in hot weather with cattle skin temperatures up to 4C lower than in pasture-only systems. High temperature reduces foraging times in paddocks fully exposed to the sun. Anxiety and fear, including fear of humans, can be reduced when partial concealment is possible. The increases in predators lowers the populations of ticks and injurious insects, such as horn flies, and hence reduces the incidence of diseases such as anaplasmosis, which has been shown to drop from 25% to <5%. The presence of nitrogen-fixing shrubs such as *Leucaena* improves animal nutrition and this, together with the better water-retention by the soil, reduces the likelihood of thirst and starvation. Feeding behaviour is improved at high temperature and humidity if the animals are in a silvopastoral system (Ceballos et al 2011). It may be that the improvement in dietary choice contributes to this beneficial effect (Manteca et al 2008).

Table 1. Summary of benefits of silvopastoral systems for animal welfare.
data from Broom et al (2013)

Nutritional improvement because of shrub and tree intake (Murgueitio et al 2011)

Thermal comfort resulting from more shade (Galindo et al 2013)

Less fear because of concealment (Ocampo et al 2011)

Health better because more predators of ticks and flies (Murgueitio and Giraldo 2009)

Body condition better because of nutrients, shade and less disease (Ocampo et al 2011, Tarazona et al in prep)

Food intake and social behaviour improved (Améndola 2013)

Better human-animal interactions (Mancera and Galindo 2011)

A study of welfare in three intensive silvopastoral systems was carried out in Colombia with *Leucaena leucocephala* and *Guazuma ulmifolia* as shrubs for browsing at more than 8,000 shrubs/ha and several tree species (Tarazona et al in prep). The needs of the cattle were met, there being good food and water availability, effective body temperature control and physical comfort, good social behaviour and low parasite levels. Some respiratory infection occurred on one farm, but this might be expected by chance.

When the social behaviour of cattle was compared in a silvopastoral system and a pasture-only monoculture system in the region of Merida, Yucatán, Mexico there was more social behaviour in total, more affiliative behaviour and less aggressive behaviour in the silvopastoral system (Améndola et al 2013 and in prep). Social licking was the main affiliative behaviour and head-butting the main aggressive behaviour. The heifers studied showed 46% more social licking but 37% fewer fights in the silvopastoral than in the monoculture system. In the silvopastoral system, 57% of interactions occurred in the shade. Head-butting and chasing occurred in the silvopastoral system but often did not develop into a fight. Social licking is known to occur after the animals have obtained food and shelter (Sato 1991) but it does reduce the heart rate of the participants (Laister et al 2011) and contributes to the stability of social relationships in cattle (Sato et al 1993).

Systems, such as these silvopastoral systems, should be considered by all farmers as consumers are likely to insist on sustainable systems more in the future.

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