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FUTURE OF PESTICIDES IN VERTEBRATE PEST CONTROL

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ABSTRACT: The present state-of-the-art provides little information which would lead to the conclusions that animal damage control will take a new direction away from chemicals. Hence, vertebrate pesticides whether toxicants or repellents will remain essential components of integrated pest management programs. The future of vertebrate pesticides is far from being bright, but current developments offer some good reasons to remain optimistic. The various factors which influence the development of new vertebrate pesticides (principally rodenticides) are discussed along with projections of stable as well as changing trends. Speculation on the future of vertebrate pesticides may provide tentative directions for some and forecast pitfalls for others.

INTRODUCTION

With or without a crystal ball, no one knows for sure what the future will bring. It is obvious, however, that we will continue using pesticides in vertebrate pest control because of their effectiveness and the economics of agricultural production. We have seen a number of changes occur in available pesticides and in their uses since the Environmental Protection Agency (EPA) was established. Many, but not all, changes were the result of additional and more complex regulations. Current trends and past history can be used to make some reasonable predictions and projections as to the future of vertebrate pesticides. The scope of this paper will be limited to a discussion of toxicants (primarily rodenticides), although it is recognized that the term "pesticide" also encompasses repellents.

FUTURE NEEDS

As the production costs of growing crops and livestock increase, the need to minimize the losses caused by vertebrates becomes economically more important to the farmer. This is especially true when the cost of production increases disproportionately to the prices received for the commodities produced. The economic need for controlling various vertebrates is greater today than at any time since World War II. Reducing excessive and unnecessary vertebrate losses also has long-term implications in energy savings, improving per capita output, and contributing to the world food supply.

To protect our crops and livestock production, as well as our environment, we continue to need safer, more effective, and a greater variety of vertebrate control materials.

DEVELOPMENTAL COSTS

Costs of both old and new vertebrate pesticides will substantially increase in the future because of the increasing expense of developing and registering new products. However, in terms of the benefits derived, pesticides must remain cost-effective or otherwise they will not find a market.

The high costs involved in conducting tests to satisfy regulatory agencies on matters relative to public health and potential environmental effects

are an important consideration in the development of vertebrate pesticides. Because of the relatively small market for vertebrate pesticides, these development costs become a substantial part of the cost to the consumer for the final product.

The cost of some of our control materials (i.e., some rodent baits and predacides) used to be extraordinarily low. This was due to the fact that their development was often undertaken, at least in part, by the U.S. Fish and Wildlife Service and state-supported institutions or agencies. Also, the sale of some field rodent baits at cost by both federal and state governments kept these prices artificially depressed compared with insecticides or herbicides. At one time the sale of rodent baits by these agencies could be justified but today private enterprise can effectively fill these needs. As state and federal agency budgets become more austere, they will compete less and less with private enterprise; however, the new commercial baits will be more expensive.

Costs of vertebrate pesticides are also influenced by the nature of the pesticide itself. In the past we have used some relatively simple and easy-to-make pesticides for vertebrate pest control. The new products are apt to be chemically more complex, thus increasing manufacturing costs. As an example, the new second-generation anticoagulants, brodifacoum and bromadiolone, are more costly to produce than most of the earlier anticoagulants. As we embark on improving some of the older materials such as warfarin, norbormide and zinc phosphide by encapsulation, the cost of these materials will naturally rise. Encapsulation, in brief, is a technique whereby individual particles of a toxicant (generally a powder) are coated with a thin layer of inert material. The coating (encapsulation), depending on its makeup, is capable of masking an undesirable taste, thus increasing bait acceptance and/or slowing the chemical reaction of a toxicant.

LIMITED MARKET

There is a strong reluctance on the part of some pesticide manufacturers to venture into rodenticide, predacide, or avicide development because the market for these materials is relatively small compared to insecticide or herbicide markets. I personally believe that the markets can be expanded with the development of the right pesticides; but even if the markets were doubled or tripled over the next decade, this would still provide little economic incentive. The limited market coupled with the high costs of meeting all the regulatory requirements for registration greatly limit development of totally new vertebrate pesticides.

Those manufacturers already in the vertebrate pesticide business have a decided advantage over firms trying to break into the field. The variety in types and sizes of potential markets and the various needs of different users of vertebrate pest materials make it difficult for companies not already familiar with the field of vertebrate pest control to cope with these complexities. Development and market decisions concerning vertebrate pesticides are difficult for the newcomer to make because there is so little published on the subject and data on the current or potential market are essentially absent for most field vertebrate pests. To further baffle potential manufacturers there is a lack of good information on the extent and severity of damage caused by the various species in the wide variety of situations where they are considered pests.

FUTURE VERTEBRATE PESTICIDES

The future of vertebrate control pesticides is far from being all gloom. Several new rodenticides are in the development or registration stage. These include EL-614, encapsulated zinc phosphide, scilliroside, alpha-chlorohydrin, and the U.S. Fish and Wildlife Service smoke cartridge.

EL-614 is a new acute toxicant being developed by Eli Lilly and Company which appears to hold promise for the control of some of our field rodent pests as well as commensal rats and mice. Hooker Chemical Company is working on an encapsulated zinc phosphide which hopefully will improve its efficacy on those field rodents such as ground squirrels which do not readily accept the regular zinc phosphide under some conditions. Alpha-chlorohydrin, a combination toxicant-chemosterilant for rats, has been submitted for registration by Gametrics Limited, and scilliroside, the purified active ingredient in red squill, is being further developed for commensal rodents by Sandoz.

PENDING DECISIONS

The RPAR has been completed for 1081, and it is currently registered for rat control in sewers. The Environmental Protection Agency's last position paper has been published for strychnine. The paper received, and justifiably so, considerable criticism which again points out the lack of understanding of the basic principles of vertebrate pest control (animal damage control) and the environmental and economic consequences of arbitrary decisions by those responsible for preparing the position paper.

The RPAR report on 1080, as a rodenticide, is still pending. New efforts by livestock producers are underway to have 1080 reinstated as a predicide, at least for use in toxic collar and single baits.

EPA is now in the process of reevaluating some of the older pesticides. The first anticoagulant to receive attention is Fumarin. A substantial amount of new and favorable data will have to be developed if this compound is to receive continued registration. As EPA reevaluates various older vertebrate pesticides, the expense of developing the new data--which was not required when the pesticide was originally registered--will, I suspect, cause some of the materials to be voluntarily withdrawn from the market. This will be especially true for materials which either are not used widely, are marginally profitable, or those which are no longer protected by patent rights.

It is too early to predict what effect EPA's reevaluation of vertebrate pesticides will have on the availability of the older materials, but the consumer may well lose existing materials at a rate much faster than the new ones will be developed.

SOURCES OF NEW PESTICIDES

As in the past, most new vertebrate pesticides were discovered more by accident than design. Discovery by serendipity will remain the trend, although we can expect that some of the current or developing insecticides may be seriously scrutinized for their potential rodenticide or predicide properties.

New rodenticides will invariably be developed and registered first for the control of commensal rodents (i.e., rats and mice) as this is where the

largest market exists, both in this country and worldwide. Once developed for commensal rodents, their use for field rodents, when applicable, will follow. At least this has been the trend in the past.

EXPANSION OF USES

The trend towards expanding the registration of existing uses to additional species (e.g., zinc phosphide for pocket gopher control) will continue. This may be accomplished through federal registration or through the 24c registration process to meet local (state) animal control needs. The 24c registrations are one way the smaller formulators can compete in the pesticide market.

Expanded uses of zinc phosphide and both the first and second-generation anticoagulants for field rodents are certainly a good possibility. The expanded use of calcium cyanide and phostoxin as fumigants for burrowing rodents also deserves further study. Hopefully the new Fish and Wildlife Service smoke cartridge will be registered for all burrowing rodent pests in addition to predators.

IMPROVING EXISTING PRODUCTS

Since fewer new vertebrate control pesticides are expected to appear on the market, product development will probably tend to improve the older chemicals and products already on the market.

Improvement of pesticide concentrates may take several forms, and micro-encapsulation seems to be gaining in popularity. Currently, Hooker Chemical Company is developing an encapsulated zinc phosphide, and encapsulated warfarin has been on the market for a number of years. Reducing contaminants in rodenticide concentrates is another method of improving bait acceptance. Ketones in anticoagulant concentrates, for example, have been shown to reduce bait acceptance. Scilliroside, currently being developed by Sandoz Company, in a broad sense might be considered a purified red squill. This scilliroside is better accepted and considerably more toxic than the old form of red squill.

Innovations in bait formulations and delivery systems seem plausible. For commensal rodents these might include semisolid moist baits, cubed baits, syrup baits, nonparaffin bait blocks, and self-contained water-bait packets. For field rodents, improved formulations are likely to be directed towards increased specificity. These may include taste repellents and/or superior visual repellents to keep birds from accidentally consuming rodent baits. Self-destructing pelleted bait and diluted baits are possible and have useful merits.

The use of improved odor attractants for predator baits (i.e., W-U Lure for coyotes) has recently shown promise. These suggestions on improving bait formulation are partially based on previous research, while others are pure speculation on my part.

COMMERCIAL PEST CONTROL

As pesticide regulations become more restrictive and as vertebrate pest control becomes more complicated because of the extensive laws and regulations,

I believe we will see a growing trend towards commercial agricultural pest control firms doing vertebrate pest control exclusively or in conjunction with their other pest control activities. This will be a welcome trend, for it should put vertebrate pest control on a higher professional level. It paves the way for more individuals to become full-time specialists in vertebrate control and will consequently reflect in their level of expertise. Greater attention to baiting strategies and more precise timing of controls should lead to better control and more efficient use of vertebrate pesticides.

COMPELLING MISUSE

The lack of products on the market, which are specifically registered for the pest or situation confronted may plague any effective curtailment of certain types of animal damage in the future.

Unrealistic registration regulations and restricted-use practices, which will eliminate effective practices now used and which were permissible in the past, will undoubtedly lead to increased use of vertebrate pesticides in ways not currently prescribed on the labels. This will be highly unfortunate, but it is a predictable aspect of unpopular legislation and/or legislation not supported by biological facts. EPA and many state regulatory agencies have essentially ignored that intentional misuse is the "consequence" when what are perceived by the farmer as reasonable solutions to animal damage problems are eliminated and alternate solutions are impractical, ineffective or unavailable. These unrealistic regulations, unfortunately, make lawbreakers out of otherwise law-abiding citizens when they believe they must protect their livelihood.

Regulatory agencies should strongly consider whether a proposed regulation will force illicit actions which will be counterproductive to the very intent of the regulations. The often-suggested solution to deliberate misuse is increased enforcement, but this is being grossly naive. At the landowner level, no amount of enforcement will stop intentional pesticide misuse for certain animal damage problems, so reasonable solutions are essential.

So as not to place all the blame on regulatory agencies, those involved in vertebrate pest research, extension and education must assume even greater responsibility for supporting good legislation and fighting poor or unrealistic regulations. We must also help educate the farmer and the public on the principles of sound vertebrate pest management, promoting alternative solutions where they exist, and develop solutions or alternative solutions where good solutions do not now exist.

I do not foresee commercial pest control operators becoming involved in intentional illegal practices because they have too much at stake. The risk of losing one's license as a consequence of getting caught dampens the temptation, regardless of the desire to help the landowner or immediate monetary gain.

PUBLIC ATTITUDE

The public's attitude towards animal control and vertebrate pesticides has been less than supportive for many years. There is no reason to believe that an improvement in attitude will occur. As the populace become further removed from the land, they will be less concerned about the complexities

of agricultural production.

The killing of animals is repugnant to many people, yet some will, when confronted with extraordinary medical expenses, request their veterinarian to destroy their pet. Relatively few of those opposed to the killing of pest mammals or birds are vegetarians, but they still expound upon what they conceive as a justifiable difference between slaughtering livestock for consumption and killing pest animals to protect a crop. Animal control has become a highly emotional issue and one on which nearly everyone has a strong opinion.

As long as we have highly vocal individuals and organizations who oppose killing animals, we can expect that they will try to impose their beliefs on others by whatever means may be effective. One popular indirect approach is to fight for a ban or severe restrictions of pesticides used in killing animals. It matters little how selective or humane the pesticide may be; if it is the prominent chemical used for control, it will likely be under attack. The last fifty years have shown this with a progression of attacks going from strychnine to thallium sulfate to 1080 (sodium fluoroacetate). Whatever may eventually replace 1080 as a pesticide will also come under fire.

The public's attitude against animal control is promoted by many so-called humane, environmental, conservation, or protectionist organizations. Memberships and financial contributions to such organizations hinge on promoting their goals and activities. Appealing to the public's emotions through protecting animals has been a highly effective means of generating money, as is exemplified by the ever-growing number of organizations established to protect one animal or another.

Since the news media thrive on controversial issues and emotional sensationalism, they often become eager and willing participants in keeping alive biased and prejudicial points of view regarding animals.

SUMMARY

In summary, the future of vertebrate pesticides is far from bright, but there are some good reasons to remain optimistic. Animal damage continues to cause significant economic losses in agricultural production and as long as the problem exists, solutions will be found. Vertebrate pesticides, whether toxicants or repellents, will remain essential components of integrated pest management programs. To speculate on the future of vertebrate pesticides, as I have done, may provide tentative directions for some and forecast pitfalls for others.

Favorable progress is based on a realistic view of the present and a commitment to a better future. I have pointed out that we have nowhere near exhausted the potentially useful possibilities for development of vertebrate control pesticides.