nature biotechnology

Stop the cull

Animal vaccines prevent disease but founder because of political motivations.

Conventional 'slaughtering-out' measures for containing outbreaks of animal diseases are draconian and medieval. They basically boil down to death and imprisonment. Livestock movement is banned, all exposed animals are slaughtered, buried or burned, and exports abroad stop immediately. Each disease outbreak thus causes premature bloodshed and huge economic losses. The question is, Can a better way forward not be found?

This year's appearance, for the first time ever, of the bluetongue virus in Britain means that all of Europe's largest countries are now affected by this debilitating disease of sheep and cattle. Bluetongue, together with its vector—midges of the genus *Culicoides*—appeared quite suddenly in Europe in 2006 and since has drifted northwards, starting in the Balkans and southern Europe (Italy, Greece, Spain), and moving through Germany, Luxembourg, Belgium, France and the Netherlands before arriving in the UK in September.

The bluetongue outbreak is the second large animal disease disaster to hit the UK this year. In August, foot-and-mouth disease was reported on a farm to the southeast of London, the most likely cause of which was an accidental leakage of virus from the nearby vaccine research center at Pirbright. Eight cases of the disease in the nearby locations may also be connected with the initial accidental outbreak. The consequence of this one small outbreak is that the export of meat and other animal products from a wide region surrounding the affected location is banned totally. Exports from most of southern England require special government dispensation and animal movement is restricted.

So why isn't vaccination used to prevent the carnage and trade posturing? For bluetongue, the simple answer is that it soon could be—a vaccine is in the pipeline. The particular strain of bluetongue (strain 8) that is afflicting Europe right now was first detected in 2006. Two manufacturers, Merial and Intervet, have recently applied for manufacturing licenses and are prepared to supply the necessary 50–150 million doses of product before the summer of 2008, when the disease is likely to return. This level of production is achievable in that time frame. It is also sufficient to implement a ring-fencing disease-control strategy: should an outbreak of the disease occur, infected animals would still be slaughtered but those in surrounding regions would be vaccinated to provide a biological barrier against broader transmission.

The only problem, and it is not a small one, is that with only months to go before bluetongue is likely to strike again, no government in Europe has yet made a firm commitment to buy any vaccine. Ostrich-like, the governments are hoping that the disease will disappear as quickly as it arrived. However, this vacillation will make it difficult for the manufacturer to prepare sufficient material in time.

The solution for foot-and-mouth is less straightforward. Countries that source meat and other animal products want it to originate in places that are foot-and-mouth free. There is a great deal of competition among disease-free suppliers to sell to markets, such as the USA and Japan. The importers assess disease-free status through serological tests that cannot distinguish between infected animals (possible diseases carriers) and those which have been vaccinated. In other words, addressing disease by vaccination gives the impression that a disease is endemic. Vaccines compromise 'freedom from disease' status.

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One solution might be a more refined form of vaccination—marker or DIVA (differentiating infected from vaccinated animals) vaccines. The basic DIVA approach is to add 'signature' immunological epitopes to the vaccine that permit the design of differential diagnostic tests. In addition, to prevent real infections being masked by vaccination, one or more natural epitopes can also be deleted.

The approach has already been successful in the eradication of Aujeszky's disease, a pseudorabies disease of pigs, in Germany. Another marker product, a live vaccine called Bovilis IBR (infectious bovine rhinotracheitis) marker, has been used successfully in the Netherlands and elsewhere since 2001 to address yield losses associated with IBR disease. The economic gains associated with the vaccine provides the impetus for its use in IBR-infected herds.

Despite this, the impetus for the development both of the vaccines and the differentiating diagnostic test is tempered by a wide range of politically voiced concerns. Farmers or veterinarians might relax animal hygiene practices if the vaccine was available as a backstop. Customs officials might become less vigilant at border crossings. But there is also an in-built resistance to anything that might remove nontariff barriers to trade in livestock and animal products. Take away the disease threat and you take away the opportunity for protectionists to block trade. And then, in Europe, the use of genetic modification (probably the most effective way to produce DIVA vaccines) would be an obstacle.

Even when faced with economic havoc and a rational technological way out of it, European politicians can always be relied on for one thing: no matter how much they posture, protectionist colors will shine through their thin pro-agriculture masks.