Residue Avoidance in Beef

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The Health of Animals Laboratory in Saskatoon provides a central testing facility for chemical residues in meats in support of Agriculture Canada's meat inspection programs. Samples are sent to this laboratory from federally inspected packing houses all across Canada to test for residues which may result from the deliberate or accidental exposure of an animal to a chemical. Additional samples are tested at Laboratory Services Division, Ottawa, and also by several private laboratories under contract to Agriculture Canada.

Canada's meat inspection programs are designed to conform to standards accepted by most nations, but with obvious particular reference to our major trading partner, the United States. Our chemical residue programs are very similar to those used by the Food Safety and Inspection Service (F.S.I.S.), United States Department of Agriculture. In the United States, testing programs are carried out by F.S.I.S., while approval of products for safe use is a responsibility of the Food and Drug Administration (F.D.A.) The F.D.A. sets maximum limits, or tolerances, for chemical residues which are permitted in food destined for human consumption.

A similar situation exists in Canada. The approval of products as safe for an intended use and the establishment of chemical residue tolerances is a responsibility of the Health Protection Branch (H.P.B.), Health and Welfare Canada. The use of veterinary drugs is approved by the Bureau of Veterinary Drugs, H.P.B., usually in consultation with and on the recommendation of Agriculture Canada. Monitoring for chemical residues of these products in animals is carried out at the slaughterhouse or packinghouse level by Agriculture Canada under the authority of the Meat Inspection Act. Meat products may also be tested at the retail level by H.P.B., by local health authorities or, in cases of suspected consumer fraud, by Consumer and Corporate Affairs Canada. Agriculture Canada's interest is in the avoidance of chemical residues at the primary production level, to protect both the Canadian consumer and the reputation of Canadian meat products in international markets.

The inspection of primary food products for conformance to regulations is a responsibility of the Food Production and Inspection Branch, Agriculture Canada. Within F.P.&I., three distinct groups are involved in meat safety programs related to meat inspection. Policy and co-ordination of activities is handled by the Agri-Food Safety Division. On-site inspection is usually carried out by personnel of the Veterinary Inspection Directorate (V.I.D.), while most laboratory testing of samples is done by Health of Animals Laboratory Division.

For chemical residue testing, Agri-Food Safety Division identify the residues to be investigated in a given year and the species to be tested, generating by computer a randomized sampling plan for the collection of samples for testing at federally inspected establishments across Canada. For each sample to be taken, the survey plan identifies the establishment, date, time and species. Inspectors collect the samples as scheduled and forward them for laboratory testing.

Sampling frequency is based on the statistical approach developed for F.S.I.S. programs in the U.S. To detect a violation rate of 1% for a given residue in a given species, a random sampling of 300 animals nationally yields results at the 95% confidence level. The randomized survey used in Canada meets this requirement, with the data base used for survey plan generation taking into account regional variations in species and kill and reflecting relative volumes at different establishments, while ensuring a truly national sampling. In addition, inspectors are encouraged to forward samples for testing from any animals they suspect may contain chemical residues.

For scheduled survey samples, the Multiple Analysis Sampling System (MASS) is currently used. Instead of producing separate survey plans with resultant sampling requirements for each residue of interest, multiple tissues (liver, kidney, muscle, fat) are submitted from each animal sample. The receiving laboratory then identifies the target tissue for each analysis required and distributes sub-samples for analysis.

Sampling time and location, animal and owner identification, name of the person who took the samples, analysis requested and any pertinent information relating to the condition of the animal are submitted to the testing laboratory with each sample.

Different chemicals behave in different ways in animals, depending on their structure, biochemical interactions and even mode of introduction and dose. It obviously is not practical to test samples of every organ from each animal selected in a survey, so an approach has been taken which should provide maximum useful information at minimum

cost. For chemicals which are deliberately administerd to animals, studies are conducted prior to registration of the product for use, which demonstrate what becomes of the chemical in the animal—what transformations occur to the chemical, such as binding to tissue and metabolic breakdown, and in what tissues, as well as in what form, the chemical is to be found, and in what relative amounts. The predominat residue, either the parent compound or a major metabolite, is then selected as the *marker residue* for analysis and for establishment of a *tolerance,* or allowable limit. Based on the experiments to determine the eventual fate of the chemical residues in the animal, there is a known relationship between the marker residue and the total residues.

Rather than analyzing all tissues from an animal, a *target tissue* is selected for analysis. The target tissue may be defined as the edible tissue in which residues persist at the highest level for the longest period of time.

The final concept of importance, taken in conjunction with the marker residue, target tissues and tolerance, is the *withdrawal period.* This is the time required from administration of the chemical to ensure that the marker residue in the target tissue does not exceed the established tolerance. Withdrawal periods post-treatment for the recommended dosage should be clearly indicated on the package of chemicals intended for veterinary use in food animals. Extralable use (i.e., administration of more than the recommended dose or administration to species not included in the registration) may result in residues in excess of tolerance even though the stated withdrawal time is observed.

For beef, surveys are conducted for a variety of residues in each fiscal year. These include arsenic, toxic metals such as lead, mercury and cadmium, pesticides, polychlorinated biphenyls, sulfa drugs, ivermectin, zeranol, DES and pentachlorophenol (PCP). This covers a range of residues which may result from the use of registered veterinary drugs and growth promoters, accidental exposure to agricultural chemicals approved for other uses, as well as environmental contaminants.

In addition to the collection of planned survey samples, inspectors at the plants also may take samples from any animal which they have reason to suspect may have received recent drug treatment, received treatment with unregistered products, or was exposed to toxic chemicals. Such samples will be sent for laboratory testing and the suspect carcass may be held pending receipt of test results.

Antibiotic testing, in particular, relies heavily on the examination by the inspector. Inspectors randomly test carcasses using the swab test on premises (STOP) and also use this test on animals suspected to have received recent treatment with antibiotics. Last year, for example, 1855 beef carcasses were randomly tested and 3948 were tested as suspect. Those which test positive have tissue samples removed for laboratory confirmation of the presence of drug residues. Of beef carcasses tested in the past year, 101 were condemned for antibiotic residues, with either penicillins or tetracyclines being the most commonly found compounds.

The introduction of ivermectin and its widespread use raised concern about a potential residue problem with this drug. However, despite a test sensitivity of 5 parts per billion (ppb), no residues of ivermectin have yet been found in random survey samples.

Experience has been similar in Canada with pesticide residues. Monitoring using methodology sensitive to 10 parts per billion of most commonly used organochlorine and organophosphate insecticides has revealed no residues above violation levels in recent years. Furthermore, concentrations of environmentally persistent compounds, such as DDT and dieldrin, have been declining in each successive survey year. Polychlorinated biphenyls also are generally not present in Canadian survey samples at concentrations in excess of the detection limit.

The experience gained in these and in other surveys, such as for zeranol, is that the majority of Canadian beef producers appear to be observing withdrawal times, as residues are consistently below tolerance. The exception is in the use of antibiotics to treat disease and these are the suspect animals that are subjected to close examination and testing when presented for slaughter. For the beef producer, measures to follow in avoiding residues are therefore obvious, but are still worth stating.

- Don't use unregistered products.
- Don't exceed recommended dosages.
- Do observe withdrawal periods.
- Do keep good treatment records.
- Do keep feed mixing equipment clean to prevent accidental contamination.
- Do keep holding areas for animals clean to prevent absorption of residue from skin contact.
- Avoid use of wood treated with pentachlorophenol for pens, stalls, etc., where animals may have skin contact with the wood.
- Avoid use of wood chips for bedding if they have been treated with wood preservatives, such as pentachlorophenol.
- In mixed farming areas, ensure that animals are kept away from crop spraying operations and treated crops.
- Don't store farm chemicals where they can contaminate the water supply or be accidentally contacted or eaten by animals.

The last decade has seen great progress in the detection capabilities of residue laboratories—from part per million (ppm) levels of a few compounds to part per billion (ppb) and part per trillion (ppt) quantities of many chemicals and their metabolites. The ability now exists

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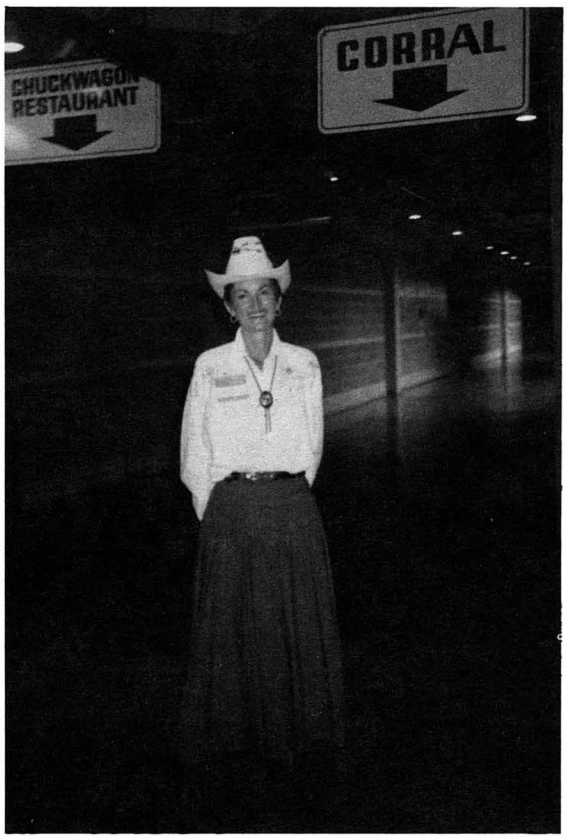
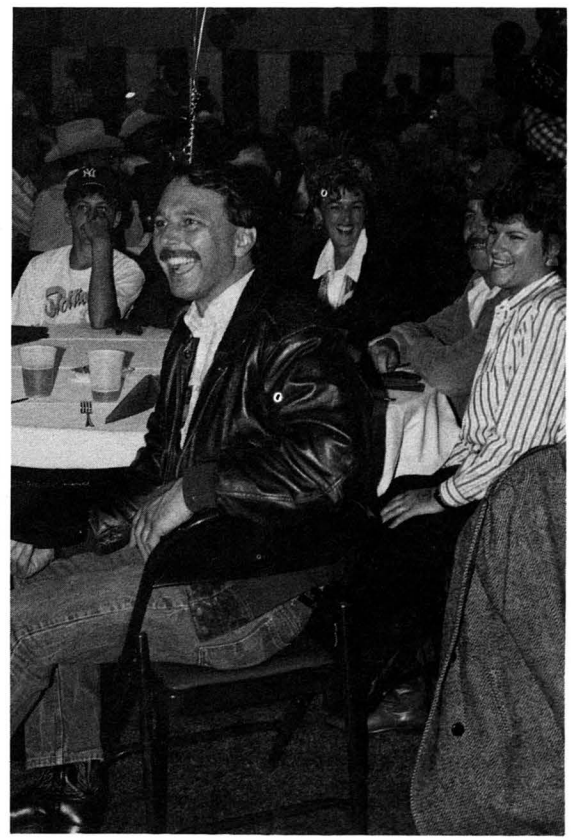
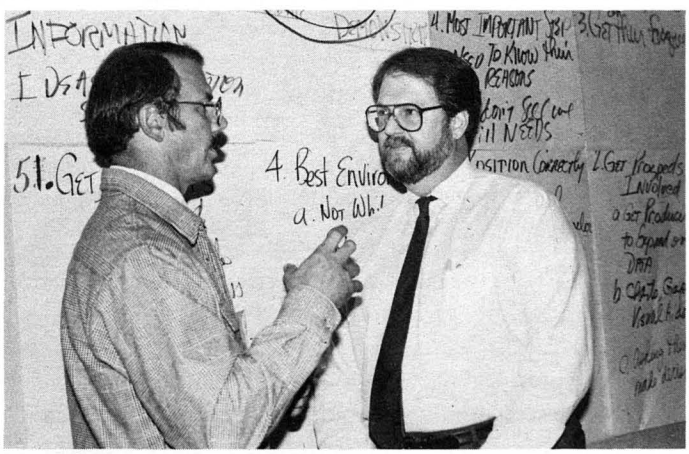
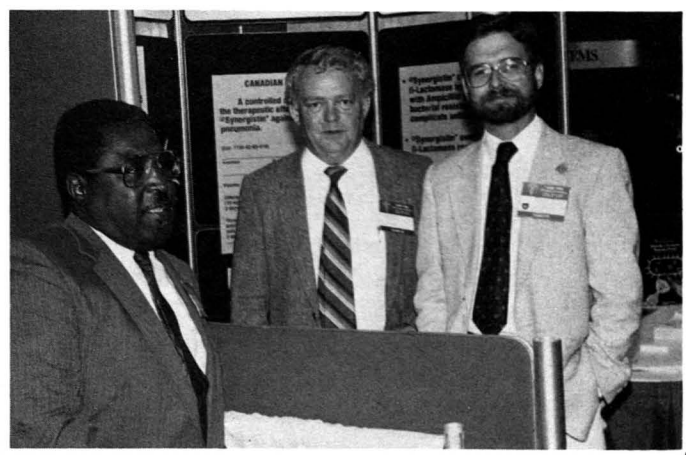
to analyze quantitatively for drugs, pesticides and pollutants at concentrations in tissue which a few years ago were "not detectable." Technology is now being developed which will permit screening tests for particular chemicals to be run on-farm or at the point of slaughter. We can therefore predict that the future will bring increased residue testing using test kits in the field, with laboratories devoting their resources more to confirmatory testing.

Consumers have already demonstrated an interest in obtaining food that they perceive to be residue free, whether it is organically grown fruit and vegetables, "natural" beef, or products certified free of detectable residues by laboratory testing. It is therefore in the interests not only of the food-producing industry as a whole, but each individual producer, to contribute to a positive and safe image for their products. Adherence to good farming practices and the applicatin of common sense when using animal drugs and other farm chemicals should help each producer market beef which contains no residues in excess of tolerances.









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