

SAFE AND JUDICIOUS USE OF PESTICIDES

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ABSTRACT

The present investigation was carried out in Jhalawar district of Rajasthan to study the growth rates, cost of cultivation and production of mandarin. A sample of 60 mandarin cultivators was selected for detailed study. The study relates to the agriculture year 2010-11. Study of cost of cultivation revealed that the total cost of cultivation of mandarin was estimated at Rs. 46933.16 per hectare with Rs. 5941.55 per hectare per year as establishment cost and Rs. 40991.61 per hectare per year as maintenance cost. The per hectare return from mandarin cultivation on an average was estimated at Rs. 1,12000 for the life span of one year. The average net return of mandarin cultivation was worked out to Rs. 65066.84 per hectare. Compound growth rates were estimated by using the exponential function of the form $Y = ab^t$. The growth rates were lowest in the year 1991-92-2000-01 and highest in the year 2001-02-2010-11.

INTRODUCTION

Pesticides are substances or mixtures intended for controlling, preventing, destroying, repelling or mitigating any form of life declared to be a pest. Today pesticides (insecticides, fungicides, herbicides, rodenticides, nematicides etc.) are extensively used all over the world to save crops in the field and in the storage. If pesticides were not used in agriculture the crop loss in the world would have been around 40%. The ease with which these substances can be used, their initial low cost and the lack of knowledge on the part of growers has led to an overuse of pesticides, with danger-

ous consequences.

Evidence suggests that not only are chemical pesticides used in increasing quantities but they are sometimes used and handled in an irresponsible way. This has led to problems to the environment, human and other forms of life. Most of the acute poisoning cases results due to the use of pesticides at higher concentrations than required, the poor quality of the spray equipments and their poor maintenance. About 3 million acute poisoning cases caused by pesticides occur world-wide every year out of which about 2 million are suicidal attempts and rests are caused due to occupational or accidental poisoning.

Types of misuse

1. Unintentional Misuse:

It results from poor knowledge of correct use of pesticides or equipment. The unintentional misuse could have impacts on health, environment, and food products. It can be prevented through effective training, certification and supervision.

2. Unintentional Release

It occurs when large quantities of pesticides are spilled or suddenly released. One must report to authorities immediately in such cases. It can be prevented through effective training, certification and supervision.

3. Intentional Misuse

It occurs when pesticides are used in acts of revenge, terrorism, etc.

Need for safe and judicious use of pesticides

Pesticides are toxicants, capable of affecting all taxonomic groups of biota, including non-target organisms. So, it is important to ensure the use of right pesticide at right time and in right doses. The under dose of pesticides may give poor results along with increasing the immunity of the insects whereas their overdose may cause harmful effects to the environment and other forms of life. Therefore, the insecticide use should be optimized in order to reduce the environmental contamination while maximizing its effectiveness against the target insect.

Consequences of indiscriminate pesticide use

The problems from applying chemical pesticides arise not so much from pesticide use but from the pesticide misuse which includes over application of the pesticides, repeated application of the same pesticide and poor application technology.

Major consequences due to the indiscriminate use of the pesticides are:

- **Development of resistance to pesticides:** The repeated use of the same pesticide over time leads to the evolutionary selection of those pest organisms that have developed resistance to a particular pesticide or family of pesticides. More than 500 species of insect pests have been demonstrated to have developed insecticidal resistance to insecticidal pressure.

- **Pest resurgence:** It is a situation where a population, after having been suppressed, rebounds to numbers greater than before the suppression occurred.

Maximum cases of resurgence belong to order Homoptera (44%) followed by Lepidoptera (24%) and phytophagous mites (26%).

- **Toxicity to beneficial fauna:** The indiscriminate use of pesticides on the crops result in wide spread mortality of beneficial insects (natural enemies, pollinators etc.) and therefore one should prefer to use those pesticides which are safer to the beneficial fauna.

- **Pesticide residues:** According to FAO, the reports of high levels of pesticide residues in food crops in India is an indication that pesticides are used in a wrong way. There are two types of sources of pesticide residues - direct and indirect. Field application of the pesticides on the crops are the direct sources of residues. On the other hand indirect sources of residues include drifting, run-off from the fields, volatilization of the pesticides and spillage.

- Outbreaks of secondary pests.
- Bioaccumulation.
- Biomagnification.
- Environmental pollution.
- Occupational hazards.

How to make safe use of insecticides?

One can make safe use of insecticides by:

- **Minimizing exposure**

- Avoid frequent applications of the pesticide. Never exceed the application rate indicated in the instructions.
- When applying pesticides, follow all precautions listed on the label, such as wearing the protective clothing to protect from exposure even when applying the safest pesticides.
- Minimally, protective wear should include rubber gloves, eye protection, a long-sleeved shirt, long pants, and closed shoes.
- Make sure any baits, traps or pesticide formulations are kept out of reach of children and pets.
- Never dump leftover pesticides in the garbage, on the lawn, or down the drain, where it could contaminate the soil or drinking water.

- **Minimizing Spray Drift**

- Avoid spraying when there is strong wind.
- Use nozzles that do not produce small droplets.
- Use large orifice nozzles at relatively low pressure.
- Adjust boom height as low as practical.
- Do not spray at high travel speeds.
- Spray when soil is coolest and relative humidity is

highest.

- Use nonvolatile pesticides.
- Use drift control additives when permitted by the pesticide label.

Some safety measures

1. While handling and mixing pesticides

- Mixing and loading operations are the most hazardous because they generally result in possible of exposure i.e. spills.
- Obtain proper equipment, including protective clothing, etc.
- Mix chemicals outside or in a well-ventilated area.
- Clean up spilled pesticides immediately from skin, clothing etc.
- Persons engaged in mixing, handling or applying pesticides should not smoke eat or drink while working.
- Do not use mouth to siphon a pesticide from the container.

2. During storage of the pesticides

Proper storage of pesticides will protect the health and well being of people, help protect against environmental contamination and protect the chemical shelf life. Attention must be paid to the following criteria:

- The storage warehouse must be located away from highly populated area, from wells or domestic water storage tanks and a well-drained land.
- The site should be accessible from all sides, to help fire fighting.
- The storage buildings should be made of non-combustible materials.
- The flooring should be of cement and should have a slope to drain off any spillage.
- A wash basin with running water and emergency shower should be placed in a suitable area.
- Warning signs in local languages should be placed on the outside of all walls of the warehouse.
- Roof should be leak proof and the material should be handled with care.
- The stores must be well lit. The electrical fittings should be sound and must be properly earthed.

3. During transportation

To ensure safe handling and transportation of pesticides the following points need to be taken into consideration:

- The best type of vehicle is the open type such as a

pick-up truck.

- Wettable powers and dust formulation in paper containers should be protected from rain.
- Avoid puncturing or tearing paper containers when handling them during loading or unloading or storing.

2. Judicious pesticide use:

Judicious use of pesticides can be made by considering the following:

- Waiting periods of chemicals,
- Economic threshold levels,
- Compatibility of chemicals with natural enemies,
- Nature of chemicals,
- The recommended doses ,
- Time of application, and
- Application technology etc.

Different measures for judicious pesticide use are:

- Choosing the right pesticide.
- Right time of application.
- Application of correct pesticide doses.
- Proper application technology.
- Use of specific formulations.
- Use of soft insecticides.
- Consulting the label before application.
- Integration of new molecules of insecticides with IPM.

1. Choosing the right pesticide

Pesticide selection depends on properties of the compound, biological activity on the target pest and the effects on the non-target organisms.

2. Application of pesticides in time

Most appropriate time to control the pests depends upon economic thresholds or the time when the most vulnerable stage of insect life is apparent. The application should be timed to reduce the frequencies and dosage of insecticides application, to save the natural enemies and pollinators.

- Timing of application depends upon suitable weather windows.
- Sometimes application is governed by crop growth stages at the period when damage is likely to occur (a specific crop growth stage).

3. Application of correct pesticide doses

The pesticides should be use in the recommended doses to:

- Avoid excessive residues on crops for feed and food.
- Achieve optimum pest control with minimum

- danger to desirable organisms.
- Avoid chemical damage to the crops.
- Obtain the most economical control of pests.

4. Application technique

Selection of method of application should be in such a way so as to use minimum dose while controlling the pests below the Economic Threshold Level (ETL). The insecticides can be used without any detrimental effect on the parasitoids and predators by selective placement or spot application. Proper application technique improves the targeting for rationale pesticide use. Controlled Droplet Application is good example of a rational pesticide use (RPU) technology. By controlling the droplet size, ultra-low volume (ULV) or very low volume (VLV), application rates of pesticidal mixtures can achieve similar (or sometimes better) biological results by improved timing and dose-transfer to the biological target (i.e. pest). Other efficient application techniques include banding, baiting, specific granule placement, seed treatments, use of rotary atomizers etc.

5. Pesticide application equipment

The correct usage of equipment and its proper maintenance affects the ability to place pesticides on target more economically and effectively. The choice of the equipment depends on its specific use and the need of a particular pest control measure.

6. Use of specific formulations

- Encapsulated and slowly release pesticides prevents the leaching as well as the volatilization of the pesticide molecules while spraying.
- Granular formulations are safe to parasitoids, predators and pollinators.
- Use of micro capsulation and controlled release

formulations which may allow less frequent or lower rates of application in the field.

7. Use of soft insecticides

Soft insecticides are those which are less toxic to non-targets, more environment friendly, quickly biodegradable, selective and have low use rates. E.g.: neonicotinoids, chitin synthesis inhibitors, insect growth regulators, Juvenile Hormone (JH) analogues, bacterial fermentation products etc..

CONCLUSIONS

Pesticides are important input in agriculture and we will have to depend upon these to meet the food challenge. Pesticides like drugs are beneficial to man when properly used but if misused they may be extremely dangerous. A world-wide problem of pesticide misuse have arisen mainly because of insufficient information and training of the farmers. As long as the pesticides will be used indiscriminately problems like pest resurgence, pesticide residues, secondary pest outbreaks, health hazards to humans and other environmental effects will be there. Therefore, it is critical to use the pesticides safely and judiciously i.e. using recommended pesticides, at recommended times and in recommended doses, while taking care of all the safety precautions. The manufacturers and distributors of pesticides and the users all carry a responsibility for the safe handling and the use of pesticides. There is a need for inception of IPM program, creating awareness among the farmers about the judicious use and banning of the ecologically disruptive pesticides. This will lead to effective and economic pest control over the long term, less pesticide usage/ load on various crops, less residues in the environment and in food and reduction in the associated risks.

