SELECTIVE BREEDING

How gene editing will perpetuate animal suffering

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INTRODUCTION

The UK Government is currently proposing to Parliament new legislation on gene editing of plants and animals. In doing so the Government claims that genetic technologies are simply a more rapid and precise way of introducing genetic changes that would otherwise be possible in traditional breeding programmes. The implication being that traditional breeding programmes have been benign in their impact on animal health and welfare, and that therefore, there is nothing to fear from the gene editing of animals. However, as this report shows, traditional selective breeding has had huge detrimental impacts on farm animals. Gene editing is poised to exacerbate these problems.

The detrimental impact of selective breeding for certain physical features on the health and wellbeing of many pedigree and purebred dogs is reasonably well known. Yet, the pain and suffering imposed on farm animals by selective breeding for increased productivity remains largely hidden.

It is over 50 years since Ruth Harrison's book *Animal Machines* gave us, for the first time, an insight into the inhumane nature of industrial livestock production. But now, more than ever, animals are treated as machines. We confine them in cages and crates and in vast overcrowded sheds – conditions based on the efficiencies of a production line rather than being appropriate for living creatures.

Nowhere is our tendency to treat animals as machines clearer than in our use of selective breeding to fine-tune animals to produce ever faster growth and higher yields. This has led to severe health and welfare problems for all the main farmed species.

The public and politicians are largely unaware of the animal welfare and health problems arising from selective breeding, even though, arguably, they cause just as much suffering as poor housing and crowded, barren conditions.

And now the UK Government is likely to make this worse by allowing a new form of breeding – gene editing – in farming in England. If passed, the Genetic Technology (Precision Breeding) Bill would permit gene-edited animals and their progeny to be used on farms, subject to some loosely defined and wholly inadequate animal welfare protections.

The Department for Environment, Food and Rural Affairs (Defra), the Government department proposing the legislation, argues that gene editing simply enables animals to be developed with traits "that could also occur through traditional breeding and natural processes, but in a more efficient and precise way".[1] The implication that gene editing is just an extension of traditional breeding, such as selective breeding, is intended to be reassuring. However, over the last fifty years selective breeding has caused great pain and suffering in farm animals. To understand the dangers posed by gene editing, it will help to examine the problems that have already arisen from selective breeding.

EXECUTIVE SUMMARY

- Over the last fifty years, selective breeding for increased productivity – particularly for fast growth, high yields and large litters – has led to many painful, stressful health and welfare problems in nearly all the main farmed animal species.
- Modern meat chickens have been bred to grow over twice as quickly as 60 years ago, causing hundreds of millions in the UK to suffer from leg disorders each year, while others succumb to heart disease. Hens have been bred to lay over 300 eggs a year – that's 15 times more than their ancestors. They have to draw on their own bone calcium to form eggshells. As a result, many develop osteoporosis, making them susceptible to bone fractures.
- Today's dairy cows have been bred to produce ten times more milk each year than they would naturally produce for their calves, placing great strain on their metabolism and contributing to lameness, mastitis and reproductive and metabolic disorders.
- Large litter size is a significant cause of multiple welfare problems for both sows and piglets, including higher piglet mortality and an increased risk of more shoulder sores for sows, as well as prolonged births.
- Male turkeys have been bred to grow to such great weights and with such disproportionately large breast muscles that many suffer from painful deformations of the hip joints. In addition, most heavy males are so misshapen that they are unable to mate naturally.
- In many cases, selective breeding is indirectly pushing animal agriculture towards greater intensification.
- There is currently just one provision in UK legislation for dealing with the impacts of selective breeding. Paragraph 29 of Schedule 1 to the Welfare of Farmed Animals (England) Regulations 2007 provides that: 'Animals may only be kept for farming purposes if it can reasonably be expected, on the basis of their genotype or phenotype, that they can be kept without any detrimental effect on their health or welfare'. There is similar legislation in other parts of the UK.
- While the principle of this is good, this provision has been widely ignored by the breeding and livestock sectors and is not enforced by the UK authorities.
- In light of the great suffering resulting from selective breeding of farm animals, the UK should be very wary of permitting gene edited animals and their progeny to be used in farming.
- **Gene editing of farm animals should not be permitted other than in the most exceptional circumstances where an independent impact assessment shows that:**
    - **there will be no detrimental impact on animal health and welfare**
    - **no less intrusive method of achieving the desired objective is available**
    - **the desired objective does not entail facilitating the use of industrial livestock systems as these have a wide range of inherent disadvantages for animal health and welfare.**

CASE STUDIES: How selective breeding leads to poor animal welfare outcomes

Broiler chickens

Modern meat chickens – broilers – now grow over twice as quickly as 60 years ago. Traditionally, they would take around 84 days to reach their slaughter weight of 2kg. However, today's broilers have been selectively bred to often reach a slaughter weight of 2.2kg in just 35-38 days. 95% of the broilers reared in the UK are these fast-growing birds.[2]

What grows quickly is the muscle – the meat. But the supporting structure of legs, heart and circulatory system cannot keep pace with the rapidly growing body. As a result, each year hundreds of millions of broilers in the UK – and over one billion in the EU – suffer from painful leg disorders, while others succumb to heart abnormalities.[3] [4] Moreover, compared with slow growing birds, fast growing broilers have higher levels of ascites (build-up of fluid in the abdomen), breast muscle disorders and hock burn, and lower levels of activity.[5] [6] [7] [8]

A report by the European Commission states that around 30% of intensively reared broilers have leg abnormalities and that these mainly result from selection for fast growth.[9] Details of the report are set out in Box 1.

Fast-growing broiler chickens are at higher risk of leg deformities, painful lameness, skin lesions, and sudden death syndrome.

BOX 1: Details from European Commission 2016 report on the impact of genetic selection on the welfare of chickens kept for meat production

Legs and locomotion

"Leg problems affecting the locomotion system, such as bone deformities and lameness, are a major cause of poor welfare in broilers and can have a genetic component. EFSA [European Food Safety Authority] has pointed out that around 30% of commercial intensively reared broilers presented leg abnormalities. These biomechanical limitations are a likely consequence of the morphological changes such as the rapid growth of breast muscle moving the centre of gravity forwards and the relatively short legs in relation to the birds' bodyweight.

That scientific opinion evidenced how the bones of a fast-growing selected strain are more porous and less mineralised than those of a slower-growing control strain. Furthermore, studies showed that slow-growing broilers reared until 56 days had significantly better walking ability than others reared until 42 days of age.

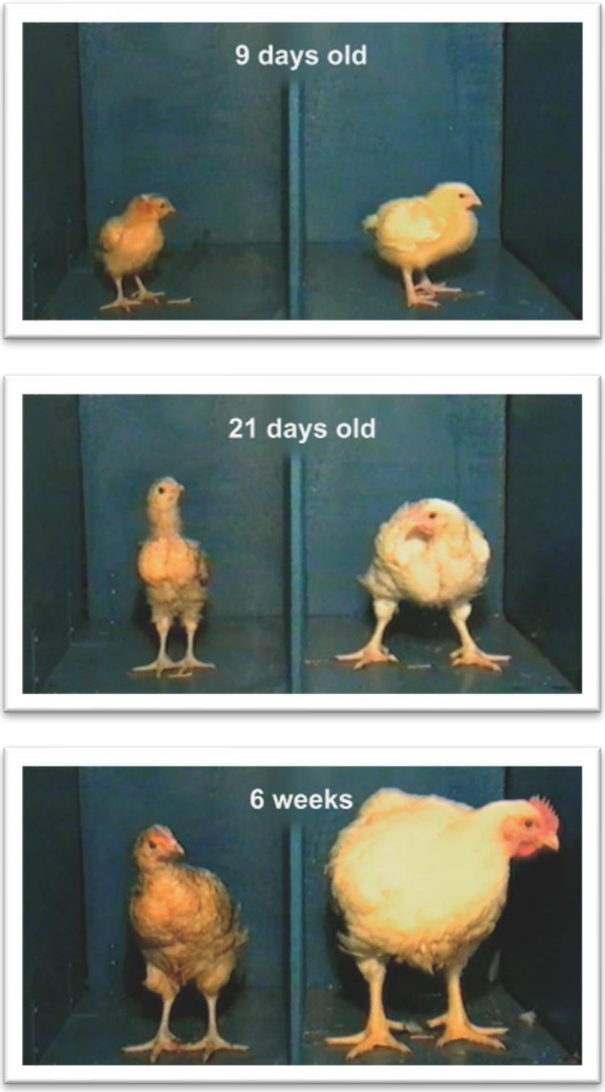
Birds suffering from severe gait abnormalities have difficulties in moving around and are likely to modify their feeding activities, i.e. increasing their time spent lying down due to pain from moving and as a result suffer from higher levels of contact dermatitis."

The report also stated:

Ascites and sudden death syndrome (SDS)

"SDS is the most frequent cause of death in flocks of broilers affecting mainly fast-growing male birds. Fast growth rates achieved by genetic selection increase the risk of these two diseases by increased oxygen demand that puts pressure on the cardio-pulmonary system. Several studies concluded that there is a higher percentage of mortality caused by ascites in fast growing broilers (slaughtered at 42 days of age) than in slow growing broilers (slaughtered at 56 days of age)."

FIGURE 1. Fast growth of broilers compared to laying hens: Laying hen chicks are on the left and broilers on the right. The greater size of the broiler is due to selective breeding for rapid growth.



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Feed restriction of breeding birds results in chronic hunger, frustration and stress

Selective breeding creates another problem. The broilers reared for meat are slaughtered at just five to six weeks of age. But the breeding flock has to survive until sexual maturity at 18 weeks – and be fit enough to breed. Because their fast growth makes them so prone to health disorders, many would die before reaching adulthood. The industry's solution? Slow down the breeding flock's growth rate by feeding them on restricted rations.[10] Alarmingly, they are often given just one third of what they would eat naturally, leaving them "chronically hungry, frustrated and stressed".[11]

Laying hens

The Red Jungle Fowl – the wild birds from whom today's laying hens are descended – lay about 20 eggs per year.[12] By the 1930s we had selectively bred hens to produce around 115 eggs per year. This was still seen as insufficient. And so we pushed on, and bred hens that today produce over 300 eggs a year.

A report by the Farm Animal Welfare Council concludes that genetic selection for high egg yields causes osteoporosis and results in hens being very vulnerable to bone fractures.[13] Its report adds that "it is questionable whether it is possible to maintain egg output of around 300 eggs in the laying cycle while attaining bone strength sufficient to reduce this vulnerability" to bone fractures.

Fernyhough *et al* (2019) point out that such very high egg yields lead to hens' structural bone being utilised in egg shell production; this results in bones becoming osteoporotic and hence to bone fragility.[14] Sandilands (2017) states that today's high yielding hens are "continuously depleting calcium from their bones".[15]

A 2021 Danish study reports that around 85% of Danish laying hens suffer from fractures of the keel bone (a bone extending outward from the hen's breast).[16] The fractures appear to be the result of disproportionately large eggs in hens who are too small for such eggs. This seems to be the result of breeding strategies that aim at smaller hens with a low food intake, while at the same time achieving high egg production coupled with an early start of lay and large eggs. The large eggs apparently pressurise the hens' bodies from within.

Image © Compassion in World Farming

*Laying hens are at high risk of bone fractures due to selective breeding. Researchers say the birds suffer "*both when the fracture occurs and afterwards, so we are dealing with a huge animal welfare problem".[17]

A further problem arises from this insistence on high yields of both eggs and meat. The chicken industry split into two in the mid twentieth century, with some chickens bred to lay huge numbers of eggs, while others – referred to as broilers – were selected for rapid body growth to produce large amounts of meat. And this left no role for the male chicks born in the egg laying flock. They cannot lay eggs and are the wrong body type for meat. And so, each year hundreds of millions of day-old male chicks are killed globally – by gassing or a process called maceration, in which they are 'ground up'.

> ***Laying hens are at high risk of fractures due to selective breeding, causing the birds to suffer, "both when the fracture occurs and afterwards, so we are dealing with a huge animal welfare problem".***
>
> **Asst Professor Ida Thøfner, University of Copenhagen**

Dairy cows

A cow producing just enough milk for her calf would produce just over 1,000 litres in her 10-month lactation. But today's commercial dairy cows have been selected for much higher yields, with average yields of over 7,000 litres per year. And many cows are producing even more than this. The highest yielding cows are producing 10,000 litres a year – in some cases 12,000 litres a year.

A report produced in 2017 by animal welfare expert, Professor Donald Broom, states: "Dairy cows producing large quantities of milk have high levels of leg disorders, mastitis and reproductive disorders. The proportion of cows affected by one or more of these disorders is high and the animals live with the poor welfare for a substantial part of their lives".[18]

A review of the scientific literature concluded that "genetic selection for high milk yield is the major factor causing poor welfare, in particular health problems, in dairy cows".[19] The review added: "The genetic component underlying milk yield has also been found to be positively correlated with the incidence of lameness, mastitis, reproductive disorders and metabolic disorders".

These problems are in part due to the prolonged negative energy balance occurring in the highest producing cows, which causes excessive loss of body condition and predisposes dairy cows to health problems such as reduced fertility, and digestive, metabolic and infectious disease, especially mastitis.[20]

In addition, the review stated that "with increasing production, cows need to spend more time eating and thus have less time available for other activities and may not be able to allocate time enough to fulfil their need for important activities such as resting".

A cow can live for around twenty years. However, after just three to four lactations – milk-producing cycles – today's dairy cows often experience exhaustion and are infertile. An infertile cow cannot produce a calf and so cannot produce any milk and therefore she is prematurely culled.

The move to high milk yields has been a key driver of the increasing use of 'zero-grazing' systems in which cows are kept indoors all year round or for the great majority of the year. This contrasts with traditional systems in which cows graze on pasture during the grass-growing season. Cows cannot produce yields of 10,000 or more litres of milk a year from grass or other forage alone. To maintain these yields, cows are fed on a 'total mixed ration' which includes grains such as maize and wheat as well as forage, minerals and vitamins. The use of total mixed rations is associated with an increased tendency to keep cows indoors all year round.

Zero-grazing entails a number of serious health and welfare problems. Cows who have no or minimal access to pasture tend to have higher levels of lameness, hoof pathologies, hock lesions, mastitis, uterine disease and mortality compared with cows in pasture-based systems.[21] Moreover, cows without access to pasture are unable to engage in key normal behaviours, which include:

- exercise which is needed for normal bone and muscle development;
- foraging, which accounts for a large proportion (up to 80%) of the daily activity of cows kept in a semi-natural situation;
- investigation and manipulation of their environment. Cows have a natural tendency to explore their environment and they show a fair amount of curiosity;
- appropriate social interactions.[22]

Cows cannot properly carry out these behaviours when they have no, or limited, access to pasture.

It is clear that selective breeding for high milk yield has both direct adverse impacts on dairy cow health and welfare and indirect detrimental effects as it is a key factor driving the move to zero-grazing.

Image © Compassion in World Farming

Bred for high yield and kept in poor conditions, dairy cows like these are more likely to suffer painful lameness and infections than cows kept in pasture-based systems.

Pigs

Pigs too have been blighted by the drive for ever higher productivity. Until a few decades ago, the average litter size of sows was nine, but genetic selection has now driven this up to 14 in many countries[23] including the UK[24] and to 17-18 in Denmark.[25]

Consequently, sows have become much larger. The modern hyperprolific sow is over 50% heavier than her equivalent 30 years ago.[26] As a result, some are too big for many existing farrowing crates, particularly those with no adjustable elements to increase length and width.[27]

As long ago as in 1978, the *National Hog Farmer* magazine said: "The breeding sow should be thought of, and treated as, a valuable piece of machinery whose function is to pump out baby pigs like a sausage machine."

This may seem part of a distant past, but more recently, in 2021, the website of a major pig breeding company stated that their sows were: "bred to maximize the pounds of weaned pigs per year … this results in a higher total number of piglets per sow per lifetime". In addition, a photo of a sow on their website is captioned: "Below is our top-selling female product".

Image © Compassion in World Farming

One breeding company boasts of its genetic line with 'Extreme numbers born and reared'. This image shows the reality for many such sows and their piglets on farm. The sow is effectively imprisoned in a farrowing crate, where she cannot even turn around and barely has space to stand up, with a very large litter of piglets.

As sow body size and litter size have increased, so has the milk yield of the sow which is now 50% greater than 30 years ago. Producing so much milk makes it difficult for sows to achieve energy balance and maintain body condition.[28]

The breeding of sows for large litters is a major risk factor for high levels of piglet mortality.[29] Mortality rises with increasing litter size due to a range of factors: low birth weights, variability in piglet weights, a greater percentage of low viability piglets, an increased proportion of crushed piglets, and starvation caused by some piglets being unable to access a teat. [30] [31] [32] The European Food Safety Authority (EFSA) states that piglets without access to a functional teat "will suffer from prolonged thirst and hunger and typically starve to death before they are 4 days old".[33] Many of the causes of mortality (chilling, starvation, injury and disease), may also cause suffering in the piglets that survive.[34]

EFSA adds that piglets with a low birth weight have an increased risk of chilling due to poorer thermoregulatory abilities and that, in the long term, they "show compromised growth, carcass quality and reproductive performance, as they exhibit impaired digestive, cardiac, endocrine and neuromuscular function". Low birth weight is associated with a variety of negative long-term effects on piglet physiology and behaviour, such as increased reactivity to stress throughout the pig's lifetime.[35] [36]

In large litters, the number of piglets born alive typically outnumbers the number of functional teats.[37] When litter size exceeds the number of the sow's functional teats, there is an increased risk – as they compete for teats – of piglets damaging the sow's teats or the faces of litter-mates. To avoid these problems, producers often clip or grind piglets' teeth, even though these procedures are stressful and painful[38] [39] and can act as a gateway for infection. Routine teeth clipping and grinding are illegal in the UK[40] and EU[41] but despite this are widely practised.

Sows with large litters spend longer giving birth and may experience prolonged pain, exhaustion and stress. Sows who raise large litters have to mobilise their body reserves to produce sufficient milk and so are at greater risk of losing body condition.[42] In addition, they have a higher prevalence of painful shoulder sores during lactation as they spend more time lying down.[43] [44]

The problem of shoulder sores has been exacerbated by selection for lean meat and reduced fat. Shoulder sores occur when sows spend long periods of lateral lying in the post-farrowing period where there is sustained pressure on the skin between the bony protuberance over the shoulder joint and the hard floor surface.[45] Baxter *et al* (2018) state: "this pressure occludes blood flow to the area, causing necrosis of the tissue which can increase in severity over time from a superficial inflammation to a deeply eroded ulcer penetrating to the bone".[46]

Where a sow has more piglets than functional teats, the surplus piglets are sometimes transferred to a 'nurse sow' whose own piglets have been weaned at around 21 days of age. The nurse sow will then 'foster' surplus piglets from a newly farrowed sow for a second tranche of 21 days. If farrowing crates are used, the nurse sow will be confined in the crate for 42 days plus the period of around five days in which the sow is kept in the crate before farrowing. Baxter *et al* (2018) state: "This extensive period of restriction prolongs lactational output, impacting on body condition, with potentially injurious consequences".[47] A study of 57 Danish sow herds found that nurse sows had higher levels of bursae (fluid-filled sacs) on the legs and wounds on the udder than non-nurse sows.[48]

Another strategy for dealing with surplus piglets is to keep them in artificial rearing systems. EFSA points out that space allowance in these systems is usually low.[49] EFSA adds that in one commercially available system, the limited space leads to there being little opportunity for piglets to walk around and also to piglets engaging in less play-fighting and spending less time resting than sow-reared piglets. EFSA also states that in artificial rearing systems, there may be lower growth rate and a higher incidence of diarrhoea, while group stress may arise from piglets, who are unable to perform suckling behaviour, redirecting such behaviour (in the form of belly nosing) to their pen mates.

Turkeys

Breeding companies have selectively bred strains of fast-growing, heavy turkeys with large breast muscles as this is the meat favoured by many consumers.[50] Selection has roughly doubled the growth rate of farmed turkeys and body weights have roughly tripled; the average weight of a wild turkey stag (male) is around 7.5kg whereas farmed stags grow to around 21kg.

These heavy turkeys are so abnormally large that their behaviour has been dramatically affected: they can no longer fly (wild turkeys really do fly) and have difficulty walking. The main negative side effects of their size include poor leg health, heart disorders and mating difficulty (described below).

Poor leg health and heart disorders

Poor leg health and lameness is a major welfare concern in turkey production[51]; lame turkeys will be in pain and may find it difficult to walk to reach food and water. Fast growth and heavy bodies put enormous strain on the skeletal structure and physiology of turkeys. This often leads to painful deformations of the hip joints and leg bones and can result in twisted leg positions.[52] These deformities can affect a large number of birds in a flock.[53] More traditional strains do not appear to suffer the degenerative disorders of the hip and other joints that are common in fast-growing strains, likely due to a more normal breast muscle size and slower growth.[54] Fast growing turkeys can also suffer from heart problems.[55]

Mating difficulty

Due to their large body size and oversized breast muscles, most heavy-strain males are unable to mate naturally or cannot do this with the high efficiency demanded by the industry. Moreover, heavy males can injure the females during mating.[56] For these reasons the turkey industry widely uses artificial insemination which has allowed the continued intense selection for heavy body weights.

Image © Compassion in World Farming

Turkeys like these have been bred to grow fast and have disproportionately large breast muscles. This puts them at risk of painful lameness, among other problems, and means that male turkeys cannot even mate properly and would put the females at risk if they tried. Unlike their wild counterparts, they are too heavy to fly.

Farmed fish

Several of the health and welfare problems that affect farmed fish are multifactorial in origin. However, selection for fast and increased growth has contributed to a number of negative side effects.

Since the 1970s,[57] faster and increased growth (measured as weight at slaughter) have been the main traits for which farmed salmon are selectively bred.[58] Farmed Atlantic salmon outgrow wild salmon several-fold due to generations of selection for increased growth.[59]

A range of factors contribute to spinal deformities, which are common in some farmed fish species. Rapid growth is a widely recognised risk factor for spinal anomaly.[60] Lovett *et al* (2020) point out that fast growth is a known driver of spinal deformities.[61] This paper states that "Deschamps *et al*[62] suggested that overload and subsequent deformation of the spinal column could occur where the rate of muscular growth increases without a concomitant increase in vertebral bone deposition. Similarly, Kranenbarg *et al*[63] reported that lordosis [increased inward curving of the lumbar spine] in sea bass may develop due to "buckling" of the spinal column under compressive muscular load during sensitive growth periods, where the mineralized support structures (i.e. vertebrae) are not fully formed".

A substantial proportion of farmed salmon have been observed to have hearing loss of around 50% and fast growth has been shown to be a contributory factor to this.[64] Hearing is a very important sensory tool for fish as they use it to identify their surroundings, communicate and analyse directional information.[65] The high prevalence of hearing impairment in farmed fish has important implications for fish welfare.[66]

Selective breeding for rapid growth is associated with an increased incidence of eye cataracts in farmed Atlantic salmon. [67] [68] One explanation advanced for this is that a relative lack of certain essential nutrients experienced during rapid growth may adversely affect the development of the lens.

Selection for rapid growth is also one of the factors that may be responsible for abnormal heart shape and function in salmon species which predisposes them to cardiac failure during stressful procedures such as grading, crowding, lice treatments and transport (Poppe & others, 2003).[69]

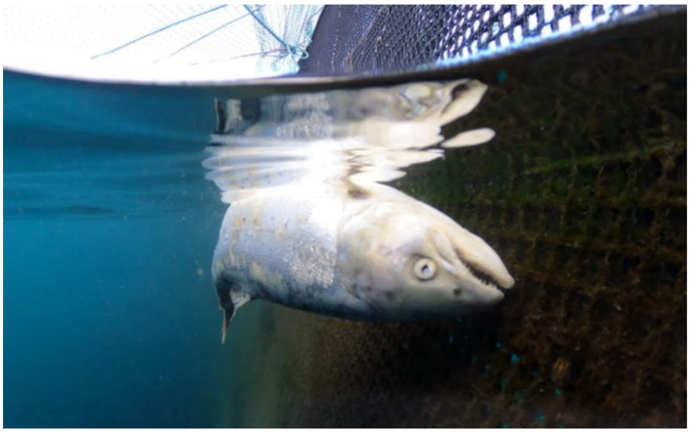

Image © Compassion in World Farming

Selective breeding for fast growth has contributed to a number of welfare problems for farmed fish. Some have abnormal heart shape and function, predisposing the fish to heart failure during the many stressful procedures imposed on them in aquaculture.

UNINTENDED CONSEQUENCES

Clearly the harmful impacts of selective breeding on animal health and welfare are unintended. Nonetheless, such adverse impacts are common. This suggests that those involved in selective breeding are giving insufficient attention to the links between animal anatomy and physiology.

Breeders could, for example, perhaps have anticipated that substantially increasing broiler growth rate and changing body shape would have a knock-on effect on the cardio-pulmonary system and the body's biomechanics. Or that breeding leaner sows would leave them with insufficient subcutaneous fat to protect them from shoulder sores.

SELECTIVE BREEDING TENDS TO DRIVE INCREMENTAL INTENSIFICATION OF ANIMAL AGRICULTURE

In many cases, selective breeding is indirectly but inexorably pushing animal agriculture towards greater intensification i.e. to systems and practices that cannot deliver good welfare. Often the harmful effects of selective breeding are addressed not by rethinking the breeding strategy, but instead by adopting solutions that are stressful and even painful for the animals involved.

Once it was discovered that fast growth rates in broilers meant that many of the breeding flock would be unfit to breed, the industry could have tackled the problem by returning to balanced growth rates, but instead chose to introduce restricted feeding regimes for broiler breeders.

The desire for chickens to produce high yields of both eggs and meat led to the production of males in the egg sector that grow too slowly for today's meat sector. Faced with this crossroads, the industry opted for killing billions of male chicks each year rather than choosing to use dual-purpose breeds that are able to produce both eggs and meat without incurring welfare deficits.

The breeding of dairy cows that produce 10-12,000 litres of milk a year has been a key factor driving the move from pasture-based dairying to zero-grazing.

The production of large litters of piglets leads to increased competition for teats and so to injuries to the sow and litter-mates. Rather than returning to lower litter sizes, the industry uses teeth clipping which is painful. Breeding for excessive litter size has also led to the use of nurse sows to foster surplus piglets, with the nurse sow sometimes being confined for 42 days or more at a time in a farrowing crate.

It's clear that selective breeding tends to drive industrial attitudes and practices and entrenches industrial livestock production.

Image © Compassion in World Farming

The breeding of dairy cows producing 10-12,000 litres of milk a year has been a key factor driving the move from pasture-based dairying to zero-grazing.

The need for legislation to control selective breeding of farm animals

There is an urgent need to strengthen existing legislation to ensure that selective breeding practices, as well as gene-editing, do not compromise the health and welfare of farmed animals. Existing legislation under the Welfare of Farmed Animals (England) Regulations 2007 – and similar provisions in other parts of the UK – has failed to provide adequate protection due to lack of enforcement and because the legislation is couched in very broad language.

Paragraph 29 of Schedule 1 to the Welfare of Farmed Animals (England) Regulations 2007 provides that: "Animals may only be kept for farming purposes if it can reasonably be expected, on the basis of their genotype or phenotype, that they can be kept without any detrimental effect on their health or welfare".

The principle of this provision is good, but it has been widely ignored by the breeding and livestock sectors and is not enforced by the UK Government. Existing legislation should be strengthened to prohibit the selective breeding of farmed animals that has a clear detrimental effect on their health and welfare.

One approach could be that taken by the Council of Europe Recommendations on all poultry species. These helpfully provide that "birds whose genotype has been modified for production purposes shall not be kept under commercial farm conditions unless it has been demonstrated by scientific studies of animal welfare that the birds can be kept under such conditions without detriment to their health or welfare". This requirement should be added to Schedule 1 to the Welfare of Farmed Animals (England) Regulations 2007 – and should apply to both poultry and mammals.

We have looked at the approach taken by several high welfare assurance and certification schemes. Other than with broilers, these schemes mainly use broad language which, if used in legislation, would not give farmers and enforcement officials sufficient certainty as to which genotypes may and may not be used.

We set out in the Annex further possible approaches to legislation designed to clarify for each of the main farmed species the application of the principle set out in Paragraph 29 of Schedule 1 to the Welfare of Farmed Animals (England) Regulations 2007.

CONCLUSION

In light of the great suffering resulting from selective breeding of farm animals, the UK and EU should be very wary of permitting gene edited animals and their progeny to be used in farming. The Government's view that gene editing is simply a faster and more precise form of selective breeding and hence is benign is misguided and misleading – this report demonstrates how over many years selective breeding has led to great suffering for farmed animals as a result of being pushed to ever faster growth and higher yields – in effect turning animals into machines.

We are at a crossroads in terms of industrial farming. Agriculture occupies half of our planet's habitable land and is the largest user, and polluter, of fresh water as well as a driver of climate and nature impacts. Gene editing of farm animals may well lead to further intensified farming exacerbating the adverse impacts of agriculture. Gene editing of animals should not be permitted other than in the most exceptional circumstances where an independent impact assessment shows that:

- there will be no detrimental impact on animal health and welfare
- no less intrusive method of achieving the desired objective is available
- the desired objective does not entail facilitating the use of industrial livestock systems as these have a wide range of inherent disadvantages for animal health and welfare.

ANNEX: Proposals for strengthening existing legislation to control the damaging impact of selective breeding on animal health and welfare

As indicated in the main body of this report, one approach could be that taken by the Council of Europe Recommendations on all poultry species. These helpfully provide "birds whose genotype has been modified for production purposes shall not be kept under commercial farm conditions unless it has been demonstrated by scientific studies of animal welfare that the birds can be kept under such conditions without detriment to their health or welfare". This requirement should be added to Schedule 1 to the Welfare of Farmed Animals (England) Regulations 2007 - and to the similar legislation in other parts of the UK - and it should apply to poultry, mammals and fish. Various other possible approaches are set out below.

In most cases this Annex does not propose precise figures for particular parameters (such as maximum average daily growth rate in broilers) as we presume that if the UK government agrees that a particular parameter is of value in determining which breeds can be used, they would ask the UK Animal Welfare Committee to advise on specific figures (e.g. should the maximum permitted average daily growth rate for broilers be 40g, 50g or 60g?).

Broiler chickens

Various assurance schemes require a maximum genetic capacity for growth that is restricted to an average of a specified number of grams/bird/day. Legislation could take a similar approach. An exception could be provided for a breeding company that is able to demonstrate by scientific studies that a particular breed can (despite exceeding the maximum permitted growth rate) be kept in commercial farm conditions without detriment to the birds' health or welfare.

The use of genotypes where feed restriction is commonly used in the parent and grandparent flocks should not be permitted. Feed restriction could be defined as, for example, where the feed intake is less than X% of an *ad libitum* fed group.

An alternative approach is taken by the *European Chicken Commitment* (ECC).This specifies the breeds that may be used and lays down the procedure that must be followed for adding new breeds to the list of permitted breeds. The ECC requires the use of "breeds that demonstrate higher welfare outcomes: either the following breeds, Hubbard Redbro (indoor use only); Hubbard Norfolk Black, JA757, JACY57, 787, 957, or 987, Rambler Ranger, Ranger Classic, and Ranger Gold, or other breeds that meet the criteria of the RSPCA Broiler Breed Welfare Assessment Protocol".

The RSPCA Protocol requires a breed to be compared to a control breed (the Hubbard JA757) to help inform a decision regarding its acceptability for use. The Protocol sets out in considerable detail how the comparison between the breed being assessed and the control breed must be carried out. It requires the following welfare parameters to be assessed and scored according to the guides set out under Appendix 1 of the Protocol:

i. Walking ability
ii. Feather cover
iii. Breast plumage dirtiness
iv. Leg straightness (angular leg deviations)
v. Pododermatitis (inflammations and ulcers on the footpad)
vi. Hock burn.

Laying hens

A key factor in the development of osteoporosis is the great egg output of modern hybrids. A hen's need for calcium for eggshells leads to a loss of structural bone and osteoporosis and accordingly to a propensity to fracture.

EU legislation could adopt the approach taken by the *Certified Animal Welfare Approved by a Greener World* scheme. This recommends that breeds with a capacity for laying over 280 eggs in a laying cycle should not be used. An alternative would be not to focus on the number of eggs produced in a laying cycle, but instead to set a maximum weight of eggs that can be produced in a laying cycle. An exception could be provided for a breeding company that is able to demonstrate by scientific studies that a particular breed can (despite exceeding the permitted maximum number or weight of eggs) be kept in commercial farm conditions without detriment to the birds' health or welfare.

A Danish study of keel bone fractures[70], which was referred to by Denmark in its note to the December 2021 EU Agrifish Council, demonstrated that a delay in onset of lay resulted in a lower flock prevalence of keel bone fractures. The study found that for every week of age that the onset of lay is delayed, the risk of developing keel bone fractures at the end of the production cycle is reduced by 12%. This indicates that legislation could perhaps prohibit the use of breeds in which the onset of lay is earlier than X weeks of age.

The Danish study also found that egg weight at onset of lay had an impact on keel bone fractures. It reports that "for every gram the egg weight at onset of lay is increased the number of fractures increased by 3%". This factor too could be reflected in legislation.

Dairy cows

The European Food Safety Authority (EFSA) has concluded that "genetic selection for high milk yield is the major factor causing poor welfare, in particular health problems, in dairy cows".[71]

The European Commission states that in the EU, milk yield continued to rise in 2020, reaching 7,509 kg per dairy cow.[72] However, in some Member States average yields were over 10,000kg per cow per lactation.[73] Some high yielding cows produce over 12,000kg of milk per lactation.

Legislation could provide that breeds should not be used if:

- they have a genetic potential for milk production of more than X thousand litres of milk per lactation, and/or
- less than X% of the breeding objectives are focussed on udder and foot and leg health.

As with other species, an exception could be provided for a breeding company that is able to demonstrate by scientific studies that a particular breed whose milk yield exceeds the permitted level can be kept in commercial farm conditions without detriment to the cows' health or welfare.

Pigs

In its 2007 Scientific Opinion, EFSA concluded: "Using breeding goals for large litter size (>11-12 piglets) implies increases in piglet mortality".[74] EFSA recommended: "Genetic selection for litter size should not aim at exceeding having, on average,12 piglets born alive in a litter".[75] Legislation could provide that breeds should not be used that have a genetic potential for producing on average more than 12 piglets per litter.

Another approach would be to provide that breeds should not be used where the average number of piglets born alive is greater than the average number of the sows' functional teats.

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