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RISK ANALYSIS IN COUNTRIES WITH SIGNIFICANT COMMODITIES IMPORT. THE ITALIAN EXPERIENCE

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Chaque année, l'Italie importe de nombreux animaux et produits d'origine animale. Si les politiques de libre commerce sont adoptées, le nombre d'animaux et produits d'origine animale qui sera échangé entre les pays du monde entier, sera probablement similaire à celui actuellement importé par l'Italie. La méthode d'analyse de risque appliquée dans le domaine vétérinaire est la méthode de Morley. Cette méthode a été introduite dans les directives du code zoosanitaire de l'O.I.E. La méthode d'appréciation du risque proposée par SENASA semble être une forme plus évoluée de celle de Morley. Les deux approches ont été testées en utilisant des données réelles d'importation de porcs vivants par l'Italie, en provenance des pays de l'Union Européenne (U.E) et de bovins vivants d'origine française, afin d'estimer le risque pour i) la maladie vésiculeuse des porcs et la peste porcine, selon le nombre de cas observés en U.E., pour les deux maladies et ii) la péripneumonie contagieuse bovine (PPCB) sous l'hypothèse d'un seul foyer épizootique non détecté sur le territoire français. Les deux approches, Morley et SENASA, ont donné des résultats insatisfaisants. Avec l'adoption des politiques de libre commerce par l'ensemble des pays, le nombre d'animaux importés et échangés au niveau international, va atteindre un niveau similaire de celui utilisé pour la simulation. Dans une telle situation, il est évident qu'aucun pays ne peut garantir de n'avoir aucun foyer d'infection non détecté, particulièrement dans le cas de phénomènes rares. Le développement de techniques génératrices de courbes de calcul du risque, basées sur l'application de mesures préventives dans les pays exportateurs et importateurs, semble être une solution possible. Cette approche a été testée en utilisant les données d'importation, en Italie, de moutons d'origine française sous l'hypothèse d'une prévalence de l'infection de 0.1 % sur le territoire français. Cette méthode, qui suppose l'indépendance de la quantité de produits importés, pourrait donner aux décideurs, des éléments pratiques afin de i) rationaliser les mesures de contrôle préventives et ii) évaluer le risque réel sur la base d'expériences pratiques.

INTRODUCTION

Free trade policy implementation will increase animal and animal products trade volume and speed. As it mentioned in the Office International des Epizooties International Animal Health Code and in the World Trade Organization Agreement On Sanitary And Phytosanitary Measures (SPS), the so called «no risk policy» cannot be implemented anymore. By definition, therefore, no Country will be able to exclude that at least one undetected infection focus is present in its territory. Quantitative risk analysis techniques seem, at present, the best approach to implement adequate and fair veterinary measures to protect human and animal health from hazards generated by international trade of animals and animal products.

The objective of risk analysis is to estimate risk curves quantitatively in relation to the implementation of different preventive measures, both in the exporting and importing Country. Morley's method is the most common method adopted for risk analysis in the veterinary field. It has been introduced also in the OIE International Animal Health Code. The method proposed by SENASA appears to be an interesting evolution of Morley's. Application of these methods to situations where large quantities of commodities come into play, might be difficult. Alternative methods less sensitive to commodities volume exchanged should probably be sought if free and fair animal and animal products trade must not be hindered.

Various risk assessment techniques have been applied to real data referring to animal imports in Italy. Aim of the present paper is to report the results obtained and to evaluate the methods, in relation to their usefulness in decision making.

MATERIALS AND METHODS

Source of data

Data on animal populations are derived from the O.I.E. Data on import are derived from the Italian Ministry of health official statistics. Averaging of both animal populations and import 1990 and 1991 data have been used in the calculation of Unrestricted Risk Estimate (URE). Average duration of infection data are the same ones used by Morley.

Application of the Morley's method to the introduction of Swine Vesicular Disease (SVD) in Italy from EU Countries

The following data have been used:

HOLLAND: swine population: 13.565.974; number of herds: 29.211; number of SVD outbreaks in 1991 = 0, in 1992 = 15, in 1993 = 0; number of animal import units (nAIUs): 1.150.988;

BELGIUM: swine population: 6.290.586; number of herds: 23.345; number of SVD outbreaks in 1991 = 0, in 1992 = 1, in 1993 = 1; nAIUs: 317.783;

SPAIN: swine population 17.044.484; number of herds 174.832; number of SVD outbreaks in 1991 = 0, in 1992 = 0, in 1993 = 3; nAIUs: 2.110.

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Average duration of infection (ADI): 0,071 years.

Application of the Morley's method to the introduction of Hog Cholera (HC) in Italy from Germany
The following data have been used: swine population 24.764.081; number of herds: 242.165, number of outbreaks in 1990 = 118, in 1991 = 5; nAIUs: 112.340.
Average duration of infection (ADI): 0,052 years.

Application of the Morley's an SENASA methods to the introduction of Contagious Bovine Pleuropneumonia (CBPP) in Italy from continental France territory *under the theoretical hypothesis of one undetected outbreak in continental France territory*
The following data have been used: cattle population: 19.600.000; number of herds: 270.000; nAIUs: 1.086.480.
Average duration of infection (ADI): 0,33 years.
Scenario Tree - *Country factor:* S0 = Infected animals in the outbreak; S1 = Animals remaining infected before leaving farm; S2 = Infected animals not detected before exporting. *Commodity Factor:* equal to 1.
A triangular distribution has been calculated with expected, minimum and maximum risk values, for each variable in the scenario tree: *S0 (Infected animals in the outbreak)* - CBPP morbidity rates: Expected=0,75; Minimum=0,60; Maximum=0,90; *S1 (Animals remaining infected before leaving farm)*: Expected=0,25; Minimum=0,15; Maximum=0,35; *S2 (Infected animals not detected before exporting)*: percent of infected asymptomatic animals not detected during a clinical visit in the Country of origin is defined equal to 1 (100%). One thousand iteration have been generated in a simulation program based on Monte Carlo method. For each iteration P value has been calculated according to the following formula:

$$P = 1 - (1 - P_r)^n, \text{ where } Pr=(S0*S1*S2*AHS)/Population \text{ and } n=nAIUs.$$

Estimation of risk curves for the introduction of ovi-caprine brucellosis in Italy
Risk curves have been calculated using the actual sheep import from France (833 imported lots, lot size according to a triangular distribution [98, 20, 150]). Five groups of scenarios have been generated: (i) absence of any serological testing on imported animals; (ii) complement fixation testing (CFT) of 1% of imported lots; (iii) CFT of a number of lots sufficient to detect at least one infected lot if infected lots were ^{3} 5%; (iv) CFT of 100% of imported lots. In all cases a sample of animals able to detect a prevalence of infection ^{3} 5% with 95% confidence level was tested in each lot; (v) serological testing of all imported animals. The same population parameters have been used for the five scenarios: 0,1% prevalence of infection in the population of origin; only one infected animal in each infected lot; refusal of the whole lot containing serologically positive animals; one single outbreak generated by an imported infected lot. Sensitivity of complement fixation test: 0,9667. One hundred iterations (i.e. simulation of the import of 83.300 lots) have been generated in a simulation program based on Monte Carlo method. The following variables have been included in the simulation model: probability of infection of the lot (binomial distribution, depending on lot size and prevalence of infection in the population of origin), probability of lot testing (depending on the 5 different strategies), number of tested animals (binomial distribution, depending on lot size and 5% threshold prevalence), probability that an infected animal is serologically tested (depending on the previous variable and on the strategy), probability that a serologically tested lot gives a false negative result (depending on number of tested animals and on test sensitivity).

RESULTS

Application of the Morley's method to the introduction of swine vesicular disease (SVD) in Italy from UE countries
HOLLAND: URE for 1992 = 0,0000; URE for 1993 = 1,0000; URE for 1994 = 0,0000. *BELGIUM*: URE for 1992 = 0,0000; URE for 1993 = 0,6208; URE for 1994 = 0,6208. *SPAIN*: URE for 1992 = 0,0000; URE for 1993 = 0,0000; URE for 1994 = 0,0026. Actual number of outbreaks documented as due to animal importation: from Holland, 4 in 1992, 2 in 1993, 5 in 1994; from Belgium, 2 in 1992, 1 in 1993, none in 1994; none from Spain in the three years.

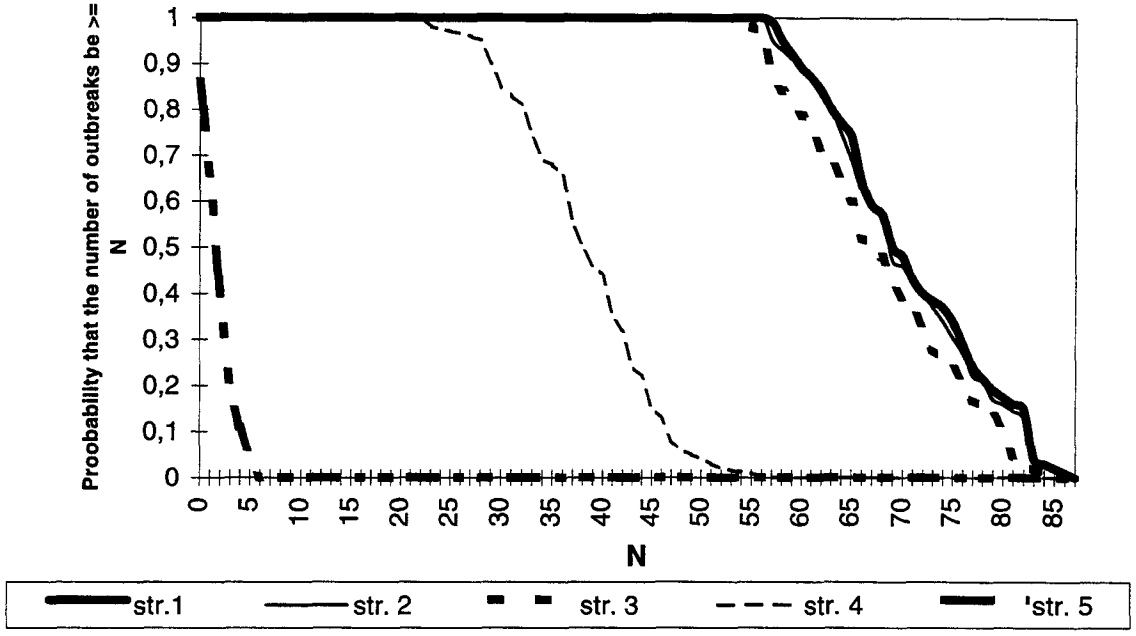
Application of the Morley's method to the introduction of hog cholera in Italy by swine import from Germany
URE for 1991 = 0,9421; URE for 1992 = 0,1137.

Application of the Morley's and SENASA method to the introduction of CBPP in Italy from continental France territory *under the theoretical hypothesis of one undetected outbreak in France*
URE=0,7337; SENASA probability = 0,5175 (95% confidence interval=0,3975-0.6409).

Estimation of risk curves for the introduction of ovi-caprine brucellosis in Italy
The 5 risk curves generated by the model are reported in Figure 1. The average number of outbreaks originated by the import of 833 lots, in relation to the various safeguard strategies, were: *strategy 1* = 71,12 outbreaks; *strategy 2* = 70,78; *strategy 3* = 68,6; *strategy 4* = 38,77; *strategy 5* = 2,27. The average number of animals tested in relation to the 5 safeguard strategies were: *strategy 1* = 0 tested animals; *strategy 2* = 337; *strategy 3* = 2451; *strategy 4* = 34739; *strategy 5* = 74011. These data allow to calculate when a strategy is more advantageous than another. Namely when the mean total cost of one outbreak is greater than the cost of the

increased number of testings needed to prevent one outbreak. In the experiment: strategy 2 is more advantageous than strategy 1 when the cost of an outbreak is greater than the cost of 992 serological testings, strategy 3 is more advantageous than strategy 2 when an outbreak costs more than 970 testings, strategy 4 is more advantageous than strategy 3 when an outbreak costs more than 1082 testings, strategy 5 is more advantageous than strategy 4 when an outbreak costs more than 1076 testings, and strategy 5 is more advantageous than strategy 1 when an outbreak costs more than 1.080 testings. In other words, with a mean cost of complement fixation test of 1 ECU, strategy 5 is always advantageous when the cost of an outbreak is [3] 1.000 ECU's.

Figure 1 - Risk curves for ovi-caprine brucellosis



DISCUSSION

Both Morley's and SENASA approaches gave inadequate results: high probabilities of importing the diseases contrast with the small number of outbreaks due to import. In Countries, such as Italy, importing large amount of commodities these methods result constantly in high probability of importing a disease/infection, irrespective of prevalence in the exporting Countries. Furthermore they are virtually useless when exporting Country is considered free of infection. This was the case for imported SVD in Italy in 1992 from two Countries and in 1994 from one Country. With the adoption of free trade policies the number of animal import units that will be internationally exchanged will probably be such that every Country, by definition, has a high probability of having at least one undetected infection focus in its animal population in any given moment. It seems, therefore, that what will be needed is quantitative risk management techniques, such as risk curves generation, if a fair decision making process is *really* what veterinary services are looking for. Calculation of risk curves based upon the application of *quantitatively defined* safeguard measures seems able to provide information for decision process more useful than URE-like methods. Serological testing used in this paper is only an example. Other safeguard strategies may be considered such as quarantine (with relevant variables represented by the frequency distribution of incubation periods and proportion of infected animals showing symptoms of disease after defined periods of time), animal testing programs in the herd of origin, accreditation scheme in the Country/Region of origin, etc. This kind of method, given quantity of imports as *independent variable*, could give decision-maker factual elements to (i) evaluate the true risk on the basis of factual "real life" experiences; (ii) rationalize preventive control measures on the basis of their costs and expected benefits.

BIBLIOGRAPHY

Blood D.C., Radostits O.M., Henderson J.A., 1983. "Veterinary Medicine", 6th edition, Tindall Ed., London

Kaplan S., Garrick B.J., 1981. On the quantitative definition of risk. Risk analysis, 1, 11-27

Morley R.S., 1993. A model for the assessment of the animal disease risks associated with the importation of animals and animals products, Rev. sci. tech. Off. int. Epiz., 12 (4), 1055-1092.

Nannini D., Ferri N., Giovannini A., Urbani G., Di Matteo A., Caporale V. 1992. Comparazione tra varie prove sierologiche nella diagnosi della brucellosi ovina in diverse situazioni epidemiologiche. Veterinaria italiana, 28 (4), 11-21.

OIE, 1990,1991. Animal Health Status and Disease Control Methods.

Prosperi S., Pini A., 1992. Pleuropolmonite Contagiosa del Bovino, Veterinaria Italiana, Collana Monografie 13

SENASA, "Risk Assessment of FMD present in an exportation of Argentine beef"