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Perspective

Role of Agrochemicals in Modern Agriculture

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INTRODUCTION

It is indisputable that pesticides have contaminated a substantial amount of the land and water on the world. As this is going on, countless animal species connected to agricultural environments are disappearing at rates that could bring them to extinction within a generation. Therefore, it is clear that the ecosystem is not being protected by our existing pesticide risk assessment. Here, a new paradigm is presented that combines a more rational risk assessment within the current tiered system with the mandated adoption of additional toxicity endpoints. Population endpoints critical to the recovery and survival of species, like fecundity and delayed mortality should be evaluated using chronic toxicity studies that are intended to identify time-cumulative effects. Since the higher levels of residues determine the primary ecological impacts, exposure assessments should make sure that field monitoring data integrate both the highest and average levels of residues.

The assessment of lethality following chronic exposure to sub lethal levels and short-term mortality (as now determined by a hazard quotient on acute toxicity) should be included in the first tier of the risk assessment. Chemicals that clear this tier ought to be examined in a subsequent tier that determines the critical population endpoints. A chemical shouldn't be registered until there is proof that it has recovered and hasn't had an adverse influence on the tested species' ability to reproduce. Sub lethal impacts, community effects investigated in model ecosystems (such as microcosms and mesocoms) and field trials are examples of further evaluation levels that can still be used, as is already done, as supporting evidence.

DESCRIPTION

The use of chemicals in agriculture is very prevalent nowadays. The sole goal of routinely applying 150 million tonnes of fertilizers and 6 million tonnes of insecticides to fields and crops annually is considered to be improving agricultural production. There is evidence that using herbicides can boost crop yields in many cases but there is also evidence that most insecticides and fungicides do not contribute to such yield increases. However, those who maintain that feeding a growing human population must come at all costs that is, at the expense of health; the economy and the environment often overlook the ecological concerns associated with these chemical inputs into the ecosystem.

The widespread use of pesticides, especially insecticides, in agriculture half a century ago, which sparked an environmental movement that is still going strong today. In the 1970's, the United States and other developed nations passed regulations pertaining to the safety of individual pesticides. In contrast, the majority of developing and underdeveloped nations were unaware of the harmful effects of these pesticides until their frequent misuse had an adverse effect on human health and other unfavorable environmental effects.

Since then, before a new agrochemical product is introduced to the market, the dangers to people and the environment are evaluated. While the effects on human health are closely examined, the methods used to analyze the effects on the environment are either unsuitable or lack a solid scientific foundation. It should come as no surprise that pesticide residues in sediments and waterways have been linked to the decline in biodiversity in aquatic ecosystems. These residues alter the composition and dynamics of invertebrate groups.

In industrialized nations, the entomofauna is disappearing at the same time and many vertebrate species that rely on them are experiencing population declines. The available data attests to our incapacity to accurately evaluate the threats that agrochemicals such as pesticides and others pose to the environment. In an attempt to "identify unexpected direct and indirect impacts on organisms by accounting for multiple propagation routes and exposures" some authors have suggested post-registration monitoring.

This strategy is predicated on the possibility that pesticides with existing registrations could subsequently be discovered to have unanticipated environmental effects after the harm has already been done. It does not ensure a new product's removal from the market, nor does it prohibit its usage.

Toxicity assessment

The primary problem with the existing ecological risk assessments is the lack of knowledge regarding the toxicity of chemicals to organism populations. The entire framework is predicated on the acute toxicity of a hazardous agent to a limited group of non-target species that are typical of significant taxa and are used in ecotoxicity testing or "surrogate species," in addition to the chronic toxicity to mammals alone. This framework is based on our understanding of human toxicology, which focuses only on effects at the individual level and places a great deal of weight on effects like carcinogenicity or mutagenicity, even though they are largely irrelevant to animal species in the wild. This is because pesticides are by definition extremely poisonous substances meant to kill animals.

Since they operate through physiological or biochemical processes unique to the target species, the individual organisms typically perish before any long-term consequences, like cancer, can manifest. Pesticides seldom, if ever, induce teratogenic consequences or deformities. Usually, other elements such heavy metals and dioxins are to blame for those anomalies. Testing for mutagenic and carcinogenic effects is obviously only relevant to human health and not environmental health.

The median Lethal Dosage (LD_{50}) or Lethal Concentration (LC_{50}) of a given chemical to the non-target surrogate species that are assumed present in a given environment is currently used to assess the ecotoxicity of agrochemicals. As previously stated, these endpoints pertain to acute lethality, which often occurs in a brief period of time: 24 to 96 hours for the majority of organisms, but earthworms typically require one or two weeks. Because chronic toxicity is relevant to human health, it is only investigated in experimental mammals, such as rats, mice or rabbits. Current rules have suggested using bees for chronic toxicity testing as well, although these studies would only run for ten days, compared to the thirty days that forager bees and winter bees typically live.

CONCLUSION

Pesticides are the primary cause of the population decreases of countless vertebrate and invertebrate species connected to agricultural environments. The fact that these ecosystems, which are continuously treated with a wide range of chemical pesticides, are not being adequately protected indicates that the risk assessment techniques now in use are insufficient to assess the ecological effects of these chemicals. Not only are the techniques flawed, but so is the ERA's current framework.