

CONFERENCIA INAUGURAL

DISEASE THREATS TO GENETIC CONSERVATION: BSE IN BRITAIN

LA AMENAZA DE LAS ENFERMEDADES SOBRE LA CONSERVACIÓN GENÉTICA: LA
ESPONDILITIS ESPONGIFORME BOVINA (EEB) EN GRAN BRETAÑA

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SUMMARY

Small populations are extremely vulnerable due to a loss of vigour and viability motivated by inbreeding, even when their direct effects are difficult measurable. These small populations, moreover when they are concentrated in determined areas, are exposed to a sanitary cause of extinction; firstly because the direct effect of the illness; and secondly because the negative effect of the fighting policy against the illness. The BSE is the last example appeared in Great Britain.

In this paper the causes and development of BSE in Great Britain is described; considering its relationship with other illness as the ovine scrapie and the human CJD. The evolution of BSE in confirmed cases is also considered, from 2469 cases in 1988, a maximum of 36680 in 1992 was reached; now is expected for 1999 only 1000 cases.

The effect of this illness concretely over bovine rare breeds is analysed; it can be centred in two levels; firstly over the productive units; and secondly over the breeding herds. The effect has been higher over the first level due to the implemented sanitary policy.

Another effect to point out is the general commercial crisis for beef production as consequence of the consumers loss of credibility. We can conclude, that the appearance of BSE was a consequence of the application of unnatural productive systems, which substitution could benefits the extension of rare native breeds adapted to extensive systems.

The negative consequences have been fundamentally commercial because the loss of credibility in the consumers, but also from some strategies in the fighting policy clearly criticised.

RESUMEN

Las pequeñas poblaciones son extremadamente vulnerables por pérdidas de vigor y viabilidad causadas por la consanguinidad, aunque sus efectos directos sean difícilmente medibles.

Estas pequeñas poblaciones, sobre todo cuando están concentradas en determinadas áreas, sufren una causa de extinción sanitaria, en primer lugar por el efecto de la propia enfer-

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medad y en segundo lugar por la acción de la política de lucha contra ella. La EEB es el último ejemplo sobre esto aparecido en Gran Bretaña.

Se describen las causas y el desarrollo de la EEB en Gran Bretaña, considerando sus relaciones con otras enfermedades como el scrapie ovino y la CJA humana. Se observa también su evolución en casos confirmados, pasando de los 2469 en 1988 a un máximo de 36.680 en 1992 y a una estimación de sólo 1000 para el año 1999.

También se considera el efecto concreto de la EEB sobre las razas minoritarias bovinas, que se pueden centrar en dos niveles: sobre las unidades de producción y sobre los rebaños de cría. El efecto fue muy superior en el primer nivel debido a la política sanitaria implementada.

Otro efecto notable es la crisis comercial general de la carne de bovino como consecuencia de la pérdida de confianza de los consumidores.

Se puede concluir que la aparición de la EEB es consecuencia de sistemas de producción antinaturales, cuya sustitución beneficiaría a las razas minoritarias adaptadas al extensivo.

Las consecuencias negativas han sido fundamentalmente comerciales por pérdida de credibilidad ante los consumidores y de estrategias en la política de lucha claramente criticables.

INTRODUCTION

The vulnerability of rare breeds is an inevitable consequence of the small size of their population. Vulnerability may be expressed through progressive erosion of genetic variability within a breed as a result of both genetic drift and selection pressure exerted by breeders, and the effect is likely to be accelerated in small populations. Reduction in genetic variability, measured through the calculation of inbreeding or increase in homozygosity, may lead to decreasing ability to adapt to changing conditions, or in a more

severe way to inbreeding depression with associated loss of vigour and viability, and even the expression of major defects.

These problems have not been particularly evident in endangered breeds. It is likely that the potential problems of inbreeding have been significantly over-emphasised, and several breeds with a small population appear to retain a much higher level of heterozygosity than might be expected. It is likely that the danger would be expressed most severely in those breeds with the smallest population and that extinction could be a very real threat when breeds reached a critical point. The danger threshold with inbreeding has been variously calculated by different authors, but the level suggested in all cases for the extinction of a breed or a group is in excess of that which is achieved normally in most breeding systems. Frankham postulated a critical coefficient of inbreeding of 40 percent, while Bowman and Falconer calculated that 60 percent was the level at which many lines became extinct. These levels are rarely achieved in farming practice.

Occasional animals may exceed a coefficient of inbreeding of 40 percent, but even in relatively intense line-breeding systems most animals would not exceed 25 percent. In Britain breeds such as Castlemilk Moorit sheep have developed from a very small base (1 ram and 10 ewes), yet they continue as viable and expanding populations.

DISEASE THREAT

A more serious threat to very small

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populations is that of disease. Where a breed exists in small numbers and is kept at only a small number of locations it is particularly vulnerable to the effects of disease and especially to associated legislation that requires mandatory notification and slaughter. For example, the outbreak of foot-and-mouth disease in Britain in 1966/67 resulted in the final extinction of Blue Albion cattle and seriously threatened the semi-feral herd of Chillingham cattle. Outbreaks of swine fever, Aujeskys and Blue Ear disease have posed similar threats to endangered pig breeds, although usually these are more widely dispersed and thus less likely to suffer the ultimate fate of extinction.

In recent times the greatest danger posed to rare breeds of cattle in Britain has been BSE. This disease was first noted officially by the Central Veterinary Laboratory in November 1986 and subsequently exploded through the national dairy herd in Britain. By November 1997 169,000 cases (1.5 percent of the total cattle population and a much higher proportion of the adult population) had been diagnosed, and a slaughter policy was implemented in 1988. Very few cases have been notified in other European countries, although it is likely that a significant number of animals are infected but have been misdiagnosed or otherwise not recognised in these countries.

CAUSES AND DEVELOPMENT OF BSE CRISIS

The problem had its roots in the ongoing intensification of livestock

production in Britain. The search for increasing levels of production from individual animals, together with the desire to reduce the unit cost of production, led dairy farmers into practises which were unnatural and potentially dangerous. BSE was the realisation of that danger. The probable cause, although it has not yet been irrefutably defined, was a change in procedure in processing animal-derived products destined for inclusion in animal feed. The most likely scenario is that infected material was not destroyed by the new rendering process and thus was spread through the dairy cattle industry.

It may have had its source in scrapie-infected material, in which case it would seem that the infective agent may have changed in type and effect as it crossed the species barrier. Scrapie in sheep has been known for more than 200 years and during that time appears to have had no effect on the human population. However, it seems that BSE in cattle, despite its recent appearance, may already have had a specific effect on the human population in the form of a new type of CJD, although again the link between BSE and nvCJD has not been finally proved.

The scrapie-source theory has been accepted widely but some evidence is in conflict. Research workers in USA have failed to induce BSE in cattle injected with scrapie-infected material. Further doubts are raised by the likelihood that solvents used pre-1980s in the processing of animal feed may not have killed the BSE agent, and by the occurrence of unusual forms of CJD in 1970s.

It is pertinent to consider alternative theories for the origin of BSE. Organophosphorus chemicals have been suggested, but the evidence is not convincing. A more compelling theory presents the case for methyl bromide (a recognised mutagen) as the primary source of BSE as a mutation in cattle in the early 1960s.

The incidence of BSE in Britain reached a peak in 1992 with 37,000 cases confirmed (**table I**). Since that time effective control measures have been applied and the number of cases has declined rapidly. The forecast for 1999 is only 1000 cases.

BSE is a low-infectivity disease, and a high challenge is necessary to produce clinical symptoms. There is no evidence of lateral transmission, and there would seem to be very little vertical transmission (c.10 percent). Some research suggests that there is no genetic resistance to the disease although this research is far from

secure, and evidence from scrapie-resistance in sheep would indicate that we might expect BSE-resistance in cattle. No research has been carried out to explore differences that exist between breeds and it is difficult to separate environmental effects, such as systems of management, from breed effects. The incidence of BSE among the Celtic and Scandinavian-derived breeds of western and northern fringes of Britain (i.e. White Park, Shetland, Irish Moiled, Dexter, Kerry) is negligible compared with that of other breeds and should be subjected to further scrutiny. It is possible that these breeds have been exposed to less risk because they are not usually reared under intensive systems of production, but equally it is possible that they possess some genetic resistance.

EFFECT OF RARE BREEDS

Control of the disease in Britain has been attempted through a slaughter policy, based on cohorts containing infected animals. However, in addition, beef animals which fail to finish by 30 months of age are incinerated; breeding animals may continue their productive life until they are culled and at that point they also are incinerated. Thus the effect on endangered breeds of cattle must be assessed in two ways. Firstly, there is an effect on beef production units; secondly, there is an effect on breeding herds.

The impact on breeding herds has been relatively small. Breeding cows and bulls have been retained in the same way as previously, but their cull value at the end of their working life is

Table I. Confirmed Cases of BSE in UK. (Casos confirmados de EEB en GB).

Year	Confirmed Cases
1988 (pt)	2469
1989	7137
1990	14181
1991	25032
1992	36680
1993	34370
1994	23944
1995	14076
1996	8014
1997 (est)	4000
1998 (est)	2000
1999 (est)	1000

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Table II. Incidence of BSE for each age group. (Incidencia de EEB según edad).

Age (years)	Incidence (p. 100)
1	0.00
2	0.03
3	0.81
4	3.86
5	4.88

lower in most breeds, and the generally depressed price of beef cattle has affected the profitability and variability of beef herds. However, the accumulation of these detrimental factors has not yet been sufficient to seriously threaten the survival of endangered breeds, although their security has been jeopardised.

The effect of the outbreak of BSE has been more significant on herds of rare breeds rearing cattle for beef. The incidence of BSE increases as cattle for beef. The incidence of BSE increases as cattle become older (**table II**), and it was decided by the UK Government that the significant break point was 30 months of age. Animals under this age were eligible for the food chain; over 30 months they were excluded.

The majority of pure-bred beef animals from rare breeds produce superior beef on grass-fed systems when slaughtered at 36 months of age. Beef produce by this system is of the highest quality and safety. It is derived from natural feeds (grass and conserved grass) in non-intensive systems from breeds that have demonstrated a low or nil incidence of BSE. Thus the

arbitrary introduction of the 30-month rule excluded the best and safest beef that was being produced in Britain and this had a detrimental effect on rare breeds. It was necessary to modify systems of production in order to ensure that animals were finished by 30 months of age and this required some degree of feeding with cereals in addition to grass. As a result the quality of the product suffered although it still remained high in comparison with products from the mainstream beef market.

The most recent restrictions have prohibited the sale of beef on the bone. The Scientific Advisory Committee (SEAC) relied on current research using heavy doses of infective material to demonstrate a risk of 1 in 1.16 bilio from the dorsal root ganglion. The UK Government reacted by imposing the prohibition despite the negligible risk.

GENERAL EFFECTS OF BSE CRISIS

The *beef ban* started in late March 1996. The various control factors, which included the introduction of the 30-months rule and a ban on exports of British beef, resulted in a collapse of confidence in beef by consumers who turned to other meat. The collapse of confidence was seen throughout Europe, and perhaps had its greatest effect in Germany and France.

It is important to understand subsequent trends in consumer attitude. Sales of beef throughout Britain plummeted at the time of the crisis but within 12 months they had recovered to 86 percent of the volume of sales that existed before the crisis. The

recovery was not so evident in other parts of northern Europe. In contrast, the sales of meat from rare breeds within the Trust's Traditional Breed Meat Marketing Scheme scarcely faltered and thereafter doubled during the same 12 month period. The public perceived that beef from traditional breeds kept in non-intensive systems with total traceability was not only of high quality but also safe to eat.

Consumers also responded to the latest ban of sales of beef on the bone by continuing to buy the product while it was available, but the repeated impositions of Government legislation and negative publicity are now beginning to depress consumer confidence and undermine the morale and financial viability of beef farmers.

CONCLUSIONS

There are important lessons to be learned from the BSE crisis.

1.- The root of the problem was the intensification of livestock farming and the unnatural practices associated with it. The main fault lay in the dairy industry (**table III**), but the most serious consequences were felt by the beef industry. Only seven pedigree beef herds were affected compared with 970 dairy herds, yet beef farmers were penalised by low prices, while dairy farmers received generous compensation, sometimes exceeding L10K per cow.

2.- The fundamental lesson is that political considerations have overwhelmed scientific evidence and common-sense; there has been mismanagement by government and farming organisa-

Table III. Herds with cases of BSE. (Rebaños con casos de BSE).

	Dairy*	Beef*	Mixed*	Mot* Know	Total Herds
Pedigree					
Yes	96.1	0.6	1.9	1.4	518
Part	94.0	0.8	4.8	0.4	502
Non	92.2	2.6	4.5	0.6	1103
Not known	53.1	6.1	4.1	36.7	49
Total					2172
*percent					

tions in the handling of the crisis. The UK Government attempted to introduce a beef assurance scheme to address the question of fair treatment for breeds/herds that posed less risk, but it was fettered in unnecessary regulations and requirements and failed to provide any significant support. Only 68 herds are participating compared with a forecast of 3000 herds. The over-30-month scheme and the ban on sales of beef on the bone were miscalculations and out of proportion as control measures. They defeated their primary objective by undermining consumer confidence.

3.- BSE (together with *Salmonella* and *E. coli* 0157) has raised awareness. The likely effect will be a need to ensure that all meat and livestock products are produced under conditions which recognise animal welfare and protection of the environment, and traceability will become mandatory. Non-intensive systems and rare breeds are likely to benefit eventually.

4.- Extra costs must be borne by the industry, and these will have a

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detrimental effect on small rural businesses. The costs of verification for beef labelling are likely to be borne by retail butchers; the cost of cattle passports at L5-L10 per head and the costs of cattle identification (double

ear tags) must be borne by producers. Other costs relate to the disposal and rendering of offal, and to the requirement for all beef to be sold off the bone, and these will have an adverse effect on all sections of the industry.