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USING ANIMAL AGRICULTURE TO ENHANCE COOPERATION IN THE CARIBBEAN REGION

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Agriculture in the region represents a unifying force which has been long overlooked but which has the potential of playing a pivotal role in the process of Caribbean integration. However, the concept of integration, though noble and perhaps even achievable, is unarguably futuristic. We genuinely want to see marriages in the region, but perhaps we should be less romantic and more realistic. It might serve us better in the long-run, if we were to aim at identifying areas of mutual benefit, developing the processes pertaining thereto and then solidifying our gains, while at the same time keeping the ultimate objective of regional integration indelibly imprinted in our minds. I must confess that I am wary of galloping revolutions which are born of flowery rhetoric and ephemeral perceptions. For this reason, this submission is simply entitled "Using Agriculture to Enhance Cooperation in the Region." Cooperation, of course, is the most active word here. And we understand Agriculture to be primarily embracing all pertinent aspects of production, processing a marketing of corps and livestock. Also, we must incorporate some relevant considerations of Forestry and Fisheries under this rubric. Finally, all of that which I have to say must be enveloped in the current and meaningful watchwords of sustainability and environment friendliness.

I must emphasise, ladies and gentlemen, that this cooperation in agriculture which we hope to promote cannot be seen vacuo, isolated from the several changes that are taking place in the domestic, regional and international trade and economic environments which impact on the performances of our individual countries. I would like to dwell on some of these changes in an attempt to accentuate the predicament in which our states individually and collectively are entangled, and underline the proposition that agriculture and, in extensor, some national economies in the Caribbean Basin states could experience great morbidity, even mortality, if measures are not undertaken to ensure immediate and meaningful cooperation among these states. I will be leaning heavily on an analysis of the agricultural sector of the Caribbean Community which was prepared this year by the CARICOM Secretariat.

Now the most significant development since the mid-1980's is the increasing trend towards global trade liberalisation and the formation of regional trading groups. The main elements of this trend are the removal of non-tariff trade barriers (including quantitative/quota restrictions and import licenses) a reduction in the nominal levels of tariff, and the gradual removal of preferential treatment for internationally traded commodities.

The "successful" completion of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in December of 1993 points to the increased emphasis being placed on world

trade liberalisation. The GATT Conference agreed to the formation of a World Trade Organisation (WTO) to replace the present GATT structure. This move underscores the principles and concepts of multilateralism in world trade.

While the gains to world trade levels, income, growth and development arising from the new GATT Agreement are estimated to be quite significant (world income is expected to rise between US$217 billion and US$230 billion annually (GATT Secretariat Report, 1993)) the benefits to the developing countries, and to the agricultural sector of those countries in particular, are not as apparent.

According to the GATT Secretariat estimates, world merchandise trade is expected to increase by about 12 per cent within the next decade, with a 20 per cent increase in the share of agriculture, forestry, and fisheries products in trade. However, the larger, industrialised countries led by the United States (US), the European Community (EC), and Japan are expected to benefit most form increased market access for their goods and services while in general the less developed countries, among which Caribbean Basin States fall, will be hard-pressed to seize the opportunities arising from increased market access

The implications of the Uruguay Rounds for the agricultural sector will, to a large extent, depend on the ability of the sector to develop production and marketing capabilities which can enable it to take advantage of greater market access. Those capabilities will have to be developed bearing in mind the increased levels of competitiveness in international trade engendered by trade liberalisation as well as the erosion of the margin of preferences in the major export market for agricultural commodities which it is likely to cause.

Traditionally the Caribbean Community has built its export agriculture around preferential arrangements which offer some protection against the vagaries of global market forces. Under those arrangements prices have remained fairly stable and a ready market is ensured for agricultural products.

In the final agreement of the Uruguay Round however, provisions for special and differential treatment for developing countries were framed mainly with respect to longer time periods for those countries to assume their obligations under the treaty. Moreover, reductions in the tariffs rates agreed to in the latter round, reduce the margin of preferences to agricultural exports of Caribbean States as they induce buyers to switch their purchases to imports from other sources. To offset the loses which are bound to arise from a reduction in preferential margins, Caribbean States will, of necessity, have to initiate measures to improve the competitiveness of their exports on the world market and to increase the volume and value of their exports to the major markets.

The agricultural reform programme of the Uruguay Round which entails reduction in the levels of subsidies and other support to agriculture could result in lower intervention price levels

in the EC and consequently to a drop in prices offered by the EC to ACP producers. At the same time, the price of imports of many of the basic foodstuffs imported by developing countries will surely increase, with adverse effects on the terms of trade of net food importers.

Two other factors are likely to work to the detriment of our agricultural sectors. The first is the continued subsidisation of competing the agricultural products in the developed countries under various guises. While the agricultural reform programme of the Uruguay Round calls for reduction in levels of subsidies and other forms of support, it conveniently makes allowance for exemptions under the so-called "green box" category. The "green box" category consisted of domestic policies which were not subject to reduction in the Uruguay Round negotiations.

Under the Export Enhancement Programme (EEP) of the United States, for example, export subsidies are provided for a larger number of commodities. Deficiency payments paid to USA rice farmers are not classified as subsidies within the GATT. Similarly, the reforms to the Common Agricultural Policy of the EC undertaken in 1992 involved an extensive shift from price support to income support policies, but made provisions for many of its support schemes to be included in the "green box" category.

The second feature of the agreement likely to hurt the development of the agricultural sector is the increase in protection offered under the Trade-Related Intellectual Property Rights (TRIPS) agreement. Improvements in the levels of competitiveness of the Community s exports will require the use of higher productivity yielding technologies. However, increased protection under the TRIPS will lead to higher prices for those technologies and increases the urgency with which the Caribbean Community Member States will have to develop their own technological packages for the agricultural sector.

Perhaps the most notable development recently in economic relations within the hemisphere, of which the Caribbean Basin is a part, is the ratification of the North American Free Trade Agreement (NAFTA) by Canada, Mexico and the United States. Like the European Common Market, NAFTA seeks over time to eliminate restrictions on the flow of goods, services and investments among its member states.

The implications of the NAFTA agreement on the economies of the Caribbean Basin countries, and on the agricultural sector in particular, is still very much a subject of anxious deliberations among Caribbean policy analysts and governments. To me, it seems clear that Mexico, with its relatively cheap labour, close proximity to the US, and vast potential for attaining economies of scale will pose a serious threat to the competitiveness of Caribbean Basin Sates' exports to the US.

Of course, while all of this is going on internationally, aid -in any of its forms- is diminishing, not lastly subsequent to the demise of the Centrally Planned Economics of Eastern Europe and the concomitant rush of the developed countries to bail them out.

The last few paragraphs dealt specifically with changes at international levels. But at home in the Caribbean Region, our individual countries have been effecting domestic policy changes too, which have battered agriculture in the past and the repercussive agony of which we still feel today. For example, you will recall that the geniuses of the past advised us that industrialization was to be given priority. Well, the widespread bias against agriculture brought the threat of food,

Table 1: Total Population and Agricultural Labour Force

Country	Total Population ('000)		Agricultural Labour Force							
	1985	2000	('000) 1985	% of Pop.	('000) 2000	% of Pop.	% age of labour force in agriculture 1970	1980	1985	2000
Colombia	28714	37999	2835	9.9	2786	7.3	39	34	31	21
Costa Rica	2600	3596	245	9.4	232	6.5	43	31	27	18
Cuba	10038	11718	854	8.5	792	6.8	30	24	21	16
Dominican Republic	6243	8407	755	12.1	765	9.1	55	46	41	27
El Salvador	5552	8708	737	13.3	944	10.8	56	43	40	32
Guatemala	7963	12222	1221	15.3	1662	13.6	61	57	54	45
Guyana	753	1196	83	11.0	90	7.5	32	27	25	18
Haiti	6585	9860	1889	28.7	2260	22.9	74	70	67	58
Honduras	4372	6978	752	17.2	1131	16.2	65	60	58	49
Jamaica	2336	2880	319	13.7	358	12.4	33	31	28	23
Mexico	78996	109180	8656	11.0	9728	8.9	44	37	33	24
Nicaragua	3272	5261	422	12.9	546	10.4	52	47	42	31
Panama	2180	2893	215	9.9	212	7.3	42	32	28	19
Suriname	375	469	21	5.6	23	4.9	25	20	18	13
Trinidad and Tobago	1185	1473	39	3.3	34	2.3	19	10	9	6
Venezuela	17317	24715	781	4.5	672	2.7	26	16	13	7

Source: FAO, 1987

Table 2: Imports of Selected Agricultural Commodities into CARICOM - 1991 (EC$; US$ = EC$2.86)

Meat and Meat Preparations	$302,878,510
Dairy Products (not including ice cream and ice cream powders) and Bird's Eggs	266,570,978
Fish, Crustaceans and Mollusks	132,085,850
Cereals and Cereal Preparations	529,355,985
Vegetables and Fruits (including peas and beans and preserved fruits and juices)	244,967,362
Sugar and Sugar Preparations and Honey	94,993,088
Coffee, Tea, Cocoa, Spices and Manufacturers thereof (e.g. Chocolate)	43,880,861
Feed Stuffs for Animals	90,382,780
Miscellaneous Edible Products and Preparations	140,840,353
Beverages	146,742,457
Tobacco	32,613,625
Oil Seeds and Oleaginous Fruits	135,866,804
Essential Oils, Perfume Materials, Toiletries, Polishing and Cleansing Materials	208,067,479

Source: Statistical Department, CARICOM Secretariat

shortages in the 1970's and a significant decline in economic growth in the 80's which was reflected in the imbalances of our current accounts, increasing fiscal deficits, higher rates of inflation and interest rates and decreasing levels of foreign exchange reserves. The concomitant

deterioration, in terms of trade, for the agricultural exports of the Caribbean Basin States now threaten to undermine the contributions of the agricultural sectors to foreign exchange earnings, the University of the West Indies has churned out most of the English-speaking Caribbean's accomplished agriculturists. However, the problems facing the region's agriculture necessitate greater cooperation. The following represents some thoughts on improving the cohesiveness of the region's sovereign nations in the areas of agriculture.

It would seem that the first cogent step would be the establishment of a separate unaligned and impartial secretariat comprising experienced cadre from the public and private sectors for the sole purpose of promoting common agricultural strategies and policies in the region. Such an institute is quite distinct in concept from an agency such as IICA whose mandate is primarily to improve the technical aspects of agriculture in the region without projecting itself as a "Think Tank" to influence the policy of governments in those countries where there is an IICA presence. Furthermore, IICA prides itself at being able to carry out the behests and dictates of the host governments. In any case, it would seem to be counter-productive to have IICA deal with national policy when it is funded, to a large degree, by the USA. Alternatively, it must be insisted that the desks dealing with agriculture in CARICOM and in the newly formed Association of Caribbean States must be strengthened and enlarged to accommodate the agricultural activities and interests of the English, Dutch, French and Spanish-speaking states of the region. The priorities of such an institution should, in the first instance, be:

1. The establishment of a data base which would provide the CARICOM Basin States with accurate and reliable information pertaining to all areas of agriculture. Within this context of coalescing agricultural information from the region, I would have to advocate the inclusion of Cuba into this network. The continued isolation of Cuba precludes us form a wealth of useful information, the acquisition of which would reduce the possibility of duplication of efforts and allow us to access the knowledge of competent professionals in the field of agriculture, forestry and fisheries.

2. The initiation of Policy Reforms which will become necessary to control increasing fiscal costs of support and, protection and to avoid further increases in trade deficits. The economic policy reforms that would be undertaken in the Caribbean region would bear strong orientation towards deregulation, corrections of foreign exchange imbalances, opening of the economies to member states and promoting export expansion. To the extent that such policies favour the production of tradeable commodities (both importables and exportables), they will contribute to the creation of a more conducive environment fore the development of agricultural trade within and without the region. At the same time, the agricultural sector should be advised relative to the provision of identifiable and accessible incentives.

3. The commencement of comprehensive studies to determine the magnitude of the impact (and perhaps even the counter productiveness) of macro-economic policy measures,

especially in those countries where agriculture is a major economic sector. (These measures include the alignment of producer prices with world prices, the reducing of input subsidies, the dismantling/rearranging of credit facilities, the rejection of marketing parastatals, the cutting of food subsidies and the altering of the degree of public sector involvement in productive economic activities.) These studies should include those sector-specific pricing policies such as taxes on agricultural exports, price controls, the creation of a gap between farm-gate and border prices because of the intervention of state marketing boards and~indeed the relevancy of such boards. If these interventions have been used unevenly across countries and commodities in our region. What a great contribution to integration it would be if we were to have common policies relative to specific agricultural products!

4. The establishment of a common response to international developments such as increasing trade liberalisation or the cementing of economic blocs and trading agreements. The sober, unemotional analysis of the pros and cons of joining NAFTA or a Common External Tariff relative to agricultural products would seem to warrant being placed high on the agenda.

5. To prioritise which commodities of which country may have a competitive advantage over countries like Mexico which will have easy access to large consumer markets. Furthermore, the establishment of a food balance sheet for the region and the delineation of the advantages of trade in specific agricultural commodities within the region would be immediately implementable activities that could bring us closer together.

6. The facilitating of the establishment of intra-regional joint ventures and interchange and optimal usage of technicians/administrators.

7. The guidance relative to the prioritisation of governmental involvement in agricultural research extension and appropriate technology development and transfer.

8. Advising an advantageous and timely agri-commodity diversification, the commercialization of the farming sector (especially at the level of the small farmer) and the use of appropriate resource management practices and systems.

In conclusion, ladies and gentlemen, let me emphasise that we do not have many options at our disposal. Whether the agricultural sectors of the Caribbean States will succeed in helping to integrate the Region will depend on their ability to complete profitably both intra-and extra-regionally. The governments of the Region with the help of the Secretariat's functions as described, will have to create a milieu that is conducive to the sector's production of high quality goods at comparatively low costs, in sufficient quantities at the right time to offset the competition bred by global trade and economic liberalisation. If we do not work consciously, cohesively and cooperatively towards increased food production, food security and food

self-sufficiency, then the very continuance of the Region, as we know it, is threatened. We believe that working together for the sustainability of agriculture in the wider Caribbean will lead in the long-run to prolonged survivability of a genuinely integrated Region.

PROBLEMS IN MONITORING DISEASES IN AQUACULTURE

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ABSTRACT

Several factors complicate our ability to obtain accurate information on the pathogen status of fish populations. First, we do not know the sensitivities and specificities of fish diagnostic tests. Most current methods use culture, and probably have very poor sensitivity. Furthermore, these tests require lethal sampling, which hinders our ability to investigate incidence rates and to obtain adequate sample sizes for prevalence estimates.

Second, apparent prevalence for most pathogens vary widely by season, water temperature, and fish age and species. Surveillance programs for pathogen detection should recognize these sources of variability in their design, in order to optimize the likelihood of obtaining test-positive fish. Surveillance programs for prevalence estimation will also need to identify and account for important environmental and host variables.

A third area of difficulty in estimating prevalence proportions stems from trying to obtain random samples of fish populations. Random sampling is only feasible when systematic samples can be taken, and must otherwise be approximated by crowding, then dip-netting from, all fish within a holding unit. The sampling scheme must also recognize that prevalence often varies widely among holding units. Purposive sampling of high-risk groups and moribund fish may be considered for pathogen detection.

FACTORS INFLUENCING CLASSIFICATION OF PATHOGEN STATUS IN ZONE-BASED FISH DISEASE CONTROL PROGRAMS

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ABSTRACT

Several countries are considering using a system of pathogen-free zoning as the basis for national and international fish disease control programs. Many variables influence the probability of misclassifying the pathogen status of a zone, including: probabilities of diagnostic errors, prevalence of infected sites, within-site prevalence of infected fish, how many sites and fish per site are sampled, how fish and sites are selected, and how many fish and sites must test positive in order to classify a zone as positive. We will present formulae incorporating these variables, which allow us to estimate the probability of misclassifying zones as either pathogen-free or infected.

We will also present examples for several scenarios. For instance, zones may be classified using retrospective data collected through certification-based disease control programs. Here, data will have been collected mainly from non-infected sites. Assuming 60% test sensitivity (40% false negatives) and 99.95% specificity (0.05% false positives), 2% of sites infected 10% prevalence within those sites, 60 randomly selected fish sampled on each of 50 sites in a certification program, and one test-positive fish being sufficient to classify the zone as positive, there is a 9% chance of erroneously classifying the zone as pathogen-free. Given the same assumptions, but in a truly non-infected zone (prevalences = 0), there is a 22% chance of misclassifying the zone as infected.

CORRAL: COMPUTERIZED AGRICULTURAL HEALTH SURVEILLANCE FOR SMALL, DEVELOPING COUNTRIES.

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INTRODUCTION

Many small developing countries lack an efficient system for surveillance of agricultural health. This makes it difficult for decision-makers to monitor important animal and plant diseases, or to plan effective control strategies. Typically in the Caribbean, infrastructural support within the Ministry of Agriculture is constrained by scarcities of trained personnel, financial resources, and diagnostic laboratory support. The few officials who have advanced training may be responsible for many technical, consultative and administrative duties. Administrative systems are often based on traditional hierarchical models that emphasize central control, and information flowing up the chain of command often relies on reports prepared manually by the level below. This tends to be cumbersome, time consuming, and subject to transcription error. Many agricultural surveillance systems are further constrained by limited operational funds and diagnostic laboratory support.

We set out to design a surveillance program that would serve as a model for countries with limited infrastructural support. To be effective, it had to: manage surveillance information efficiently; use existing information in its present format; have minimal impact on the organizational structure; and be flexible, easy to use, and inexpensive.

MATERIALS AND METHODS

CORRAL was developed as an application of the Epi Info database, version 6 (Centers for Disease Control, Atlanta, Georgia, USA). Epi Info was selected because it was designed specifically for epidemiological applications, there was ongoing technical support, it would operate on most IBM compatible computers, it was easy to use and was inexpensive.

CORRAL was developed in modules, one each for Animal Health, Plant Health, and Meat Inspection. Within each module, a complete menu system was designed for data entry and report generation. Pull-down help windows and validation checks were incorporated to speed data entry and minimize errors. Wherever possible, we used internationally accepted codes to record key data in a standard format. International Standards Organization (ISO) codes were used for countries, Office International des Épizooties (OIE) codes were used for species and diseases of

animals, and BAYER codes used by the European Plant Protection Organization (EPPO) were used to describe host plants, plant diseases and plant pests. We enabled each Ministry of Agriculture to build custom codes for the country's geographic regions, ports, and inspectors.

CORRAL was field tested in nine countries and after final modifications were made, was distributed to all 23 countries and territories in the CARAPHIN network.

RESULTS

Surveillance information is entered directly from field investigation reports or inspection certificates into questionnaire-style screens. All modules store basic data such as the country, district, inspector, date of inspection, species affected, and the name of the disease or pest. In addition, each module records epidemiologic details specific to that category. For animals this includes the numbers at risk, affected, dead, treated, vaccinated, and slaughtered. For plants it is the number of plants (or the area) affected, the disease incidence, and the estimated yield loss, and for meats, the weight of meat condemned. Users may also record the number and type of diagnostic tests conducted, the number of visits or inspections performed, and the amount of inspection fees levied.

Within each module a series of reports can be generated that summarizes disease occurrence, volume of international trade, and use of inspection program resources. Disease occurrence can be expressed as listings, as cross-tabulations of disease prevalence against host species or geographic location, and as bar charts of incidence per month. Based on values provided by inspectors, an estimate of the economic loss from each disease can be generated in terms of value of shipments condemned, number of animals affected, or crop production lost. Since all international import and export shipments are supposed to be inspected, the volume and type of agricultural products traded internationally can also be monitored. Additional reports track the diagnostic and personnel resources used to carry out inspection programs.

DISCUSSION

CORRAL has a number of advantages as a surveillance system for developing countries. It consolidates existing information from a number of sources into a snapshot of the nation's agricultural health. This synopsis should form the foundation of all disease control efforts. As the database builds over time, each Ministry can conduct its own retrospective analyses on particular problems of interest. Senior regulators can also request frequent updates on surveillance activities without adding administrative burdens on their staff. For example, under the present system in one Veterinary Services Division approximately 1200 person-hours per year were spent in routine report writing. Using CORRAL, this time could be cut to 120 hours.

To use CORRAL effectively, a few minor administrative changes are recommended. Inspectors should pass their inspection certificates to a clerk who will enter the data directly into the program. (In this regard, it would be advisable to rearrange inspection forms to conform with data entry screens.) Surveillance reports generated by CORRAL would then passed back to both the supervisor and the inspector. Senior officials would receive reports for the entire country. This sequence would not alter the chain of command, but it would encourage more participation from all levels in planning and implementing disease control strategies.

CORRAL can be adapted to a variety of national applications, yet still function as a regional surveillance system. Each module of the program can be run separately, and as needs change old ones can be modified or new ones added. Plans are underway to develop two new modules, one to monitor control efforts against the Amblyomma tick, and one to monitor registration and use of pesticides in the Caribbean. Because core data is stored in an internationally accepted format, regional surveillance organizations such as CARAPHIN can easily merge information from many countries. This feature also enables CORRAL to complement reference programs used by other international agencies. For instance, it could function as the information-gathering "front end" for programs such as HandiSTATUS used by IICA and OIE, and the Plant Quarantine Retrieval System (PQR) used by EPPO.

Resources required to operate CORRAL are modest. The program operates efficiently on 386 and 486 model IBM-compatible personal computers with 640 kilobytes of random access memory and at least 20 megabytes of free space on the hard drive. Since it is entirely menu-driven, minimal staff training is required. During our field tests, most operators with basic computer knowledge could run the program confidently in 30 minutes or less. CORRAL is not encoded, so upgrading or developing new applications can be done by anyone familiar with Epi Info programming. Theoretically CORRAL could handle up to two billion records, but a practical limit is probably several hundred thousand.

CONCLUSION

CORRAL is a model national surveillance program that can be adapted to a wide variety of situations, but it is especially suited to developing countries that have limited technical resources.

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RISK FACTORS ASSOCIATED WITH CALF DIARRHOEA AND MORTALITY IN A GUYANA DAIRY HERD

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ABSTRACT

Forty-two Holstein calves <28 days of age were used in a prevalence study of four selected diarrhoeal agents, and, concurrent colostrum feeding trial. Agent-associated diarrhoea, mortality, and an assessment of passive immune transfer were key factors which were examined in the study. Calves were raised as natural herd replacements under conditions typical of state-owned farms in coastal Guyana. On alternate months from Feb to Dec 1992, the first 5-8 calves born in each month were randomly assigned to either force-fed or to traditional-fed colostrum groups. Force-fed calves were bottle-fed colostrum at 10% of bodyweight within 1 hr after birth. Traditional fed calves were allowed to suckle directly from the dam, according to normal practice. Calves were bled 24-48 hrs after birth for serum immunoglobulin(Ig) quantitation and were weighed weekly. Faeces were scored(0 to 5) and collected from each calf on alternate days. K99+ Escherichia coli was detected in 7%(by ELISA), group-A rotavirus in 60%(by ELISA), cryptosporidia in 48%(by acid-fast staining), and coccidia in 45%(by sheather flotation), of 42 calves tested. Of 1176 observations, mean proportion of time with diarrhoea, Pd, in the 0-28 day life of calves was 17.5%, with 31 calves having diarrhoeal episodes of 23 consecutive days. Mean diarrhoeic days per calf was 4.9 days. Diarrhoeal rates were significantly greater in the interval 0-7 days of age($p= 0.0001$). Force-fed calves had significantly greater serum Ig concentration($p= 0.001$) compared to controls. Associations were also detected between dam body condition and Pd($p= 0.0107$), serum Ig concentration and season($p =0.0262$y, and, birthweight and rotavirus shedding($p= 0.0326$). Agent associations with diarrhoea and mortality were not statistically significant. Mortality during the 0-28 day study period was 2.5% of 42 livebirths at risk, and the all-causes mortality rate for all of 146 livebirths was 16%.

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HEMOPARASITE NETWORK FOR THE GUIANAS

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The "Guianas" are three little known countries located in the humid tropical region on the north coast of South America. These three countries share borders, historic and geographic similarities, but have maintained little contact, due to language, political, administrative and economic differences. Guyana, the former British Guiana, is an independent democratic country, whose national language is English. It has a human population of 750,000 and a bovine population of almost 300,000. Suriname, the former Dutch Guiana, is also an independent democratic country, whose national language is Dutch. It has a human population of approximately 400,000 and a bovine population of just under 100,000. French Guiana (or Guyana Francaise), is an overseas department of France, therefore not a sovereign nation. It has a human population of 115,000 and a bovine population of 7,000. Guyana and Suriname are considered to be developing countries. As a French overseas department, French Guiana enjoys social and economic benefits similar to those in metropolitan France. In all three countries, the great majority (80-90%) of human and livestock populations are concentrated along the Atlantic coastline.

Due to their geographic proximity, similar climates and ecosystems, these countries share various livestock pests and diseases. The difference lies in their ability to respond to such problems. due to its significant technical, financial and human resources, as well as its relatively small livestock population, French Guiana has been able to conduct disease research, monitoring and control programs. In contrast, the veterinary services of Guyana and Suriname have been confronted with scarce technical, material, financial and human resources. Guyana's veterinary diagnostic laboratory ceased operations in 1990. Suriname's laboratory continues to operate on a limited basis, but has great difficulty with material supply and equipment maintenance, due to

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a shortage of foreign exchange. Obviously, these limitations make it difficult or impossible for the veterinary services of Guyana and Suriname to implement livestock disease monitoring and control programs.

The livestock hemoparasites, anaplasmosis, Babesiasis and Trypanosomiasis, and their arthropod vectors, are among the most important constraints to animal health and livestock production in tropical South American countries. *Babesia bovis* and *B. bigemina* are transmitted by ticks, mainly *Boophilus microplus* in South America. *Anaplasma marginale* is transmitted by biting insects and ticks. These diseases cause fever, anemia, loss of condition, abortion and mortality in cattle, sheep and goats. In South America, the Trypanosomes, *Trypanosoma vivax* and *Trypanosoma evansi* are mechanically transmitted by biting insects, including Tabanus, Cryptotylus and Stomoxys species. Vampire bats (*Desmodus rotunaus*) are also believed to play role in the transmission of *T. vivax* (Heare, 1965). High seroprevalence rates to *T evansi* have been found among capybaras (*Hydroechoerus hydrochaeris*), giant wild rodents in Venezuela and Colombia (Reveron et al, 1992). These animals have been suggested to be reservoirs for this organism. In Africa, Trypanosomiasis due to *T. vivax* causes fever, anemia, loss of condition, abortion and mortality in cattle sheep and goats. the epidemiology and clinical significance of Trypanosomiasis in South America are less completely understood. However, recent evidence in French Guiana has associated *T. vivax* infection with abortion and mortality in sheep. In cattle, the disease appears in clinical and subclinical forms, in endemic and epidemic patterns, depending on individual animal and herd immunity to the organism. *T. vivax* epidemics in Colombia have been associated with outbreaks of anemia, weight loss, severe reduction in milk production and mortality in adult cattle (Otte et al, 1992).

Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement (CIRAD) is the French governmental agency for agricultural development in French speaking countries. Its subagency dealing with livestock production and veterinary medicine in tropical countries is CIRAD-EMVT (Elevage Medecine Veterinaire Tropicale). CIRAD-EMVT has a branch in the Institut Pasteur in Cayenne, French Guiana dealing specifically with applied research into arthropod-borne diseases.

The Inter-American Institute for Cooperation on Agriculture (IICA) is the specialised agency for agricultural development under the umbrella of the Organisation of American States (OAS). Its Agricultural health program serves to support the Ministries of Agriculture in member countries in plant protection and animal health programs. IICA has agricultural health projects in both Guyana and Suriname.

In 1993, animal health professionals from CIRAD-EMVT and IICA met with Chief Veterinary Officers of Guyana, Suriname and French Guiana to develop a collaborative project titled "Hemoparasite Network for the Guianas". The general objective is: ***"To increase knowledge of the epidemiology, clinical and economic importance of hemoparasites in Guyana, Suriname and French Guiana in order to develop effective control methods and thus improve***

the health productivity of livestock".

The specific objective was

i. to exchange zoosanitary information with particular emphasis on hemoparasites, between the veterinary services of the three Guianas

ii. to exchange information on hemoparasites with researchers in Latin America and the Caribbean, by formation of a Hemoparasite Information Network.

iii. to strengthen the diagnostic capabilities of the veterinary services of Guyana and Suriname by:

   a. creation of a hemoparasite Reference Laboratory for the Guianas at CIRAD-EMVT in Cayenne

   b. training Guyanese and Surinamese technicians in hemoparasite diagnostic techniques

   c. purchase of equipment and reagents for the veterinary diagnostic laboratories in Suriname and Guyana

   d. laboratory support for other livestock disease investigations whenever possible.

iv. To conduct an epidemiological study of bovine hemoparasites, particularly Trypanosomiasis, on cattle in Guyana, Suriname and French Guiana.

Activities began late in 1993 and are ongoing. The Hemoparasite Reference Laboratory received funding from the European Community. Training in basic hemoparasite diagnostic techniques was offered to Guyanese and Surinamese technicians in February 1994. More advanced laboratory training will be offered to these technicians. The epidemiologic study is currently underway. The Hemoparasite Information Network was launched by translating two CIRAD-EMVT technical publication from French to English and distributing them to livestock production and animal health professionals in Guyana and Suriname. The English versions were titled "Horseflies of the Guyanas: Biology, Veterinary Significance and Control Methods" and "The Cattle Tick, Boophilus microplus". Funding has been received from the French Government for the Hemoparasite Information network. A request has been made for Lomé IV (European Community) funds for equipment and material purchase for the veterinary diagnostic laboratories in Guyana and Suriname.

Animal diseases and pests do not recognise geographic, political and language boundaries. Animals health professionals in French Guiana, Suriname and Guyana share many common

concerns, problems and goals. Pooling of scarce financial, technical and scientific resources, along with exchange of veterinary information among these countries can serve to assist these technicians and producers in their struggle to improve animal health and livestock productivity. perhaps this project can serve as a model for similar inter-agency and international cooperation among other small developing countries.

ACKNOWLEDGEMENTS

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UNCONVENTIONAL AGENTS CAUSING SLOW INFECTIONS: A PROFILE OF BOVINE SPONGIFORM ENCEPHALOPATHY- THE GLOBAL IMPLICATIONS

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ABSTRACT

The diseases in humans and animals caused by unconventional agents are complex and the implicated organisms possess unusual properties compared to conventional viruses. Their resistance to treatments that inactivate viruses and their failure to elicit an immune response complicate control efforts and contribute to an enigmatic clinical spectrum. Classical bovine spongiform encephalopathy, its pathogenesis, epidemiology, and clinical signs will be highlighted to compare disease manifestations to the human syndromes and provide a comparative perspective of these subacute encephalopathies, and the association and correlation between prion protein (PrP) and infectivity.

(A review of the history, regulatory impact, and international collaoration to prevent the spread and limit the reservoirs of the disease will be heightened to provide regulatory control officials a semblance of the complex epidemiology).

INTRODUCTION

In the 1940's Bjorn Sigurdsson discovered a new class of slow infections in Iceland while studying two important sheep diseases, visna and maedi, both characterized by long incubation periods. (1) The findings of this initial research prompted Sigurdsson in 1954 to introduce the concept of slow infections. (2) Shortly after this newly developed theory, Gajdusek and Zigas in 1957 published their extraordinary findings of a degenerative neurologic condition in the highlands of Papua New Guinea called kuru, the first identified human slow infection. (3) In 1959, William Hadlow, a veterinary pathologist, observed distinct parallels between kuru and scrapie, a slow infection of sheep. (4) These findings established the impetus for analysis of the infectious basis for other degenerative neuropathologic diseases of humans, and the comparative relevance of slow infections to human medicine.

The agents of slow infections of the nervous system fall into two general classes: Conventional viruses and the unconventional infectious agents. These unconventional agents possess the following unusual properties. (5)

1. Resistance to physical and chemical treatments that inactivate conventional viruses.

2. Absence in tissues with high titers of infectious agent of typical viral particles with nucleocapsid and envelope structures.

3. No evidence of immune or inflammatory response.

4. No evidence of replication in explanted fragments of infected brain: Scrapie agent does replicate to some extent in neuroblastoma tissue cultures but without producing cytopathic effect or inclusion bodies or interfering with the growth of conventional viruses.

Kuru - the characteristic pathological changes in kuru are cerebellar, with the major clinical manifestations being cerebellar ataxia, dysarthria, and tremors of the head, trunk and extremities. In the Fore language of New Guinea, kuru means trembling or shivering. (5)

Creutzfeldt-Jakob Disease (CJD) in contrast to kuru is found trhoughout the world as a presenile dementia with incidence of the d~isease peaking between ages 55-75. (6,7) The mode of transmission is not known. The sporadic form of the disease affects men and women equally, approximating an incidence of one in a million. (5) Patients display memory loss, personality changes, abnormal behavior, and impaired judgment. (5) Death is usually within a year after onset of symptoms in the majority of cases, many occurring within 4 to 7 months. (7)

Gerstmann-Straussler Syndrome (GSS) is characterized by extensive spinocerebellar involvement (incoordination and disturbances in gait) plus dementia. (5)

BOVINE SPONGIFORM ENCEPHALOPATHY (BSE)

Bovine spongiform encephalopathy (BSE) is a fatal degenerative disease of the central nervous system (CNS) in cattle. The disease was first recognized clinically in Great Britain in 1985, and the hypothesis at the time was that transmission requires prolonged exposure to the infectious agent. (8) One investigator has described BSE as the first subacute spongiform encephalopathy identified in cattle, and the bovine equivalent of scrapie in sheep. (9) The disease belongs to a group of related neurologic conditions known as the transmissible spongiform encephalopathies. The group includes scrapie, which affects sheep and goats; transmissible mink encephalopathy; feline spongiform encephalopathy; chronic wasting disease of mule deer and elk; and the three rare diseases in people, already alluded to: kuru, Creutzfeldt-Jakob disease (CJD) and Gerstmann-Straussler Syndrome (GSS). (8)

The disease's incubation period varies from two to eight years. In Great Britain, 97% of the cases occur in dairy cattle or dairy crossbreds between three and five years old. A breed or gender predisposition has not been identified, although most cases occur in Holstein-Friesian cattle. (8,1 0)

The causative agent of BSE is unknown. The prevailing theory based on histologic findings, is that the BSE agent is identical to or closely resembles the yet identified agent that causes scrapie in sheep. (11) The infectious agents that cause BSE and scrapie have not been completely characterized, but several terms have been used to describe them - unconventional viruses, slow viruses, prions, and virinos. Prusiner (12) has performed extensive research on molecular biology and transgenetics of CNS degeneration in humans and animals. He observed that many features of scrapie, kuru, Creutzfeldt-Jakob disease (CJD) and Gerstmann-Straussler Syndrome (GSS) are not typical of an infectious disease, and proposed that to distinguish these agents from viroids and viruses, the term prion was introduced, and has subsequently gained broad acceptance. Thus, the advent of prion diseases.

Clinical signs

The onset of clinical signs is insidious. The disease progresses until the affected animal inevitably dies, usually in one to six months. In the early stages, the animal appears apprehensive and fearful. Later, the animal exhibits erratic reactions to sound and touch, as seen in cases of rabies. Many early signs are suggestive of metabolic or deficiency syndromes, such as nervous ketosis and hypomagnesemia, or toxic conditions, such as ryegrass staggers. The animal's gait is uncoordinated and characterized by a loss of balance and swaying, often with high-stepping, particularly of the hind feet. Some cows may paw the ground or lick their nostrils frequently. The general posture is abnormal. Tremors, an abnormal head carriage, and knuckling at the fetlock are present. Affected animals are afebrile and exhibit progressive deterioration with loss of body weight despite a normal appetite, reduced milk yield, ataxia, and falling. (11,13,14)

The diagnosis

Cattle exhibiting clinical signs of BSE should be confirmed through histoligic examination of the brain. The histopathologic changes are characterized by degenerative alterations in the grey matter of the brain stem, with the most outstanding feature being the intracytoplasmic vacuolation of neurons in various brain stem grey matter nuclei. (14) The discovery of fibrils similar to scrapie-associated fibrils in detergent extracts of BSE-affected brain tissue confirms that BSE is a scrapielike disease. (15) Scrapie-associated fibrils (SAF) are pathologic aggregates of a prion protein, which is a neuronal membrane protein. A protease-resistant form of prion protein is a molecular marker of scrapie-associated fibrils (FAS), which are found in brain extracts of all animal species affected by scrapie or other transmissible spongiform encephalopathies. (15)

Potential Routes of Transmission

The epizootic curve of the BSE outbreak in Great Britain was consistent with that of an extended common source of exposure. Epidemiologic investigations into the source of this outbreak have been comprehensive and extensive. Many possible causes were considered before the consumption of rendered animal proteins containing the scrapie agent was determined to be

the likely source of exposure. Meat and bone meal (MBM) containing material from rendered mature sheep was epidemiologically implicated. This protein supplement has commonly been used in Great Britain in feed for lactating cows and young calves. (9)

Preventing a BSE Outbreak

Control and prevention strategies must be geared toward breaking the potential existing routes of BSE transmission. Such planned strategies should be a joint effort by the government, livestock producers, academic and research institutions, and the rendering and feed industries.

Any government free of the disease can institute the following preventive measures:

1. Prohibit the importation of cattle and animal protein products from countries where BSE has been confirmed.

2. Implement a scrapie surveillance program to assess epidemiologic trends and the prevalence of the disease.

3. Develop an active histologic surveillance program for cattle showing signs of BSE, and other neurologic disorders.

4. Work with researchers internationally to monitor the occurrence of scrapie and BSE and assess the status of control programs worldwide.

5. BSE has global implications. The World Health Organization (WHO) should be a resource to facilitate and fund training of professionals for BSE research.

6. Governments should pool resources to develop a test to recognize BSE-infected animals before they become clinically ill.

7. Every government should have in place emergency response guidelines to react to a possible outbreak and take measures to control the spread of the disease.

8. Government should provide educational updates to "interested parties" on the incidence of BSE worldwide, and enhance that information with timely advice as appropriate.

Livestock producers must be aware of the relationship of scrapie and BSE, and the epidemiologic significance of feeding meat and bone meal produced from sheep offal. They should also be aware of the clinical signs of BSE and report neurologic signs in cattle over two years old to regulatory authorities.

Academic and research institutions should collaborate with government disease control

officials on procedures for preventing the disease. Teaching modules should be incorporated into the professional curriculum and videos produced for practitioners and others with an interest in controlling the disease.

PUBLIC HEALTH IMPLICATIONS

The application of scrapie as a relative public health comparative indicator and the theory that cross-infection to humans from scrapie infected sheep and goats could occur, the current epidemiological evidence does not support such a causal association or link. Adjunctly, present knowledge suggests that the scrapie agent is not an important pathogen in man, and a reasonable extrapolation can propose that BSE will not likely pose a risk to publiC health. (16) Nonetheless, there have been lingering public and professional anxiety that human transmission may occur, even though all evidence remains highly speculative and anecdotal.

Uncertainties persist about the possible alteration of the properties of the infectious agent following species to species transmission, in spite of the remote risk of BSE to humans. Experimental evidence suggests that the dosage of the agent and route of inoculation are paramount to transmission. (16) The consideration of potentially contaminated beef as a transmitting reservoir of BSE presents serious limitations, since the oral route is 40,000 times less efficient than intracerebral inoculation experimentally. (17) In the continued assessment of potential exposure, the distribution of the infectious agent in tissue is a pertinent factor in infectivity. The tissues that contain significant titres of the agent include components of the lymphoreticular system, the brain and spinal cord. Therefore, muscle or milk will unlikely contain titres of the agent, making the risk of BSE oral transmission to humans remote. (16)

DISCUSSION/SUMMARY

BSE is a complex neurologic disease, and the causative agent has not been specifically characterized. Both epidemiologic and histologic findings have established a distinct similarity between the BSE agent and the scrapie agent. The disease is a challenge with a prolonged incubation period that complicates traditional principles of prevention and control. Protection of the cattle industry mandates a close working relationship among all involved in livestock agriculture.

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PRIVATIZATION OF THE VETERINARY HEALTH CARE DELIVERY SYSTEM: THE JAMAICAN EXPERIENCE

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ABSTRACT

The delivery of veterinary services in Jamaica has been by tradition, a role of Government based on a policy decision aimed at giving support to the development of the local livestock industry.

Over the years, veterinary services to livestock farmers have been delivered totally free, or on a highly subsidized basis.

As with many other developing countries, the socio-economic structure, size and geographic distribution of farms, among other factors, have served to create some almost unique problems of animal health care delivery. This situation has become exacerbated by the current global economic crisis which imposed very stringent economic measures on poor developing countries such as Jamaica.

One major result of this crisis, is that the Government was forced to adopt specific structural adjustment policies introduced by the various international monetary organizations. The adoption of these policies has in turn, led to con committant drastic reduction in budgetary allocations to all the public service entities, including those in agriculture. The cutbacks have severely affected the ability of the Veterinary Services to perform its assignment.

Given the severe economic constraints, a review of several alternative systems for delivering veterinary services were considered; with the decision being made to privatize the clinical aspects of the service, while retaining those aspects such as quarantine, regulatory and laboratory diagnostics, which were considered non-delegable at that time.

As a result of this decision, veterinarians made redundant were given use of available residences and clinic/office complexes on a low charge lease basis, in order to maintain continuity of service; and in lieu of their roles as **local Veterinary Inspectors.**

The initial impact of the changes brought about by this decision was determined to be a mix of negatives and positives in terms of, the Government, Livestock Farmers and veterinary personnel involved.

After approximately two (2) years of existence, and despite the drawbacks, the new system

appears to be working and gaining general acceptability.

THE SERO PREVALENCE OF CAPRINE ARTHRITIS ENCEPHALITIS (CAE) IN JAMAICA

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ABSTRACT

Epidemiological studies have indicated that Caprine Arthritis Encephalitis (CAE) is a recently imported disease of goats in Jamaica.

A national survey to determine the sero prevalence of CAE in the local goat population, and aimed at designing an appropriate control measure and if practical, an eradication programme was conducted during the period June 1993 to June 1994.

Approximately 1,210 goats from 34 random selected farms were serologically tested for Caprine Arthritis Encephalitis Virus (CAEV) antibody, using the Standard Agar-Gel Immuno Diffusion Test and the ELISA Technique.

Of the total number of animals tested, only a single sero positive reactor was confirmed.

The results of this survey supported previous studies which indicated that CAE was not endemic to Jamaica, and was in fact, limited to herds with previously imported CAE-Infected Stock.

AN EVALUATION OF THE MINERAL STATUS OF DAIRY CATTLE IN COASTAL GUYANA

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SUMMARY

An evaluation of the mineral status of dairy cattle from six different locations East of the Essequibo River and West of the Berbice River in coastal Guyana was conducted. A total of 85 Animals were bled by Jugular Vein Puncture and blood serum was analysed for Na, K, P, Ca, Mg, Cn, Zn and Fe. Blood serum concentrations of Na and K were normal, irrespective of location. The study indicated that 79.4% of the animals were deficient in P ($P<0.01$), 20.5% were deficient in Ca ($P<0.05$), 13.7% were deficient in Mg ($P>0.05$), 41.0% were deficient in Cn ($P<0.01$), 10.8% were deficient in Zn ($P>0.05$) and 8.4% were deficient in Fe ($P>0.05$). Significant between location differences were observed for mean serum concentrations of P, Ca, Mg and Cn ($P<0.001$) as well as for Na, K, Zn and Fe ($P<0.01$), respectively. It was concluded that further studies are necessary on a soil-plant-animal basis in order to determine the level of dietary supplementation necessary to satisfy physiological mineral requirements.

INTRODUCTION

One of the major limiting factors to ruminant production in the tropics is a lack of adequate amounts of specific minerals in tropical pastures (Wilson et al, 1981). Inadequate dietary intakes of energy and protein are also responsible for poor animal performance in the tropics (Conrad et al, 1984), however, sub-optimal dietary levels of minerals can affect the efficiency of utilisation of ingested energy and proteins.

Reports in the literature of the incidence of mineral deficiencies in Guyana are few. Legg et al (1960) reported a zinc deficiency in grazing cattle in Guyana. Apart from this report, there have been no other reports to date on the mineral status of grazing cattle in Guyana.

There are however, reports of the incidence of mineral deficiencies in cattle from other South American countries (Sutmoller et al, 1966; Mc Dowell, 1976). There are also reports of the occurrence of mineral deficiencies in grazing cattle from Latin America (Mc Dowell et al, 1977; Edwards et al, 1981), the Caribbean Basin (Conrad et al, 1984) and more recently from Trinidad (Mohammed et al, 1994).

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An overview of the dairy sub-sector in Guyana (Surujbally et al, 1993) indicates a desire to increase local milk production. The majority of dairy cattle in Guyana are reared under a semi-intensive system of management with only a few of the farms having improved pastures. The dairy sub-sector is concentrated mainly in the coastal belt of Guyana (Surujbally et al, 1993). Small amounts of copra meal and rice bran are used as concentrate feed to supplement forage protein. The use of mineral supplements in dairy cattle nutrition in Guyana is not only cost prohibitive but in most cases mineral supplements are unavailable locally.

Given the importance of minerals in reproductive performance and hence milk production from dairy cattle, the objective of the present study was to evaluate the mineral status of dairy cattle in coastal Guyana.

MATERIALS AND METHODS

Location:

Six (6) locations East of the Essequibo River and West of the Berbice River were randomly selected for sampling.

Animals:

Eighty five (85) animals over six (6) months of age were blood sampled as follows:

- Silver Hall Linden - 18
- Garden of Eden - 15
- East Coast Demerara (Small Farms) - 12
- Lillendalle - 16
- East Bank Demerara - 14
- West Berbice - 10

Blood Samples:

Ten (10) ml of whole blood was taken by Jugular Vein Puncture into non-haeparinised vacutainer tubes:

- Blood serum was separated from whole blood
- Samples by centrifugation at 2500 RPM for 25 minutes
- Serum samples were stored at -20°C

Serum Analysis:

Serum samples were analysed according to the method of Fick et al (1976) for Sodium,

Potassium, Phosphorus, Calcium, Magnesium, Copper, Zinc and Iron.

Statistical Analysis:

Analysis of Variance (ANOVA) was used to test the effect of location of blood mineral concentrations.

RESULTS AND DISCUSSION

Mean serum mineral concentration according to location are given in Table I

Sodium and Potassium

Mean serum Na and K concentrations were well above the 285mg $100ml^{-1}$ and 9.8mg $100ml^{-1}$ critical levels (Puls 1990), respectively, irrespective of location. Of the 85 animals sampled, serum Na concentrations ranged from 296mg $100ml^{-1}$ to 361mg $100ml^{-1}$, while serum K concentrations ranged from 16.3mg $100ml^{-1}$ to 35.3mg $100ml^{-1}$. Mean serum Na and K concentrations were significantly different ($P<0.01$) between locations. These results indicate that dietary Na and K intakes were adequate in the cattle studied.

Calciums

Serum Ca concentrations ranged from 5.0mg $100ml^{-1}$ to 10.7mg $100ml^{-1}$. Critical serum Ca concentrations of <6.0mg $100ml^{-1}$ (Puls 1990) were observed in all locations except West Berbice (Table 2). Mean serum Cn concentrations in all six (6) locations were above the critical 6.0mg $100ml^{-1}$, however, 46.2% ($P<0.01$) of the animals sampled from the Garden of Eden had serum Ca concentrations below the critical value. The animals sampled at Small Farms East Coast Demerara also indicated a 30.8% ($P<0.01$) deficiency with 16.6% ($P>0.05$) of the animals sampled at Silver Hall Linden demonstrating critical levels of serum Ca. Of the 85 animals sampled, 20.5% ($P<0.05$) had serum Ca concentrations <6.0mg $100ml^{-1}$ (Table 2). Mean serum Ca concentrations were significantly different ($P<0.001$) between locations. Soil Ca concentrations in the frontland clays of the Garden of Eden and Small Farms, even though decreased by weathering, are higher than the coropina soils of Silver Hall and the riverian soils of West Berbice (Ahmad et al, 1963), however, blood serum Ca concentrations indicate that a greater number of animals raised on frontland clays tend to be deficient in Ca. Ironically, the riverian soils of West Berbice are the poorest of the three (3) soil types in Ca, (Ahmad et al, 1963), yet none of the animals sampled in West Berbice had serum Ca concentrations below the critical level of 6.0mg $100ml^{-1}$.

Phosphorus

Serum P concentrations ranged from 3.3mg $100ml^{-1}$ to 6.6mg $100ml^{-1}$. All 15 animals

sampled at the Garden of Eden had serum P concentrations below the critical value of 5.0mg $100ml^{-1}$ (Puls 1990). Over 80% ($P<0.01$) of the animals sampled at Silver Hall, Small Farms and West Berbice had serum P concentrations <5.0mg $100ml^{-1}$, respectively (Table 2). From East Bank Demerara and Lillendalle, 36.4% ($P<0.05$) and 66.6% ($P<0.01$) of the animals demonstrated serum P concentrations below the critical level, respectively. Mean serum P concentrations were significantly different ($P<0.001$) between locations. Amongst the 8 minerals measured in this study, P was the most deficient mineral. This observation concurs well with the findings of Mc Dowell et al (1977), where P deficiency in cattle in other Latin American countries was the most widespread. Phosphorus deficiency was attributed to the poor P status of Latin American soils, (McDowell et al,1977) however, in the absence of data regarding the P concentrations of the soils of coastal Guyana specifically, it is difficult to explain the low P levels detected in the blood

TABLE 1: MEAN (+SE) BLOOD SERUM MINERAL CONCENTRATIONS ACCORDING TO LOCATION

LOCATION	MINERALS							
	(mg $100ml^{-1}$)					(mg $100ml^{-1}$)		
	Na	K	Ca	P	Mg	Cn	Zn	Fe
Silver Hall Linden	324.3 ±12.6	23.9 ±3.5	7.5 ±1.4	4.0 ±0.8	2.5 ±0.6	279.0 ±12.0	450.0 ± 9.2	820.0 ±35.5
Garden of Eden	328.4 ±20.2	23.3 ±3.1	6.6 ±1.3	4.8 ±0.9	2.2 ±0.5	81.0 ±8.9	302.0 ± 3.4	448.0 ± 4.8
East Coast Demerara (Small Farms)	327.3 ±13.9	19.9 ±3.2	6.6 ±1.1	4.7 ±0.4	1.6 ±0.5	88.0 ±6.2	398.0 ± 8.8	362.0 ± 3.2
Lillendalle	340.8 ±10.0	19.7 ±1.9	7.1 ±1.1	4.7 ±0.7	1.1 ±0.4	84.0 ±3.1	99.0 ±4.8	1237.0 ±104.2
East Bank Demerara	339.3 ±11.2	20.9 ±2.6	8.5 ±1.3	5.1 ±1.0	1.4 ±0.5	70.0 ±2.3	235.0 ± 3.0	1088.0 ±126.0
West Berbice	333.4 ± 5.8	22.2 ±4.0	9.6 ±1.1	4.7 ±0.8	1.6 ±0.5	51.0 ±1.4	357.0 ± 4.2	1010.0 ± 74.3

TABLE 2: PERFORMANCE OF CATTLE SHOWING CRITICAL BLOOD SERUM MINERAL CONCENTRATIONS ACCORDING TO LOCATION

	MINERALS							
	Na	K	Ca	P	Mg	Cn	Zn	Fe
	(Mg 100ml^{-1})				(Mg 100ml^{-1})			
CRITICAL LEVEL	<285.0*	<9.8*	<6.0*	<5.0*	<1.1*	<65.0**	<80.0**	<130.0*
LOCATION	PERCENTAGE (%) DEFICIENT							
Silver Hall	0.0	0.0	16.6	88.2	0.0	5.6	0.0	0.0
Garden of Eden	0.0	0.0	46.2	100.0	0.0	60.0	0.0	13.3
East Coast Demerara (Small Farms)	0.0	0.0	30.8	91.7	23.1	31.3	0.0	31.3
Lillendalle	0.0	0.0	9.1	66.6	27.3	25.0	33.3	0.0
East Bank Demerara	0.0	0.0	7.7	36.4	23.1	57.1	14.3	0.0
West Berbice	0.0	0.0	0.0	85.7	20.0	100.0	25.0	0.0
Total % Deficient	0.0	0.0	20.5	79.4	13.7	41.0	10.8	8.4

*Puls (1990) **McDowell (1976); McDowell et al (1977)

serum of the animals in this study. Serum P concentrations are however, indicative of dietary P intakes (Mc Dowell et al 1982). Of the 85 animals sampled, 79.4% ($P<0.01$) were deficient in P. Poor conception rates in grazing ruminants is a characteristic of P deficiency (Underwood, 1981). The reproductive performance of dairy cattle in coastal Guyana may therefore be affected by the low levels of endogenous phsophorus.

Magnesium

Serum Mg concentrations ranged from 0.4mg 100ml^{-1} to 3.4mg 100ml^{-1}. None of the animals sampled from Silver Hall and the Garden of Eden had serum Mg concentrations below critical 1.1mg 100ml^{-1} (Puls, 1990) level, however 23.1% ($P<0.05$) and 27.3% ($P<0.05$) of the animals sampled from Small Farms and Lillendalle were deficient in serum Mg respectively, while 23.1% ($P<0.05$) and 20.0% ($P<0.05$) of the animals sampled in East Bank Demerara and West Berbice demonstrated serum Mg concentrations below the critical level, respectively. Only 13.7% ($P>0.05$) of the 85 animals sampled were deficient in Mg. Mean serum Mg concentrations were significantly different ($P<0.001$) between locations. It would appear therefore, that dietary

intakes of Mg are sufficient to meet the physiological requirements of dairy cattle in coastal Guyana.

Copper

Serum Cn concentrations ranged from 14.0mg $100ml^{-1}$ to 385.0mg $100ml^{-1}$. The animals sampled at silver Hall had the highest mean serum Cn concentrations of 279.0 ± 12.0mg $100ml^{-1}$ (Table 1) amongst the six (6) locations, with only 5.6% ($P>0.05$) of the animals demonstrating serum Cn concentrations below the 65.0mg $100ml^{-1}$ critical level (Mc Dowell 1976; Mc Dowell et al 1977). A mean serum Cn concentration of 51.0 ± 1.4mg $100ml^{-1}$ was observed for the animals sampled at West Berbice. All 10 animals sampled had serum Cn concentrations below the critical clinical level.

Even though mean serum Cn concentrations were above the 65.0 $100ml^{-1}$ critical clinical value in cattle from the four (4) locations dominated by frontland clays. The data in Table 2 indicates that a significant number of animals in the study ($P<0.05$) had serum Cn concentrations below the critical clinical level, particularly those animals sampled from East Bank Demerara (57.1%, $P<0.01$), and the Garden of Eden (60.0%, $P<0.01$).

It would appear therefore, that the riverian soils of West Berbice, where 100% ($P<0.01$) of the animals sampled were deficient in Cn, may either be depleted in Cn or may be high in Molybdenum (Mo), since dietary Mo intakes in excess of 5.0mg Kg^{-1} can improve Cn deficiency in ruminants (Underwood 1981). A similar rationale may be used to explain the 60% deficiency observed in the cattle sampled from the Garden of Eden.

The serum Cn status of dairy cattle from coastal Guyana appear to be similar to the serum Cn status of cattle in Trinidad, where 94.3% and 100% of cattle sampled from North and South Trinidad, respectively, were found to be deficient in copper (Mohammed et al 1994). Copper deficiency in cattle in the Caribbean Basin is widespread, and appears to be a serious limiting factor to cattle production in South and Central America (Conrad et al 1984).

Of the 85 animals sampled in coastal Guyana, 41.0% ($P<0.01$) had serum Cn concentrations below the critical clinical 65.0mg $100ml^{-1}$ value. One of the symptoms of Cn deficiency in cattle is poor conception (Underwood, 1981). Reproductive performance of cattle in coastal Guyana may, therefore, be compounded by Cn deficiency, in addition to the low levels of P observed in this study. Mean serum Cn concentrations were significantly different ($P<0.001$) between locations.

Zinc and Iron

Serum Zn concentrations ranged from 27.0mg $100ml^{-1}$ to 480mg $100ml^{-1}$ whilst that of Fe ranged from 46.0mg $100ml^{-1}$ to 1500mg $100ml^{-1}$. None of the animals sampled at Silver Hall,

Garden of Eden and Small Farms had serum Zn concentration below the critical clinical 80.0mg $100ml^{-1}$ (Mc Dowell et al 1977) level, however, 33.3% and 25.5% of the animals ($P<0.05$) from Lillendalle and West Berbice, respectively, were deficient in Zinc. Only 14.3% of the animals ($P>0.05$) sampled in East Bank Demerara had critical serum Zn concentrations.

Zinc deficiency in cattle is the only report in the literature on mineral deficiencies in Guyanese cattle (Legg et al 1960). Of the 85 animals sampled, only 10.8% ($P>0.05$) demonstrated critical levels of serum Zn. It is apparent from this study that dietary Zn intake by dairy cattle in coastal Guyana is adequate to meet physiological requirements.

Animals sampled from four (4) of the locations had adequate levels of serum Fe concentrations (Table 2), however, significant between location ($P<0.01$) differences were observed in mean serum Zn and Fe concentrations. Only 13.3% ($P>0.05$) of the animals from the Garden of Eden and 31.3% ($P<0.05$) of the animals from Small Farms had serum Fe concentrations below the critical 130.0mg $100ml^{-1}$ (Puls 1990) level, and this may be attributed perhaps to intestinal parasite burden in these two (2) locations at the time of sampling. Of the 85 animals sampled, 8.5% ($P>0.05$) appear to be deficient in Iron.

CONCLUSIONS

The results of this study indicate significant sub-clinical blood serum concentrations of Ca, P and Cn. It is also apparent that there is a location effect on serum mineral concentrations, however, it is difficult to attribute these findings to differences in soil type and soil mineralogy in the absence of data on soil and forage mineral concentrations. The results nonetheless gives a reasonable indication of the mineral status of dairy cattle in the areas of coastal Guyana studied.

Further studies are therefore required to establish soil and forage mineral concentrations in order to determine the level of dietary mineral supplementation needed to satisfy physiological requirements, and by extension, improve dairy cattle performance and productivity.

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RESPONSE OF LACTATING DAIRY COWS IN JAMAICA TO RECOMBINANT BOVINE SOMATOTROPIN

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ABSTRACT

The Jamaican Dairy Industry has the potential to produce increased quantities of milk, thereby making for drastic reductions in current imports of dairy products. However, inadequate overall production and low individual animal productivity, along with limited available allocated land space are probably the most prohibitive factors contributing to the development of the local dairy industry.

Tile use of bST, a naturally occurring bovine somatotropin, has been found to significantly increase milk yield under different management conditions and over a wide range of geographic locations.

The study being reported here, was designed to evaluate the effects of bST on milk yield in lactating dairy cows under Jamaican conditions.

For this study, native Jamaican Hope and Holstein dairy herds were randomly assigned in equal numbers, to both bST injected and non-bST injected (control) groups.

The bST preparation (Sometribove - Monsanto Agricultural Corporation) was administered in a prolonged release system every fourteen (14) days, for ten (10) weeks within two stages of lactation (I -- 85-160 days, II = 161-220 days postpartum) and to two (2) parity groups (primiparous and multiparous). Milk yield was monitored one day per week for twelve (12) weeks, including two (2) weeks pre-treatment (covariate period).

Over the 10-week injection period, cows given bST, produced more milk (4.2 lbs./ cow/day, or an increase of 19.5%) than the cows in the control groups. Response in milk yield was different among herds. Both primiparous and multiparous bST-injected cows produce more milk than their controls.

Milk response to bST-injected multiparous cows (3.8 lbs./cow/day) exceeded injected primiparous cows. Similarly, cows in Stage I lactation, responded better to bST (4.3 lbs./cow/day) than cows in Stage II (3.2 lbs./cow/day).

The results of the study indicated that the use of the bST increased milk yield and

persistency, and with no apparent adverse effects on animal health.

It would appear as if bST has the potential to increase milk yield and persistency under Jamaican, and by extension, tropical management conditions.

NEW WORLD SCREWWORM MYIASIS:A RISK ANALYSIS OF THE ECONOMICS AND PUBLIC HEALTH IMPLICATIONS AND RATIONALE FOR ERADICATION IN JAMAICA

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ABSTRACT

Myiasis caused by the New World Screwworm (NWS) fly, Cochliomyia hominivorax (coquerel) is endemic to Jamaica, and is arguably, the single most debilitating animal disease in this country, as well as the Caribbean and Central American regions. In Jamaica, potentially, every untreated wound can become screwworm infested. NWS, a voracious obligate parasite, affects all warm blooded animals, including man.

This parasitic condition exerts a major impact on the health of animals and in turn, the economy of many countries of the regions. Furthermore, NWS Myiasis is believed to be fast becoming an important zoonosis, and can adversely influence the biodiversity of these countries.

Despite these facts, most of these countries can provide no more than "estimates" of the direct, indirect, consequential], visible and invisible resultant losses caused by diseases.

In Jamaica, it has been shown that significant, direct and indirect losses have occurred to the livestock industry. This in terms of reduced productivity, increased mortality rates and increased veterinary intervention, relative to surveillance, therapy, prophylactics and labour costs. This situation has had significant impact on human nutrition, animal export trade and an already critically scarce foreign exchange situation, due to increasing importation of animal products. Its indemicity has led to increased vulnerability to wild life, with preventative and curative interventions, being neither available nor practical. This could have serious implications for the island's tourism sector, especially as this relates to eco-tourism; while causing possible disruption and alteration to the biotic community and eco-systems.

Based on data collected in 1984, and more recently, in 1993, it has been estimated that the annual direct losses to the livestock industry alone, is 3.5 million (US) dollars or approximately 35 million dollars over the last decade. The indirect losses resulting from decreased productivity of livestock, were estimated to be at least, of a similar magnitude. The cost in human health and the impact on biodiversity and the tourism sector, remain essentially incalculable.

In addition, the presence of NWS Myiasis in Jamaica presents a constant threat to the

re-invasion of the already eradicated and non-endemic areas of the Caribbean, as well ac Mainland America.

The eradication of NWS can be achieved using the Sterile Insect Technique (SIT) which involves the sequential aerial dispersion of radiation-sterilization treated NWS flies over infected areas, aimed at eliminating the native fly population.

Preliminary results, and the experience gained in other countries in the region, have shown that the eradication of the NWS from Jamaica, is economically feasible. In fact, based on the estimated losses of 3.5 million dollars annually and an eradication cost of 5.9 million (US) dollars, a cost benefit ratio of 1:6, is being projected over a 10-year period.

With a total of approximately 10,991 square kilometers and a potential livestock host population of 1.5 million, not including wild life species and humans, the eradication of the NWS parasite must be se as a priority. This is made even more urgent with the stated national goal of increased food self-sufficiency, especially at the small farmer level.

THE SERO PREVALENCE OF INFECTIOUS BURSAL DISEASE (IBD, GUMBORO), IN THE COMMERCIAL BROILER INDUSTRY IN JAMAICA

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ABSTRACT

Infectious Bursal Disease (IBD, Gumboro) is an acute and highly contagious viral infection affecting poultry. It is characterized by the destruction of lymphocytes in the Bursa of Fabricius, and to a lesser extent, other lymphoid tissues. The disease presents a major problem in areas of concentrated poultry production throughout the world.

The virus usually affects chickens in the first three (3) weeks of life, when the immune system is immature. The disease is often not recognized due to a subclinical form. However, in broilers, clinical manifestation of the disease becomes more marked, the closer they come to slaughter age. Affected chickens show reduced antibody response to vaccinations, strong post-vaccinal reactions and increased susceptibility to concurrent or secondary infections.

Clinical symptoms resembling IBD infection were increasingly being reported by field officers on some of the broiler farms of the two (2) largest commercial broiler operations in the country.

This study was designed to verify and to determine the extent and significance of IDB) infection in the local broiler industry, and if necessary, to develop an effective control programme based on existing local conditions.

Serum samples from broiler farms participating in the study, were analysed for IBD virus antibody, using the ELISA Technique. Similarly, Bursal Fabricius, thymic and tracheal tissue specimens were histopathologically examined, using standard procedures for the presence of lesions.

The level of protective antibodies found~ were considered generally low, as well ac poorly uniformed at 11 days of age or less. Lesions in the Bursa Fabricius were not shown until after 18 days of age or older. Some of the bursal lesions were remarkedly characteristic of IBD.

These findings suggest that some of the farms involved may be heavily contaminated No immuno-suppressive IBD was identified in the flocks investigated. However, the results of the study conclusively demonstrated that the IBD field virus infection is present in commercial broiler operations in Jamaica.

The findings further suggest that the infection pressure was not an overwhelming factor, and as such, professional restraint should be considered in developing relevant control programmes.

THE MYTH OF THE LONG TOE - LOW HEEL RACEHORSE

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Although the title of this paper refers specifically to racehorses the contents apply equally to all horses.

The tendency to encourage the development of long toe - low heel feet in racehorses has existed for as long as people have been racing horses.

A long toe - low heel foot is a foot that has a cranio-caudal (anter-posterior) imbalance. For a foot to be cranio-caudally balanced the angle of the front of the hoof wall should be the same as the angle of the pastern, or in other words the hoof/pastern axis is a straight line. When the hoof/pastern axis is straight the proximal, middle and distal phalanges are thought to be in a straight line. In addition the angle of the hoof wall at the heels should be parallel to the hoof wall at the toe.

To a large extent the angle of the pastern is determined by conformation, although it can be influenced by the way in which the hoof is trimmed. On the other hand the angle of the front of hoof wall is determined largely by the ratio of toe to heel that is trimmed from the hoof wall although foot conformation may be involved in some cases.

The longer the toe is left and the lower the heels are trimmed the more acute an angle (more sloping) the front of the hoof wall becomes with the ground. The more the toe is trimmed and the longer the heels are left the steeper the angle the front of the hoof wall becomes.

Trimming the toe or leaving the toe untrimmed by 1cm more or less will alter the angle of the front of the hoof by approximately 4 degrees.

Unfortunately many farriery and veterinary textbooks state that the ideal angle for the front foot should be 45 - 50 degrees and the hind foot 50 - 55 degrees. These are theoretical "ideal" angles and are unrelated to the conformation of the horse. This kind of theoretical farriery is practised by those who shoe feet not horses. The correct angle for foot should be whatever is determined by the individual animal's conformation.

By far the most common cranio-caudal imbalance the world over is the long toe -low heel which produces a backward broken hoof pastern axis. This imbalance, invariably man-made, occurs in all breeds and activities of horses. Nowhere is it more common than in the equine speed athlete such as the racehorse, the trotter and the pacer. This imbalance is actually encouraged by many trainers and owners.

The possible reasons why this imbalance is so common in all horses are:

i. It is so common that it is seen as normal/acceptable.

ii. The toe is the thickest, hardest part of the hoof wall and the heels are the softest, thinnest part. It is easier, without thinking about it, to trim the heels than the toe.

iii. The heels are trimmed in order to adhere to the "frog pressure theory" on foot expansion. The theory is that the frog must contact the ground to such an extent that it is compressed which causes compression of the digital cushion which results in outward movement of the hoof cartilages and hoof walls. This theory has received widespread acceptance for over 100 years although very little research has been carried out to prove or disprove it. However recent work carried out by Colles (1989) has shown that frog pressure is not necessary for expansion of the heels to take place and, in fact, increasing frog pressure produces inconsistent results - some heels over-expand others contract.

iv. The practice of shoeing short and tight at the heels is common particularly on sport horses to try and prevent shoes being pulled off. This leaves the heels unsupported and puts the weight bearing surface in front of the vertical axis of the limb. This has the same effects as, and encourages the foot to grow into, a long toe - low heel imbalance.

v. All of these reasons individually or in combination could account for the preponderance of this imbalance but by far the most prevailing reason, particularly in racehorses, is the belief that a long toe - low heel increases the horses stride length and therefore speed. This has been believed for so long that most people consider it to be an established fact, however it has never been properly investigated until recent years.

Work carried out by Clayton (1987, 1990) using high speed cinematography has shown that previously described arcs of foot flight for the balanced and long toe - low heel imbalanced foot (Hickman 1977, Stashak 1987,) are wrong. The arc of flight for a normal foot is not a symmetrical arc with the peak of the arc as the foot passes the opposite limb, but rather a biphasic curve the highest part of the flight arc being shortly after lift off then a low flight path with a small second elevation as the foot prepares to land heel first or flat-footed.

The arc of flight for a long toe - low heel imbalanced foot has been previously described as an asymmetrical arc with the peak of the arc before the foot passes the opposite limb followed by a long sweeping stride. The longer, more sweeping stride was attributed to the leverage effect of the long toe causing a delay in breakover. Breakover is the time from heels coming off the ground to the toe coming off the ground. However, studies have now shown that the flight path is, in fact, very similar to that of a normal foot, a biphasic curve. The only difference is that at the end of the stride instead of the toe being elevated for a heel first or flat footed landing in this case the toe tends to land more often first. With the long toe - low heel foot breakover time is

significantly longer than a normal foot because of the long toe acting as a lever but no difference in length of stride has been found.

As the speed of a horse increases the time for each stride decreases. Therefore the stride rate (strides per unit time) increases. Increased stride rate is achieved by the feet spending less time on the ground (shorter stance and breakover phase) while the swing phase ~time in the air) tends to remain the same. Contrary to popular belief a long toe -low heel foot is more likely to retard a horses' speed because the delay in breakover restricts the reduction in time on the ground.

In addition to the effects of the long toe - low heel imbalance on stride there are a number of other detrimental effects which need to be weighed against any perceived advantages.

Studies in Britain (Jeffcott, Rossdale, Freestone et al 1982) have shown that economic loss in racing due to lameness problems was three times higher than any other problem. A pilot study in USA by Kobluk, Robinson, Gordon et al 1989 showed that horses with low hoof angles had a significantly higher incidence of musculo-skeletal problems resulting in loss of racing and training time.

The other detrimental effects of long toe - low heel imbalance are:

a. an increased tendency to land toe first which encourages stumbling

b. abnormal forces on the foot at landing and breakover

c. increased tension on the deep flexor tendon and navicular ligaments at breakover

d. increased compressive forces on the navicular bursa and navicular bone

e. increased tension on the dermal-epidermal laminar bond

f. thinning of the sole and loss of its natural concavity

g. a tendency for the hoof wall to collapse at the heels.

Because of these detrimental effects a number of lameness conditions are associated with or predisposed to by the long toe - low heel imbalance.

These conditions include tendonitis, navicular disease, pedal osteitis, desmitis of the suspensory ligament of the navicular bone, sole bruising, toe, quarter and heel cracks, and chronic corns.

Unfortunately like many foot imbalance problems the long toe - low heel imbalance is quickly and easily produced but is much more difficult, and often requires a long period, to correct.

Correction involves the farrier trimming the toe back as much as possible from the ground surface but trimming nothing from the heels. If the heels have become so low and weak that they have collapsed then the collapsed portion of the heel will need to be trimmed. The foot is then fitted with a shoe that will give support to the low heels and allow heel growth. This can either be a flat wide webbed shoe fitted long at the heels or an egg-bar shoe depending on the severity of the imbalance. The horse should be shod in this way until there is enough natural heel growth to straighten the hoof pastern axis. In severe cases a shoe which takes some of the weight be~ring off the heels may need to be used such as an egg-bar/heart bar combination shoe.

Many people make the mistake of trying to correct the low heels by using a wedge pad under the shoe at the heels or using heel calks. Although these will mechanically lift the heels up and give an impression of correction it is short lived. Raising the heels in these ways results in increase pressure on the hoof wall at the heels and will tend to encourage more heel wear and collapse.

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DISEASE PREVENTION: VACCINATION AND DISINFECTION

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VACCINATION PRINCIPLES

INTRODUCTION

With the world wide development of intensive poultry breeding and rearing, it is inevitable that changes are and will be made in all aspects of management including house design, ventilation, feeding, lighting and above all, in health care. This paper deals with special measures taken in health care, with attention to the prevention of infectious diseases by means of vaccination and disinfection.

VACCINATION

Before embarking on the application of vaccines, it is important to realize that the basic principles of disease prevention begin with a good hygienic and sanitation protocol. Using sound management, including prophylactic and therapeutic measures, a reduction of challenge and infection can be seen.

Most infectious poultry diseases are common to all countries in particular the viral diseases. The importance of a particular poultry disease may differ from country to country or even from one geographical area to another. These differences are mainly related to the climate, husbandry, and management applied.

With respect to viral diseases and some bacteriological diseases, the poultry farmer is dependent mainly upon vaccination of birds to control these diseases. Two types of vaccines are available to control infectious poultry diseases live vaccines and killed vaccines. Despite some disadvantages, inactivated vaccines are used more and more in the poultry industry today. These vaccines are mainly used in layers and breeders with the exception of inactivated N.C.D. vaccine which can be used in broilers in high risk N.C.D. areas.

The following is an outline of the recommendations to practice for successful water, spray and killed vaccine use.

WATER VACCINATION

STORAGE AND VACCINE TRANSPORT

- Store at 2°- 8°C.
- Transport in cooler with ice pack until used.
- Do not expose to sunlight.

WATER

- Quality: Check twice a year for organic matter, chlorine, pH, heavy metals, bacteria. Keep a record of analysis results.

- Chlorine: Chlorinator: Turn off 72 hours before vaccination. deep well: Use a charcoal filter 72 hours before vaccination.

- Quantity: - If a water meter is used, vaccinate with 40% of the daily consumption. - The vaccine should be consumed within two hours. - A practice run using only water, one or two days before vaccination, will verify the amount of water needed for vaccination.

GUIDELINES FOR WATER VACCINATION IN LITRES PER 1,000 BIRDS

Age (wks.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Broiler chickens	10	20	29	38													
Replacement pullets	7	14	24	30	33	38	44	48	51	57	60	65	68	71	74	76	76
Turkeys (repr.)	15	30	45	60	76	98	120	152	181	204	227	250	257	264	257	257	257
Turkeys (meat)	10	23	38	53	60	68	76										

Important: Assuming an outside temperature of 21°C (70°F). - The values can change dependent on temperature, season, humidity, and feed type.

DRINKERS

Bell drinkers: 1/100 birds
Nipples: 1/15 birds
Cups: 1 /30 birds
Troughs 6': 1/150 birds
Troughs 8': 1/200 birds

HYGIENE

- Clean the drinkers with a mild soap.
- Flush the water lines.
- Rinse with water and powdered milk (1 Ib./50 gallons).
- If possible, avoid filters and pressure reducers (to avoid minerals, bacteria and disinfectant residues).

WATER STARVATION

- Should create a degree of thirst in the birds.
- Guideline of two hours before vaccination.
- Breeders: - Turn off the water one hour before turning off the lights. Vaccinate one hour after the lights are turned on.
  - Vaccinate on the feed day, after feeding.

VACCINE PREPARATION

- Add skim milk powder (1 Ib./50 gallons) to water used for vaccination and mix thoroughly.
- Dissolve the vaccine by adding water to the vaccine vials.
- Add the vaccine to the skim milk solution.
- Rinse each vial properly (otherwise, 15% of the vaccine may be lost), mix the vaccine solution thoroughly.
- Note the serial number and the expiry date of vaccines.

VACCINATION

- Vaccinate on feed days.
- Bell drinkers, troughs and cups: Pour by hand into each drinker.
- Nipples: Transfer the vaccine from a tank to water lines with a sump pump (1/3 H.P.) or by gravity.
- Open the water line at the end of the line.
- Close the line when the white vaccine solution comes through. **DO NOT USE A MEDICATOR OR A PROPORTIONER.**
- Walk among the birds so that each one can drink.
- Water the birds when the vaccine is completely consumed.

SECURITY MEASURES AND EMPTY CONTAINER ELIMINATION

Wear gloves, mask and safety glasses during preparation and vaccine administration to avoid eye infection (conjunctivitis) following Newcastle virus contact. Burn all empty containers.

COURSE SPRAY VACCINATION

STORAGE AND VACCINE TREATMENT

- Store at 2°-8°C.
- Transport in cooler on ice until used.
- Do not expose to sunlight.

DILUENT

- Preferably, use distilled, demineralized or spring water to maximize the vaccine quality and viability (avoid impure, contaminated or chlorinated water).
- Quantity:

Age	Litres/10,000 birds
At 1 day old (farm)	3 (30 mL/box)
Older than 7 days	7-8 (700-800 mL/1,000 birds)

A practicer using only water, one or two days before vaccination will verify the amount of water needed and vaccination speed required.

BEFORE VACCINATION

- Rinse the sprayer with water.
- Spray at a light source to observe spray particle size and pattern. - Important: The Hardi sprayer or the Spraymaster must be used for vaccination only (never for pesticides, herbicides or disinfectants).

VACCINE PREPARATION

- Adequate water quantity of appropriate quality.

- Dissolve the vaccine in the vials. Add to water.
- Rinse each vial properly (otherwise 15% of the vaccine may be lost).
- Shake well.
- Enough doses should be prepared for each floor or for the whole barn.
- Record the serial number and the expiry date for the vaccines used.

VENTILATION

- Turn off fans during vaccination.
- Turn on all fans 20 minutes after vaccination.
- During the hot summer weather, vaccinate very early in the morning and resume ventilation after vaccination.

VACCINATION

- No need to water starve birds.
- Breeder pullets: Vaccinate the birds on the feed day and dim lights over the feed lines.
- Broilers: Group the birds along the side wall(s) Distance between the vaccinator and side wall must not be more than 4 metres (1 2 feet). Reduce the light intensity over the birds and turn off other lights if possible. Walk slowly and keep the spray nozzle in a downward direction, one metre (three feet) above the birds heads.
- Pullets (cages): Dim lights, walk down the barn at a slow pace spraying at the face of the birds.
- Keep a constant pressure of 4.5-5.0 Bars (65-75 PSI).

SPRAYER MAINTENANCE

- After vaccination, rinse the sprayer thoroughly with distilled water.
- Sanitize the sprayer with "clean tabs".
- Rinse and leave upside down to dry in a clean place.

SECURITY MEASURES AND EMPTY CONTAINER ELIMINATION

Wear gloves, mask and safety glasses during preparation and vaccine administration to avoid eye infection (conjunctivitis) following Newcastle virus contact. Burn all empty containers.

VACCINATION BY INJECTION

STORAGE AND TRANSPORT

Store in a refrigerator at 2°-8°C. Do not freeze. Do not expose to sunlight. Take the vaccine out of the refrigerator 24 hours before administration, to facilitate vaccination and syringe ability.

FEED DAY

To avoid regurgitation, do not vaccinate the birds on the feed day.

VACCINE PREPARATION

- Shake the vaccine well (30 seconds) before using.
- Record the serial number and the expiry date of vaccines.

CALIBRATION OF INJECTORS

- Calibrate before and half-way through each vaccinating day. Inject five doses in a syringe. For a 0.2 mL calibration, obtain 1 mL. For a 0.5 mL dose, obtain 2.5 mL. Correct dosage if necessary.
- Use vegetable oil (because it is liquid with a viscosity similar to vaccine).

VACCINE ADMINISTRATION

- Use 1 8-gauge X 1/4 inch needles.
- Subcutaneous injection is preferred, intramuscular injection may lead to abscess formation and to carcass condemnation in birds destined for market.
- Inject in the upper part of the neck, half-way between the head and the shoulder.
- Change the needle at every 1,000 birds.
- One person should check to ensure each bird has been vaccinated (missed birds will often shake their heads, scratch, bleed, or have wet feathers). The missed birds must be revaccinated.

INJECTOR MAINTENANCE

- Clean the injectors with a disinfection solution (70% ethyl or isopropyl alcohol).
- Rinse well with water.
- Rinse with vegetable oil.
- Store in a clean dry place.

SAFETY PRECAUTIONS

- Avoid any self-injection. If it happens, consult a doctor immediately - for first aid and treatments, see below.

PROCEDURE TO FOLLOW IN CASE OF SELF-INJECTION

When a service person has accidentally injected him or herself, they should put ice on the injected area to reduce swelling. They then should see a medical doctor immediately. The injected area should be cleaned as soon as possible. Remember, the virus portion of the vaccine cannot be transmitted to people (not zoonotic) and is of no risk. The virus is inactivated or killed. The injection however is not sterile and bacterial contamination is highly possible. The medical doctor will routinely give antibiotics and a tetanus shot if the person has not recently had one.

This treatment however is not enough! Because of the nature of the emulsion; liquid paraffin, tween and mineral oil, the infected fluid must be removed. Medical doctors therefore lance, locally debride and remove the emulsion before the tissue reaction begins and causes inflammation. It is critical that the attending physician knows that it is an oil emulsion and should be treated for its content and not just for the infection due to contamination. The same protocol as a pressurized oil injection is recommended.

DISINFECTION

There is no doubt that cleaning and disinfection are instrumental management tools in lowering the insult to poultry houses. Bacteria, viruses and mould can build up in organic debris and surfaces causing sickness and production losses.

For this reason, it is important that the poultry house is maintained in a clean and sanitary condition. Profitable farming cannot be achieved with a dirty poultry house. Barns must be cleaned and disinfected regularly.

There is no ideal disinfectant. No single chemical antimicrobial agent is "best" for any and all purposes. Nevertheless, there are compounds available for practical use. The choice of a disinfectant is based upon the organisms involved, under what circumstances and where. Safety points addressing the operator, eggs/embryos/chicks and environment must also be taken into consideration.

The ultimate goal with chemical disinfectants is to eliminate or reduce certain disease causing organisms and therefore, reduce the stress on the bird.

The following outline covers the types of disinfectants available and a guideline for general cleaning and disinfection.

1. **CHLORINE**: Kills by protein denaturalization.

FEATURES	DISADVANTAGES
- quick kill	- corrosive
- good virucide	- non-residual
- broad-spectrum	- inactivated by organic debrie
- inexpensive	- volatile
- non-residual	- pH dependent
- low toxicity	

USES

i. Food Processing Plants
ii. Water Treatment
iii. Table Egg Processing
iv. Water Lines

2. **IODINE**: Kills by oxidation.

FEATURES	DISADVANTAGES
- quick kill	- neutralized rapidly by organic debris
- good virucide	- corrosive
- broad-spectrum	- pH dependent
- Inexpensive	- volatile
- safe with birds	
- more stable than chlorine	

USES

i. Food Processing Plants
ii. Hand (skin) Cleaning
iii. Foot Baths
iv. Water Treatment

3. **CRESYLIC ACID**: Kills by invading the cell.

FEATURES	DISADVANTAGES
- good bactericide	- does not have a natural soap system
- low cost	- can be toxic
- good organic tolerance	- strong odour
- hostile to insects	

USES

i. Poultry House Disinfection
ii. Foot Baths

4 **PHENOLS**: Kills by penetrating all membranes.

FEATURES	DISADVANTAGES
- rapid kill	- limited virus activity (IBD)
- good bactericide	- insoluble in water
- good organic tolerance	- can be toxic, irritating to skin
- residual action	- can be corrosive

USES

i. Farm Premise Disinfection
ii. Foot Baths

5. **FORMALDEHYDE**: Kills by penetrating all membranes

FEATURES	DISADVANTAGES
- most effective biological killing agent	- temperature and humidity dependent
- rapid action	- toxic and irritating vapours
- broad-spectrum	
- works in wide pH range	
- effective in organic debris	

USES

i. Sterilization
ii. Farm Premise Disinfection

6. **QUATERNARY AMMONIUM**: Kills by increasing the permeability of the cell membrane.

FEATURES	DISADVANTAGES
- non-selective, broad-spectrum	- inactivated by soaps
- odourless, tasteless, non-irritating	- water hardness sensitive
- low cost	- poor in organic debris
- excellent residual effect	- not effective on spores or fungi

USES

i. Hatchery and Egg Sanitation
ii. Food Processing
iii. Farm Premise Disinfection

A PROPOSED CLEANING/DISINFECTION PROGRAM

In order to reduce the harmful pathogens in the barn, a strict and sequential program for cleaning and disinfection must be followed. When the birds go to market, new chick/poults do not enter the barn until the following is accomplished:

1. Remove all market birds from the barn, depopulate and do not leave any stray birds around.

2 Empty the feeders, troughs, bins, hoppers of feed. Do not hold over feed.

3. Remove all the equipment possible. Get drinkers and other equipment out of the barn and begin soaking them.

4. Blow down all dust and dander from walls, ceiling beams, lights, fans, hoods, stairways, etc.

5. Use a high pressure spray as a prewash (soaking) to remove and soak any residual dust.
primary 1-1.5 litres/m^2 secondary 0.2-0.3 litres/m^2
Soaking saves time, energy, water and improves cleaning.

INFLUENCE OF SOAKING ON CLEANING TIME

Duration of Soaking (hours)	Cleaning Time (hours)
1.0	100
2.5	70
3.5	60
24.0	60

6. Remove manure and litter and haul it far away from the poultry barn.

7. Incinerate all dead birds.

8. Shovel and sweep up dust, excess litter and organic debris.

9. Use a high pressure spray with detergent sanitizer* to clean interior.
   a. 500-700 PSI after presoak.
   b. 750-1,200 PSI with no presoak.
   *Follow the recommendations of the product insert.

10. Scrape and scrub where necessary.

11. Rinse the entire house ensuring the rinsing of all detergent.

12. Apply a recommended and certified disinfectant at the properdilution to the entire surface area of the interior of the house. A pressure sprayer or fogger can be used; follow the recommendations of the product insert.

13. In barns with past production problems due to infectious organisms (such as Staphylococcus, IBD, Pasteurella), it is recommended that fumigation with formaldehyde gas be done.

    This step may be optional, but is highly recommended. There are three choices of formaldehyde base products:

    i. Adding formalin liquid to potassium permanganate.
    ii. Using paraformaldehyde prill and heated pan.
    iii. Using an aqueous formalin.

Fumigation must be conducted carefully and with the environmental temperature and humidity conforming to product demands.

CLEANING OF EQUIPMENT

1. Clean and flush the inside of water lines using chlorine or other recommended products.
2. Flush with pure water to rinse the water line of residue.
3. Clean and disinfect all removed equipment. Dip drinkers in acid to descale the surface, use elbow grease and a boot brush to clean thoroughly.
4. Repair all equipment that needs fixing or adjustment.
5. Return equipment and assemble before fumigation.

CLEANING OF EXTERIOR

1. It is vital that all weeds and grass be mowed 50 to 100 feet around the barn.
2. Implement an insect and rodent control program if necessary.
3. Keep the poultry houses clean by practising biosecurity and isolation.

CLEANING FINALIZED BY

1. Biosecurity, sanitation and isolation.
2. Foot baths at each doorway.
3. Feed sample drop off bin.
4. Vaccination is not a substitute for cleaning and disinfection. It helps to build up antibodies against disease organisms.
5. Lock the poultry house.

PROBIOTICS CONCEPT FOR THE FUTURE IN POULTRY HEALTH MANAGEMENT

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A variety of products, from drugs to antibiotics have been used in the poultry industry to increase production parameters and optimize efficiency. In the final episode it is hoped that the infectious disease is controlled. However, nature does not intend for treatment to be this way, it is not natural. The recent restrictions in the use of antibiotics have now shifted the veterinary profession to consider the use of biological products. Biological products are naturally occurring products such as Probiotics, acidifiers, enzymes, organic acids, complex sugars and even plant extracts as aids or alternatives to the more traditional products (antibiotics, growth promotants).

Why the recent change towards the use of biological products in the animal health industry? consider the government regulation of antibiotics, consumers preferring poultry products that have been produced with "natural" products, the desire to improve efficiency in the poultry industry, the competitive exclusion of harmful gut organisms, health and sanitation, the environment concerns with respect to residues and pollution. A constructive component to these concerns is the use of Probiotics as an alternative and in addition to conventional management procedures.

Probiotics as the name suggests, simply means "for life", whereas antibiotic means "against life". This is an 180 degree turn from the conventional term antibiotic. Probiotics are cultures of living microorganisms which are able to grow in the birds intestinal tract resulting in a balanced microflora and therefore exert beneficial effects upon their host. Most probiotic preparations consist of live cultures of a variety of species of Lactobacillus, Streptococcus, Bifidobacterium and some yeast. These preparations, ranging in titer from 10^6 to 10^{10} are usually presented in a powder feed grade form or in advanced preparations, freeze dried vials. The administration of probiotics in feed, water, coarse spray or at hatch have been shown to modify gut microflora in the bird and improve growth performance and competitively exclude Salmonella sp. and coliforms.

The principle competitive exclusion (CE) is a complex interaction of microbes, nutrients and host (bird) reactors that selectively exclude specific groups of microorganisms from colonizing the intestinal tract. Simply, undesirable organisms are excluded because they are unable to compete with the existing resident bacteria. the Nurmi concept of CE conclude that organisms fail to attach, multiply and invade. Hence, in the protected (Probiotic) chick, on Salmonella ingested means on Salmonella excreted, whereas in the unprotected chick it means 100,000,000 Salmonellas per gram of feces (Fowler , 1990).

The requirement for a beneficial and successful probiotic follow that;

1. the organism must be able to grown once it arrive in the intestinal tract (viable)
2. the organisms must survive passage through the stomach pH, and stomach enzymes
3. the organisms must be bile resistant; and
4. the organism must possess the ability to produce the desired effect.

The mode of action of probiotics is to establish their colonization of the intestinal tract. Once established, the **probiotic** species produce lactate (Lactobacillus sp) and reduce the intestinal pH. Also, the beneficial bacteria adhere to colonize and restrict the attachment of harmful bacteria (E. coli/Salmonella). Probiotics occupy all available receptor sites. In addition to lowering gut pH and occupying receptor, probiotics can also produce bacteriocin, a natural antibiotic like substance which helps exclude the unwanted coliforms. The integrity of the gut is maintained with the increasing awareness of Salmonella and its zoonotic potential to the human population, many animal health companies are evaluating alternatives to growth promotants and antibiotics. some companies have evaluated live and killed Salmonella vaccines as a means of reducing horizontal transmission. Other companies have looked at complex sugars as a food source favoring the growth of gut Lactobacilli. Organic acids, by reducing gut pH also favor Lactobacilli growth and retard Salmonella and E. coli colonization.

Probiotics, as was previously mentioned, are clearly the future in the medical field as well as the animal health field. With the application methods currently used (feed, water, spray) and the future routes (hatch, in ovo) we can expect competitive exclusion at a very early age when challenge can occur. The benefits are coming in from field testimonials and research (University of Guelph trial) in better livability, uniformity, disease reduction and most importantly, the competitive exclusion of harmful bacteria (Salmonella). Probiotics are no longer a yogurt culture given to livestock. Research and commitments have produced host specific products with purity, safety and most importantly, efficacy.

A CANADIAN TRIAL TO OBSERVE THE USE OF A DEFINED LIVE MICROBIAL COMPETITIVE EXCLUSION CULTURE TO CONTROL SALMONELLA IN BROILER CHICKENS

S.L Gillingham, C. Gyles, R. Julian, I. Linjacki
Canada[§]

SUMMARY

The protective effects of the treatment of a defined commercial live microbial product (Interbac) on Salmonella enteritidis colonization was evaluated in broiler chicks in an in vitro setting. a defined microbial product was introduced to broiler chicks via the coarse spray route and the drinking water route. One day old broiler chicks free of Salmonella were divided in 4 groups of 30 chicks. Cage 1) Interbac via coarse spray, Cage 2) Interbac via drinking water, Cage 3) control-water only via coarse spray, Cage 4) Control-water only via drinking water. all four groups of 30 birds were challenged 2 days later with a known Salmonella enteritidis phage type 8 (3.6×10^6) culture. Twelve days after challenge the chicks were evaluated for Salmonella colonization in the cecum and also colonization in the liver spleen and gall bladder. the chicks with the microbial product Interbac had significantly less ($P<0.0001$) Salmonella colonies per ml of cecal contents than the controls. Likewise the microbial product significantly reduced ($P<0.001$) the incidence of bacteremic to the liver, spleen and gall bladder from an incidence of 50% in the controls to 11.6% in the experimentals. The results indicate that a commercially defined live microbial product effectively controlled the colonization of Salmonella enteritidis and significantly reduced the bacteremia known to be characteristic Salmonella enteritidis.

INTRODUCTION

The Nurmi concept whereby undesirable bacteria such as salmonella may be prevented from colonizing the gut by presence of a mature intestinal microflora and the resulting effect of competitive exclusion is accepted world wide. It is recognized that this early gut colonization is occupying all the available receptor sites in the gut, undesirable organisms are excluded because they are unable to compete with existing flora. Being unable to compete the organisms fail to attach, multiply and invade. This could revolutionize one aspect in our approach to the minimization of Salmonella in the poultry industry.

The usual method for application of probiotics is via water or as a feed additive. However, due to the quality of water and its administration in the field a new approach was

[§]Special thanks to Dr. G. Diaz and Dr. Tai for laboratory assistance and Dr. J.P. Vaillancourt for the statistical analysis

investigated for application. In the Canadian poultry industry, spray application of virus vaccines in the hatchery have been implemented for 7 years. According to recent publications in Europe, the coarse spray application of a probiotic is successful in competitively excluding a Salmonella challenge. Therefore, the knowledge of coarse spray was applied for the evaluation of an effective means of inoculating the probiotic product.

The objective of this study was:

1. To evaluate the use of a commercial microbial culture to protect the chick from Salmonella colonization.

2. To evaluate the effectiveness of the microbial culture to prevent systemic spread of Salmonella to the liver, spleen and gall bladder.

3. to evaluate the effectiveness of coarse spray to facilitate application and the rapid acquisition of the probiotic by the chick.

Materials and Methods

Salmonella

The inoculum was prepared from the 139N Salmonella enteritidis phage type 8 pure culture acquired from Dr. C. Poppe, Agriculture Canada laboratories. Cells were grown in .1% peptone, incubated and transferred to MacConkey plates by spiral technique and incubated. The reason for this procedure was to plot the curve from a colony count and optical density to obtain the concentration of Salmonella enteritidis in making the inoculum. the concentration of the inoculum was 1.8×10^7 colonies per ml. Each chick was inoculated with .2 ml (3.6×10^6) using the syringe and gavage method.

Chicks

Chicks were obtained from a local commercial hatchery immediately after hatch. Samples of meconium, chick pad, feed, water and cages were all Salmonella negative. chicks were allotted into 4 groups of 30 chicks each and all were fed an unmedicated broiler starter (17%) *ad libitum*. The four groups of chicks were divided into two groups of two, two groups in one isolation unit. Unit E6 housed two groups of 30 chicks each in separate brooder cages. also, Unit D3 housed two groups of 30 chicks each in separate brooder cages. The isolators, 4 feet by 2 feet, had wire mesh floors so that feces would drop through, thereby reducing coprophagy. The experimental protocol is illustrated in Table 1.

Live Microbial Product and Application

Interbac distributed by Intervet Canada Ltd. is a commercial viable microbial freeze-dried product utilized in the Canadian poultry industry. The product contains a number of live acid producing bacteria (*lactobacillus acidophilus, streptococcus faecalis* and *bifidobacteria*). Interbac was applied to group 1 (INCS) via coarse spray using the showervac plus cabinet sprayer of Intervet Canada. With group 2 (INDW) Interbac was mixed with one litre of distilled water and the amount needed to inoculate 30 chicks was diluted in 1 litre of sterile water and applied via a 2 litre bell drinker. The control group 3 (SWCS) and group 4 (SWDW) were given distilled water only with no probiotic (Interbac) with it.

All groups were challenged at 2 days with 3.6×10^6 Salmonella enteritidis via gavage (.2ml) and all groups were harvested at 14 days of age for microbial analysis of the outline tissues. Sterile technique was applied between each postmortem for each chick. the post mortem room was sanitized between each group.

Results

The average weight of samples in all four cages were similar. there were no significant differences between cecal weights and organ (liver, spleen, gall bladder) weights between each group (Figure 1).

The Salmonella enteritidis colonies recovered from the control chicks (group 3 and group 4) were significantly higher than group 1 and group 2 which received Interbac via coarse spray and drinking water respectively. Figure 2 clearly shows the difference between the four groups. although group 1 (INCS) was significantly higher than group 2 (INDW), the two Interbac groups were distinctly lower than the two controls (SWCS and SWDW) which were not significantly different from each other. figure 3 clearly shows the importance of the Interbac groups in reducing the bacteremic effect of Salmonella to the liver, spleen and gall bladder. A much lower number of isolations were observed (Figure 3) as well as a lower number of colonies found in tissue where the organism was found.

Discussion

A viable microbial commercial product, Interbac, significantly reduced the colonization of Salmonella enteritidis in the cecal organ. A host specific, bile and pH tolerant probiotic like Interbac, can be used to minimize the horizontal transmission of Salmonella by reducing colonization of the coliform. Not only was there a reduction of cecal colonies but most significantly a reduction in the bacteremic effect or systemic showering of Salmonella to the liver, spleen and gall bladder. Due to the invasiveness of Salmonella enteritidis and its capability of causing vertical transmission via the oviduct, we have found that a defined commercial product can reduce this effect significantly. With the use of the probiotic we can scientifically theorize

that there will be significant minimization of Salmonella colonies in the ceca and major organs.

With respect to the application of the product, it is found that the drinking water route was the most significant route in minimizing Salmonella colonies. Although drinking water was more significant than coarse spray it cannot be forgotten that both wee independently superior to the control groups. since colonization of the intestinal tract with a lactobacillus sp is critical before the environmental coliforms get established, it is advised to inoculate the chicks immediately at or after a hatch. Therefore, coarse spray application post hatch in the hatchery using the cabinet sprayer showervac plus is strongly recommended.

TABLE I

Experimental Protocol Flow Chart

Room

D3 E6

Group 1 Group 2 Group 3 Group 4

Day	INCS[*1]	INDW	SWCS	SWDW
Day 1	Interbac Coarse Spray .2 ml/chick (INCS)	Interbac Drinking Water[*2] (INDW)	Sterile Water Coarse Spray .2 ml/chick (SWCS)	Sterile Water Drinking Water (SWDW)
Day 3	Salmonella Enteritidis Innoculum .2 ml/chick	Salmonella Enteritidis Innoculum .2 ml/chick	Salmonella Enteritidis Innoculum .2 ml/chick	Salmonella Enteritidis Innoculum .2 ml/chick
Day 14	30 chicks harvested 1) serology [2) cecum-Mac (Spiral) [*3] [3) cecum-BGS [4) LSG-Mac (Spiral)	30 chicks harvested 1) serology 2) cecum-Mac (Spiral) 3) cecum-BGS 4) LSG-Mac (Spiral)	30 chicks harvested I) serology 2) cecum-Mac (Spiral) 3) cecum-BGS 4) LSG-Mac (Spiral)	**30 chicks harvested 1) serology 2) cecum-Mac (Spiral) 3) cecum-BGS 4) LSG-Mac (Spiral)**

[*1] Interbac Coarse Spray
[*2] Dilution made for 30 chicks as recommended by company
[*3] Tissues were collected sterily and placed in sterile petri dishes for microbial analysis

FIGURE 1

AVERAGE WEIGHT OF SAMPLES IN ALL FOUR CAGES

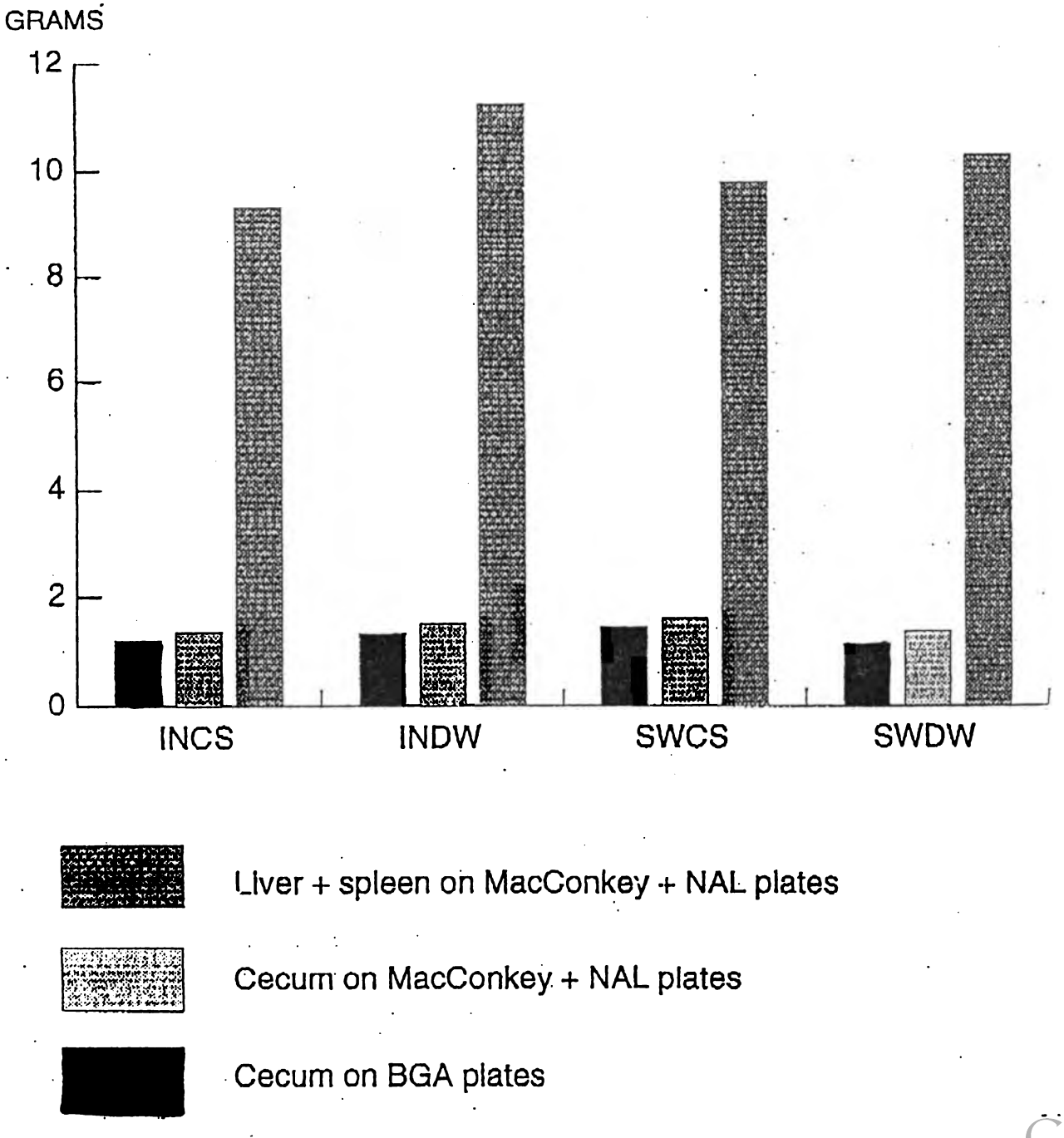


FIGURE 2

MEDIAN NUMBER OF COLONIES PER GROUP CAECA

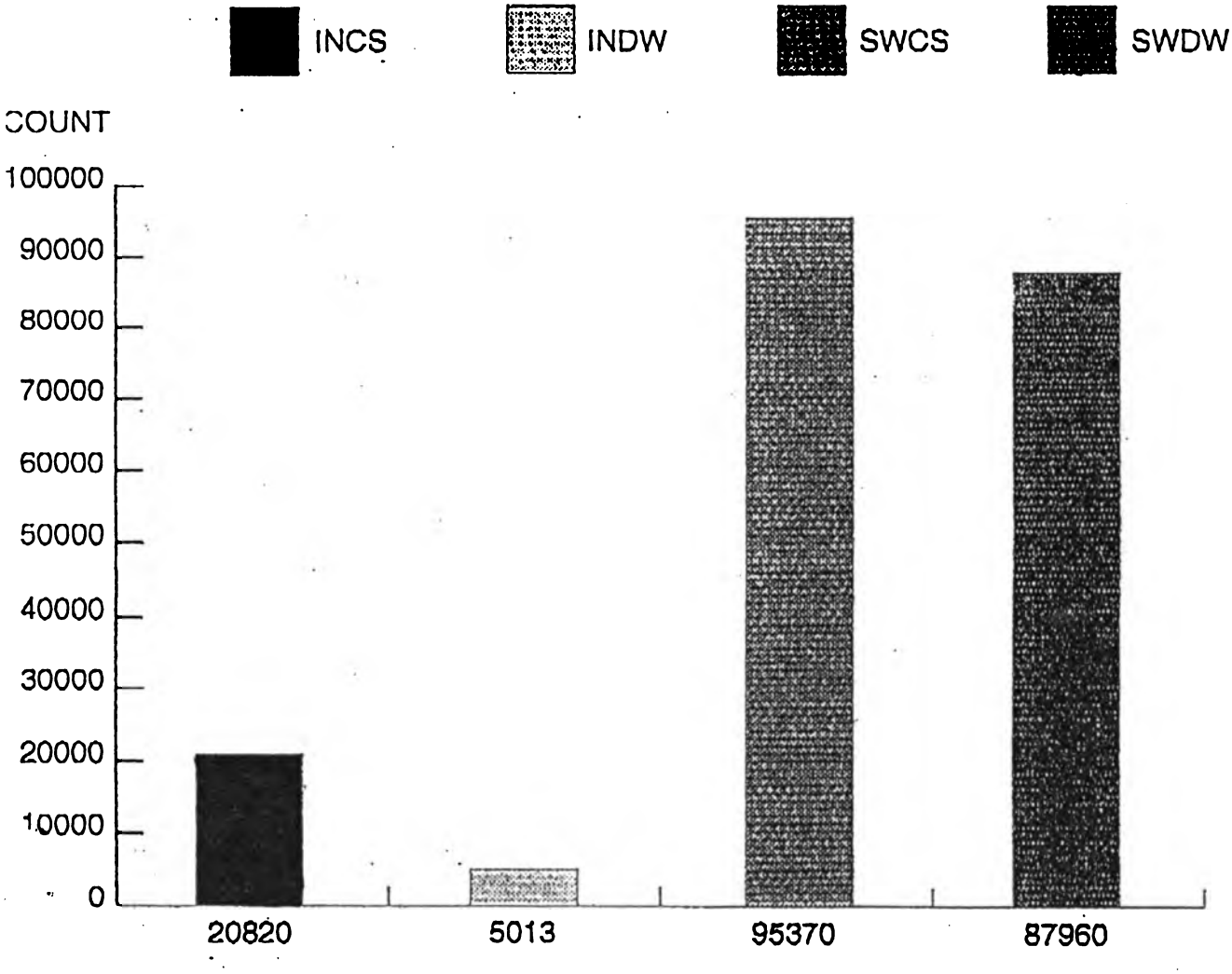
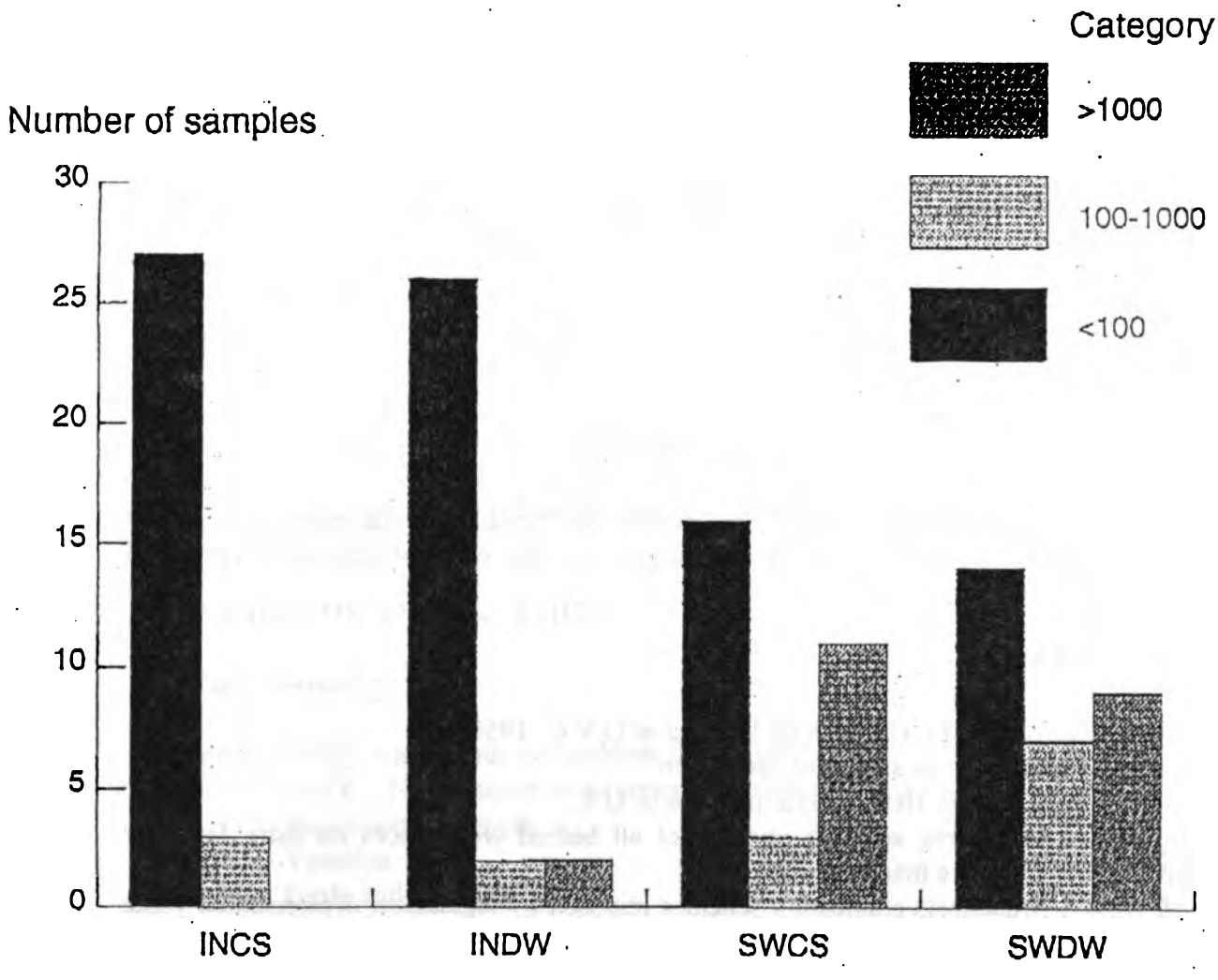


FIGURE 3

NUMBER OF BIRDS PER GROUP
CATEGORICALLY CLASSIFIED IN ORGAN ISOLATIONS OF SALMONELLA ENTERITIDIS



	Colony Groupings		
	0	100-1000	>1000
INCS	27	3	0
INDW	26	2	2
SWCS	16	3	11
SWDW	14	7	9

MY 20 YEARS OF SWINE HERD HEALTH PRACTICE

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In giving this presentation I thought it only fair to admit that my total experience has been gained on intensive-style swine operations in temperate climates (though some Canadian winters are hardly temperate!) I hope that most of the items I cover will translate across the regional differences and husbandry methods represented at his conference.

My presentation only assumes what subjects veterinarians and producers living 3,000 miles away from my present home in a tropical setting might wish to hear but I'm hoping that the Q & A session to follow will guide me to the problems that form your reality.

My presentation will be divided into 3 general sections:

A. The concept of Herd Health
B. My methods
C. My remedies for a selection of common problems

I must also warn you that this is the presentation of a humble practitioner but I hope that what it might lack in technical back-up and jargon will be counterbalanced by practical observations and applications.

A. THE CONCEPT

- First exposure - Dr. D. C. BLOOD lectures at O.V.C. 1959-60
- Attempted guidance towards herd protection
- Followed by 15 years Herriot-style practice in U.K.
- Might have considered advising removal of all barbed wire fences on dairy farms or making cow brassiers mandatory!
- F & M and Brucellosis eradication schemes imposed by legislation demonstrated value of ultimate national herd health
- 1968 1st I.V.P.S. conference in Cambridge with the late Dr. C. K. ROE, DR. TOM ALEXANDER and DR. 0.RADOSTITS
- Eastern bloc involvement
- Discussion on frequency of herd visits proved the concept had taken off
- 1975, Arrived in S.W. Ontario prepared to put the concept into practice

MY METHODS

Practice from residence with office, stockroom, secretary and telephone answering machine plus an assortment of vehicles designed to combat Canadian weather and road conditions Sole owner and practitioner Government provided laboratory services for back up Practice radius 100 miles in most directions Calls 5 days a week. Emergencies very rare and often handled by phone due to distances 3 to 5 pre-arranged farm visits per day. Never arrive early! practice pragmatism not purism - no barn burning! Barn inspections performed in farm-provided attire. Some shower-in Great variety of herds re: size, facilities and management Most farrow to finish Marketing system sadly denies easy slaughter checks Visits last 1-2 hours mainly, rarely 2 day Visits abandoned if fear of contagion Herd file contains hand written reports made during all visits plus all laboratory and feed analysis reports Production figures by chart or print-out checked for areas of concern Inspections done in sequence First in farrowing section to monitor litter size, litter health, sow condition and health, water and feed supply, birth and weaning weight, treatments, procedures and vaccinations. 2ndly the weaning section to check room temperature and air velocity. Monitor piglet comfort, health re:scours, respiratory disease and strep suis. Piglet density, cannibalism feed and water conditions and medicating procedures are always checked 3rd the breeding section to monitor weaned sow condition, delayed first oestrus, boar health, boar to sow ratio and frequency of 21-day-repeats. Supply of ope gilts and their ability to cycle plus provision of bred gilts to fill-in breeding gaps Finally the finishing facility to monitor frequency of treatments and losses, perform all post mortem exams possible, check days-to-market and general health Coffee-time to coincide with in-depth statistical analysis and hand-written report including all recommendations Supply all possible product requirements from preferred source assuming right price Account presented to initiate cheque-writing reflex!

C. PROBLEMS AND REMEDIES

1. Piglet Scours

a. Viral, usually winter thus no problem down here?
- T.G.E. No response to treatments. Sows sick also,
- Biosecurity - People
- Vehicles
- Birds and roaming animals
- Chronic or recrudescent
- 3 week duration

Remedies: Feed-back and vaccination

b. Bacterial
- generally E-coli
- less spectacular

Remedies: Environmental, raised crates, all-in-all out, high sanitation, freedom from chilling
Vaccination
Medication - sows in ration or water
- piglets orally and/or parenterally

2. Non-Specific Pre-weaning mortality

- litters uneven, losses high, no scours, some arthritis

Remedies: Check average herd parity, old sows add L.A. penicillin to 2 iron shots

3. Farrowing Sickness in Sows

- check overconditioning of sows in gestation, farrowing room temperature, water supply, feed palatability

Remedies: High doses Pot. Pen.G. water soluble, Trimethoprimsulfa, Dexamethasone.

4. Post Weaning Scours

- mainly swine dysentery complex

Remedies: Environmental - slats, air quality, chilling Medication, Carbadox in feed, Tiamulin in feed or water, Lincomycin in feed or water

- occasionally E. coli

Remedies: Environmental Medication - Neomycin + Tetracycline in water and/or feed

- Rarely exotics - Salmonella etc.

5. Atrophic Rhinitis

- many ascribed causes in past
- currently Toxigenic Pasteurellas A & D plus Bordatella bronchiseptica
- normal flora & require trigger
- triggers include heavily infected imports, deterioration in air quality, overcrowding
- starts as sneezing and tearing in litters and weaners
- eventual nasal distortion

Remedies: Environment, air quality and velocity

Vaccination sows and litters
Medication in feed and parenteral sows and litters and weaners

6. Meningitis

- mainly post-weaning
- cause Strep Suis T II
- triggers - crowding and air quality
- signs, tremors, paddling or sudden death
- sporadic or semi-epidemic

Remedies: Improve environment Medicate ration and/or water with high levels penicillin

7. Cannibalism

- tail biting, ear biting, flank sucking

Remedies: Improve air quality, slats over pits bad
Improve feed quality N.B. salt level
Reduce crowding and back-up
Provide playthings - straw. chains

8. Pneumonia

- mainly hogs, occasionally weaners

a. Mycoplasma with secondaries
b. Haemophilus/Actinobacillus differentiate by symptoms, P.M. and lab tests

Remedies: for a. Improved environment, all-in-all-out plus various medications and vaccinations
for b. Initially medication, no vaccination, frequent observation and treatment
-retro-infection in hog barns, partitions, all in-all out
-depopulation

9. Post Weaning Anoestrus

Causes - stress and nutritional
Remedies: Wean to individual pens or stalls
Stresnil to grouped sows
Good boar contact

High light levels
Full feed lactation ration post-weaning
Hormones to all weaned gilts

10. Anoestrus in Maiden Gilts

- generally stress or nutrition

Remedies: No hormones
Self feeders
Boar contact
'Diddy' (vasectomised) boars
Reduce crowding
Lots of light

11. Repeat Breeders

- assume complete vaccination program
- records essential
- patterns re: boars and parity
- multiple repeaters
- boar use frequency
- boar-to-sow ratio
- A.I. use, semen storage and handling
- mixing stress in bred sows
- sow condition at weaning and weaning rate
- infections in boars or sows
- 21 day boar check

12. Low Birth Rate

- very intransigent if no obvious cause
- under 10.5 is low

Remedies: Check boar-power 1:20
A.I. use and technique and semen storage
Twice weekly weaning
Split-weaning factor
Early weaning factor
Patterns re:boars, sow parity
Previous lactation length
Sow condition at weaning and weaning rate
Gestation sow housing - fighting
Feeding frequency in grouped sows

Age at first breeding

13. P.R.R.S. (Blue ear, S.I.R.S. or Mystery Swine Disease)

- high incidence of antibodies in symptomless herds and retro actively checked samples
- varied symptoms
- sources likely airborne or pigborne, semen possibly.

Remedies: Challenging!
Can run source in 3-12 months
No response to medications
Vaccination recent, short experience
Depopulation

14. Days-to-Market

- diseases, slaughter checks
- environment
- nutrition
- genetics

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