

# Agriculture & Pesticides Facts

## PESTICIDE RESISTANCE

Almost all pesticides are selective to some degree - they kill some species and leave others unaffected. As a result, some species are naturally resistant to some pesticides.

However, there have also been cases, over the past 40 years, where a pest that was once susceptible to a certain pesticide became resistant to that pesticide or to a whole family of pesticides.



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## HOW DO PESTS DEVELOP RESISTANCE TO A PESTICIDE?

The use of a pesticide does not "create" resistant pests (i.e., the pesticide does not cause genetic mutations which make the pest resistant to that product.) Instead, the pesticide selects out the resistant individuals that naturally exist within the population and allows them to increase in numbers.

Although there are exceptions, most pest populations contains a few individuals that are naturally resistant to a pesticide. This resistance exists either because of the diversity that is always present within the population of that pest, or because of naturally occurring genetic mutations that convey resistance. Normally, pesticide-resistant individuals comprise only a small fraction of the natural pest population. (Otherwise, people wouldn't be using that pesticide as a control measure.) In the absence of the pesticide, the number of resistant individuals remains low because they have no advantage over their susceptible counterparts. In other words, a pesticide-resistant individual is no more successful at reproducing than is a susceptible one. In many cases, the resistant pests are actually less competitive under natural conditions than are susceptible ones. Often, they are resistant because they lack the chemical or process which the pesticide attacks, and the lack of this may cause the resistant pests to be less vigorous than their susceptible counterparts.

When a pesticide is used, however, it favours resistant individuals over susceptible ones and the proportion of resistant pests begins to increase. Susceptible insects are either killed or weakened sufficiently that they do not produce the usual number of offspring, while resistant individuals continue to reproduce at least as well as before. (Because the resistant individuals face less competition, they could well produce more offspring than before.) If the pest is frequently exposed to the same pesticide, the resistant strain continues to build up. Depending on the characteristics of the pest and the pesticide, a population consisting almost entirely of resistant individuals can build up within a few generations.

## FACTORS INFLUENCING THE DEVELOPMENT OF RESISTANT PESTS

The speed at which a resistant population develops is related to the likelihood that the resistant pests will mate with other resistant pests, thereby producing highly resistant offspring. When susceptible and resistant pests mate, their offspring are not fully resistant and the buildup of a fully resistant population is slowed. The likelihood of two resistant individuals mating depends on the initial effectiveness of the pesticide and on how widely and frequently it is used.

- Pesticides that are highly toxic kill most of the susceptible pests. Because most of the surviving pests are resistant, most of the next generation will also be resistant, even before the pesticide is applied again. Less toxic products allow some susceptible pests to survive and mate with resistant ones, thereby limiting the number of highly resistant pests in the next generation.
- When the same pesticide (or one with the same mode of action) is used repeatedly against the same population, the susceptible strains never get a chance to recover and the proportion of resistant individuals increases with each generation.
- The more widely the pesticide is used, the fewer susceptible individuals there will be in the area to interbreed and produce susceptible offspring.

## PREVENTING PESTICIDE RESISTANCE

When a pest population becomes resistant to a pesticide, farmers and other pesticide users lose a valuable tool - sometimes their only tool - for keeping that particular pest under control. Therefore, it is very important that pesticides be used in ways that do not enable the buildup of resistant populations of pests.

Development of resistant pest populations can be prevented, or at least delayed, through:

- **changing pesticides** - using different pesticides, with different modes of action, over the years, will prevent the buildup of pest populations that are resistant to any one type of pesticide (e.g., use of "pesticide B" forces both the pests that are resistant to "pesticide A" and those that are susceptible to compete on equal terms again.)
- **crop rotation** - growing a different crop usually favours different pest species, thereby slowing the buildup of any one type of pest, and also allows use of a different set of pesticides.
- **IPM** - the use of other integrated pest management techniques, thereby reducing the need for chemical pest control interventions.