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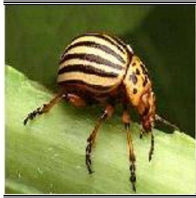

Management of Insecticide Resistance in Insect

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Resistance has been defined as a developed ability in a strain to tolerate doses of toxicants which would prove lethal to the majority of individuals in normal population of the same species (Anonymous,1957), World Health Organization (WHO), Expert Committee on Insecticides, (1957). Insecticides resistance management (IRM) strategies are becoming more important in agricultural production system. Pest resistance to a insecticide can be managed by reducing selection pressure by the insecticide on the pest population.Preventing and managing resistance to insecticides is an important stewardship practice that ensure insect control products will remain effective long term.In other words, the situation when all the pest except the most resistant ones are killed by a given chemical should be avoided.Resistance to insecticides was first documented in 1914 by A. L. Melander in the Journal of Economic Entomology.

Types of resistance :

Simple resistance : Simple resistance is the resistance of pest s to individual compounds or insecticides eg. Malathion resistant houseflies were not resistant to other Organophosphates.

Cross resistance : Cross resistance is the resistance of pest to more than one insecticide or more than one chemical eg. DDT resistant houseflies are also resistant to other chlorinated hydrocarbons.

Guidelines for insecticide resistance management : Create a season – long insect control plan to avoid unnecessary insecticide applications.

Consider planting early maturing varieties of plants that are more resistant to late – season insect attack.

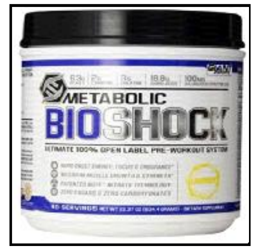
Consult an IPM adviser about the use of beneficial insects, synthetic and biological insecticides, crop rotation and other cultural practices that can be incorporated into crop production.

Use insecticides at labeled rates and spray intervals only. Using reduce rates of insecticides can result in incomplete control that can lead to resistance development.

Apply insecticides properly. Check and calibrate all application equipment on a regular basis to ensure good spray coverage. Proper pruning of tree crops can allow for better penetration into the canopy. Always use the application volumes and techniques found on the product label.

Causes of resistance : Several ways that insects can become resistant to crop protection products:

– Metabolic resistance
– Altered target-site resistance
– Penetration resistance
– Behavioural resistance



Pests often utilize more than one of these mechanisms at the same time.

Metabolic resistance : It is the most common mechanism.Insects use their internal enzyme systems to break down insecticides. Resistant strains may possess greater levels or more efficient forms of these enzymes.These enzyme systems also may be broad spectrum, meaning they can degrade different pesticides. The earliest reported case was DDT-resistant houseflies. Resistance to organophosphates (*e.g*., carbamates, acylureas) and pyrethroids can also result from this mechanism.

Altered target-site resistance : It is the second most common mechanism of resistance caused by a change in the structure of the site or the number of sites where the pesticide causes toxicity to the insect.Some DDT, organophosphate and pyrethroid failures are due to target-site resistance.In tobacco budworm (*Heliothisvirescens*) and the Colorado potato beetle (*Leptinotarsa decemlineata*).

Penetration resistance : Penetration resistance occurs when insects, such as the housefly (*Muscadomestica*), show slow absorption of chemicals into their bodies.The bad news is that this can protect insects from a wide range of insecticides.

Behavioural resistance : It occurs when insects or mites are able to evade contact with insecticides through avoidance. Reported for several classes of insecticides, including organochlorines, organophosphates, carbamates and pyrethroids. Insects may simply quit feeding on the area where spraying occurred.With transgenic plants, insects may stop short of consuming or eating enough toxin to kill them. It is hard to diagnose, and few management strategies are known; but rotating or alternating insecticides delay its effects.

Measures to be taken to avoid resistance :

An integrated approach prevents resistance: The ultimate strategy to avoid insecticide resistance is prevention. Insecticide resistance management programmes as one part of a larger integrated pest management (IPM) approach. Insecticide resistance management, involves three basic components: monitoring pest complexes for population density and trends, focusing on economic injury levels and integrating control strategies.

Monitoring pest: Progress of insect population development should be done to determine if and when control measures are warranted. Monitor and consider natural enemies when making control decisions.After treatment, continue monitoring to assess pest populations and control.

Focus on economic thresholds : Insecticides should be used only if insects are numerous enough to cause economic losses that exceed the cost of the insecticide plus application. Economic thresholds of target pests should be known.

Integrating control strategies : Take an integrated approach.Incorporate as many as different control mechanism as possible.In IPM use synthetic insecticides, biological insecticides, beneficial insects , cultural practices transgenic plants, crop rotation , pest resistant crop varieties and chemical attractants or deterrents. Avoid broad-spectrum insecticides when a narrow or specific insecticide will suffice.

Timely and correct applications : Timely insecticide and miticide applications against the most vulnerable life stage of the insect pest. Use recommended spray rates and application intervals.

Mix and apply carefully : As resistance increases, the margin for error in terms of insecticide dose, timing, coverage, etc., assumes even greater importance.Sprayer nozzles should be checked for blockage and wear and be able to handle pressure adequate for good coverage. Spray equipment should be properly calibrated and checked. on a regular basis. In tree fruits, proper and intense pruning allows better canopy penetration and tree coverage.Use application volumes and techniques recommended by the manufacturers and local advisors.

Alternate different insecticide classes : Avoid repeated use of the same insecticide or related products in the same class year after year. Rotate insecticides across all available classes to slow resistance development.Avoid tank-mixing products from the same product class. Rotate product classes and modes of action, consider the impact of pesticides on beneficial insects and use products at labelled rates and spray intervals.

Protect beneficials : Select insecticides in a manner that causes minimum damage to populations of beneficial arthropods. Applying insecticides in a band placement of insecticide rather than broadcasting.

Consider crop residue options : Insecticide resistance in the United States adds $40 million to the total insecticide bill in additional treatment costs or alternative controls. Cotton production failed due to resistance in the budworm/bollworm pest complex in India, Thailand and Mexico. Despite this, insecticides and miticides are still among the most efficient tools for keeping pest populations under control.

Conclusion : Evolution of resistance in insect to insecticides is a threat to modern Agriculture and calls for a thorough understanding of the dynamics of resistance. The strategies used to delay the onset of resistance and to manage resistant population are known as Insecticide Resistance Management (IRM) and form an important component of IPM programmes (Dhaliwal and Arora, 2004).The concept of quick kill or kill all hard chemicals will have to give way to concept of bio rational and soft chemical insecticides.Within the idealized IPM paradigm, biological and insecticidal management are complementary and can be utilized harmoniously. The synergism between natural and synthetic management can result in greater profitability for growers improved environmental stewardship of farmland and surrounds and sustainable management of organisms notorious for developing insecticide resistance.

References:

Hoy, M.A. (1995). Multitactic resistance management: An approach that is long overdue? *Fla. Entomol.***, 78**: 443 - 451.

Melander, A.L. (1914). Can insects becomes resistant to sprays. *J. Econ. Entomol.*

Roush, R.T. and Tabashnik, B. E. (1990). Pesticide resistance in arthropods. Chapman and Hall, NEW YORK, U.S.A.

http://entomologytoday.files.wordpress.com/2014/04/melander-jee-1914.pdf.

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