

## LOSSES OF PESTICIDES IN VECTOR CONTROL

BY

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The dose of pesticide sufficient to affect (with a high degree of probability) all the individuals of vector in a given area may be calculated in mg and even in parts of mg. In practice to get an even effect kilograms of this substance should be used. Thus the main part of the pesticide serves only to guarantee paralysis, but is not used directly for the affect.

The difference between the minimum quantity of pesticide that is necessary for the affecting of a vector and its routine dosage we qualify as "losses". This means not a simple material idea, but the loss of useful (for our purpose) action of pesticide in its practical use.

The process of paralyzing a vector may be described as bringing in some control action (in this case — the pesticide agent) by means of special mechanism to the object of the action, i.e. vector population. Losses appear on the way from the mechanism to the place where the vectors are situated, as well as at the place of destination. The causes of losses at the different stages differ.

The first group of losses may be determined as "evident". The evident losses are equal to the quantity of pesticide that fails to fall on the treated surface, they determine the quantity of pesticide lost in particles between the mechanism and the vector. These losses are the result of unfavourable meteorological conditions due to physical processes atmospheric in ground layer, as well as to characteristics of pesticide used.

Atmospheric in ground layer horizontal vertical and complicated vertical movements of air take place. In the first place they affect the most effective small particles of the pesticide. These particles are mostly susceptible to the influence of temperature — they may evaporate quickly. The quantity of evident losses according to numerous data may be rather large. The evident losses are especially found in aerochemical treatment where the treated surface may get only 5-10% of the dispersed pesticide.

It is possible to reduce and even absolutely overcome evident losses. One way is to enlarge pesticide particles — the use of pesticide in the form of granules. But such enlargement has negative sides — insufficient covering of treated surface, the presence of important part of toxicant inside of carrier etc.

A highly favourable perspective is the principle of a positive fall of pesticides by means of special mechanisms that depends on the state of ground atmospheric layer very little. A low-flying helicopter may serve as such a mechanism. When a free fall of pesticide takes place it is necessary to choose suitable conditions and this may result in the high settling of pesticide particles (for example, when using lateral wind in aerial treatment of large area).

The second group of losses determined as “obscure” has more complicated and varied causes of formation. The following are the main causes, but may not be all of them.

First of all there are mechanical causes connected with imperfection of mechanisms and with defects of planning of treatments. If the particles of pesticide are applied unmethodically there will be places where, due to insufficient quantity of substance there is no effect, and places where there is plenty of pesticide. In this case the usefulness of the pesticide decreases.

Secondly there are the physical and chemical characteristics of the pesticide used. If the form of use and particle size of pesticide are not optimum for the given vector this results in unnecessary loss of substance.

The third group of causes is the “psychophysiological” (according to V. A. Contar) activity of pesticide. There are many examples of repellent action of pesticides used. Complications appear during unmethodical spraying, if the vector can actively choose places with insufficient concentrations of pesticide or if the vector reacts negatively to the increase of pesticide concentration.

The fourth group of causes has to do with the biological peculiarities of vector that determine methods and means for its control. If a weak horizontal movement of object takes place it is necessary to

apply much more pesticide on the treated surface; if long drawn-out activation of vector population takes place it is necessary to assure a high persistence of pesticide by increasing its quantity etc.

And finally a very important cause of losses is connected with insufficient grounds (to be more exact — in the absolute groundlessness) of control measures from the ecological point of view. We have in mind the problem of desorganisation of biocenosis due to artificial interference the use of pesticide) in the natural development of this biocenosis.

It has been proved mathematically, that considerable reproduction of pests is possible after unfounded use of pesticides of wide spectrum of action. Such examples are known in agriculture. The objects of medical importance have in this respects undoubtedly greater specificity our slight knowledge of this question, however forces to think very seriously about possible consequences. Desorganisation of biocenosis under the influence of chemical action also determines the obscure losses.

It is possible to achieve a reduction in this group of losses in many cases. First of all we connect this possibility with serious biological and toxicological grounds of control measures against each specific vector in given conditions. But the important part of the obscure losses may be considered as "inevitable". The inevitable losses are determined by the biological peculiarities of the vector and knowledge of these peculiarities may assure reduction of these losses to a minimum.

At the present time, the problem of optimum use of some pesticides (in particular, fumigants) is composed and solved by V. A. Contar (Moscow Institute of Agricultural Engineers). The solution of the problem depends on physical and chemical parameters of pesticide formula, technological parameters of mechanisms and biological parameters of objects of control. These conditions enable the choosing of the parameters of the pesticide and regulate the process of its use so that the biological object of control with given characteristics would be affected with the minimum expense of pesticide.

The attempts at using pesticides together with attractants, and pesticides of very specific action (especially biological insecticides) may be considered as perspective for the purpose of reduction of obscure losses.

We think it useful to settle a question about losses of pesticides and the causes of such losses. First of all, it is necessary to find out the nature of causes in each case and to give them quantitative value (to determine specific importance of each cause). This will make it possible to find ways of reducing losses and creating optimum conditions for affecting the vector.

The question of losses of pesticides is doubtless up-to-date. It is

enough to think about the scale and intensity of use of pesticides, economical expenses and the main thing — increasing danger of accessory toxic effect because of chronic overexpenditure of biocidal substances.

And who else but medical entomologists will show initiative in this question by making vector control a fight for the health of the human body in the widest sense of the word?

## STRATY PESTYCYDÓW W ZWALCZANIU PRZENOSICIELI

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Jako „straty” autor określa różnicę między minimalną ilością pestycydu potrzebną do zadziałania na przenosiciela a rutynową dawką preparatu. Minimalną ilość pestycydu określa się za pomocą miejscowego zastosowania roztworu pestycydu na ciało przenosiciela (następnie przelicza się na ilość osobników w jednostce objętości lub powierzchni). Straty te mogą być podzielone ze względu na swoje działanie na „oczywiste”, „niejasne” i „nieuniknione”. Straty oczywiste są równe tej ilości pestycydu, która nie spada na poddaną działaniu powierzchnię z powodu niekorzystnych warunków meteorologicznych. Nieprzepisowe podanie pestycydu na poddaną działaniu powierzchnię oraz niektóre cechy pestycydu (postać, wielkość cząstek), które nie są optymalne dla danego przenosiciela, mogą spowodować straty niejasne. Straty nieuniknione są zdeterminowane tylko odrębnościami biologicznymi przenosiciela (ruchliwość, okres aktywności, charakter ekspozycji na pestycydy itd.).

Przeprowadzono analizę jakościową i ilościową strat różnego rodzaju i badano możliwość ich zniwelowania lub redukcji.