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PESTICIDE USE AND APPLICATION PATTERNS AMONG FARMERS: A STUDY FROM THE NCR REGION (GURGAON) OF HARYANA

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ABSTRACT

The study was conducted on 110 farmers, to find out the usage and pattern of use, awareness about pesticides and its health prospective on the farmers of the Gurgaon district of Haryana. The structured questionnaire was provided to the farmers to get the data about their personal issues, pesticide use, health issues and awareness about pest control. The comparative analysis revealed that Malathion (90%) and Phorate (87%) are the two pesticides which are being most frequently being used by the farmers. The bio pesticides are not so common among the farmers. The chemical pesticides are being used by the farmers with manual application without proper requisite safety measures. There was no correlation among education, age and health hazards among the farmers. The choice of pesticide were not based on the efficacy but on recommendations and cost effectiveness.

KEYWORDS: Pesticides, Insecticides, Haryana, Health Hazards

INTRODUCTION

India is the second most populous country in the world with a large segment of the workforce (191 million) employed in agriculture. Agriculture is an important sector, forms the backbone of Indian economy and is extremely vital for the nation's food and nutritional security. Substantial quantity food produced is lost because of insects, pests, plant pathogens, weeds, rodents, birds, nematodes and during storage[1]. Even with the advances in agricultural sciences, losses due to pests and diseases is estimated to vary from 10-90%; with an average loss of 35- 40%when taking into account potential food and fibre crops[2]. Increase in acreage of land under cultivation and with improved quality of seeds availability; there is an anticipated increase in the production of food grains, this in turn will lead to greater use of pesticides by farmers. While India is a leading pesticide manufacturer in Asia, the domestic per capita consumption at 0.5 kg / ha is lower as compared to other Asian countries[3].

A pesticide is a substance or a mixture of substances intended to prevent, destroy, repel or mitigate pest nuisance[4]. From the agricultural perspective, pesticides are intended to increase crop yields and farming efficiency, reduce loss of food grains during storage and transportation, while ensuring a stable and predictable food supply. Since the pesticides have the ability to reduce the level of vector borne diseases, the availability cost; while providing better quality goods and services to society, the general public has been rather tolerant to their use[5]. Although pesticides are intended to harm only the target pest, if not used correctly, they can harm the local populace and the environment. It has been estimated that 85-

90% of the pesticides applied in agriculture fields never reach their target organisms; however, they are dispersed in the environment[6, 7]. In consonance with the use of toxic substances, harm to humans is based on the dosage, exposure, sensitivity of individuals to the toxicity of the pesticides being used. The exposure of local population to pesticides can be by inhalation, oral consumption or dermal exposure[8, 9].

Classification of pesticides can be done on the basis of chemical composition or chemical structure pesticides are of three types: inorganic, organic and bio-pesticides. Inorganic pesticides are without carbon and are made of elements such as arsenic, copper, boron mercury, zinc, tin, sulphur, silica and other compounds e.g. lead arsenate, paris green, zinc phosphate, etc. Organic pesticides contain carbon. They may be natural i.e. organochlorine, organophosphate and carbamates or may be synthetic such as synthetic pyrethroids. Organophosphate insecticides are one of the most important and largest groups of pesticides commonly used now-a-days and are preferred over organochlorine derivatives.

According to the Department of Natural Resources[10], Michigan, some of the most toxic organophosphate pesticides includes disulfoton, phorate, dimethoate, ciodrin, dichlorvos, dioxathion, ruelene, carbophenothion, supona, TEPP, EPN, HETP, parathion, malathion, ronnel, coumaphos, diazinon, trichlorfon, paraoxon, potasan, dimefox, mipafox, schradan, sevin, chlorpyrifos and dimeton. These pesticides are applied to crops, buildings, ornamental plantsto protect them from pests and insects. Some of the less toxic compounds are used as systemic insecticides in animals against internal and external parasites e.g. chlorthion, thichlorphon, diazinon, fenchlorphos, and dichlorvos. Malathion, paraoxon, parathion and potasan have an action similar to chlorinated hydrocarbons and act as contact poisons.

In terms of pesticide consumption, Haryana is the third largest consumer of pesticide of India after Uttar Pradesh and Punjab[11], and is the area shortlisted for this study.

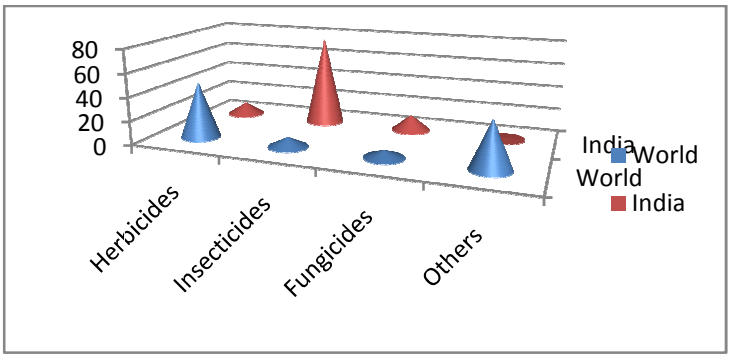

Figure 1: World And Indian Pesticide Consumption Pattern[12]

Sources for obtaining information on plant protection for the farmers are pesticide dealers, company representatives, agricultural extension officers, newspapers and progressive neighbour farmers. According to a survey done by Shetty[13] in 28 different districts of India, about 40% of the respondents in the districts were dependent on pesticide dealers, 20% from agricultural officers and the rest of the respondents relied on other sources like company representatives (10%), progressive farmers (9%) and media like Radio (2%), TV (9%) and Newspapers (7%).

In the current study, a survey was conducted in six different villages of Gurgaon district of Haryana, India. One hundred ten farmers participated in the survey giving details on the use pesticides use in their farming practices.

METHODOLOGY OF STUDY

A random survey was conducted to gather information on various aspects of pesticide usage i.e. type, frequencies, dosage, health effects, economic aspects.

Area of Study

The study was focused on the grain and vegetable growing areas of Gurgaon district. A number of crops were shortlisted for the study. The details are as under (Table 1):-

Table 1: The Details of Area of Study, Crops and Cultivated Area

Village	Acreage Under Cultivation	Land Type	Major Crops
Kaliawas	2-5	Sandy, Mold	Wheat, peas, pearl millet, sorghum, marigold, mustard, ridge gourd, bottle gourd
Makdaula	3-50	Domat sand, Sandstorm, Mold	Wheat, peas, pearl millet, sorghum, mustard, bottle gourd, ridge gourd
JhanjhraulaKhera	3-20	Sandy, Mold	Wheat, pearl millet, mustard, guar, oat
Sultanpur	4-30	Sandy, Mold	Wheat, pearl millet, mustard, spinach, singara, bottle gourd, ridge gourd
Ikbalpur	2-20	Sandy, Mold	Wheat, pearl millet, mustard, sorghum, marigold, pea
Budhera	2-9	Sandy, Mold	Wheat, pearl millet, mustard, sorghum, marigold, pea

Data Sought

The farmers were provided with an information brochure containing details of the study. The farmers were requested to provide their age, qualification, period involved in farming, land holding to include acreage, crops cultivated, pesticides used and their frequency, precaution taken and health hazards. They were also asked on methodology of used for grain storage.

RESULTS

One hundred ten farmers participated in the study; all of them being male. The data being shared has been provided voluntarily by the farmers. The details are given in succeeding paragraphs.

Personal Information

- **Age**: The farmers who participated in the study were aged between 29-50 years.
- **Marital status**: All shortlisted farmers were married.
- 4.1.3**Off-springs:** Three of the 110 farmers did not have children. (The purpose for adding this requirement

was to obtain data on infertility in farmers using pesticides).

- **Education**: 90% of the farmers had passed high school; while two percent farmers were graduates.

Pesticide use and Management

Though, there are 31 pesticides which are recommended by the state (2, 4 – D, BromadioloneCarbendazim, Chlorpyrifos, Clodinafop-propargyl, Cypermethrin, Dichlorvos, Diclofop Methyl, Endosulfan, Isoproturon, MancozebMethabenzthiaZuron, Methyl Parathion, Metribuzin, Metsulfuron Methyl, Pendimethalin Phorate, Propiconazole, Quinalphos, Sulfosulfuron, Tebuconazole, Thiamethoxam, Thiram, Triadimefon, Trichlorofon, Zineb, Carboxin, Farmatheon, Fenitrothion, Malathion, Sulphur). Out of these, a few pesticides which are recommended in the state are not registered in CIBRC (Carboxin, Farmatheon, Fenitrothion, Malathion and Sulphur). It was observe that the farmers used following pesticide for the control of the pests. Melathion was the most commonly used pesticide followed by Phorate by the farmers of this area (Table 2).

Table 2: Pesticides used by the farmer of Gurgaon District

Sr. No.	Type	Toxicity Class	Registered For Crops	Chemical Class	Percentage Of Farmers Using Pesticide
1	Chloropyrifos	I	10	Insecticide	7.2
2	Dimethoate	I	24	Insecticide	60.9
3	Malathion	I	16	Insecticide	90
4	Endosulphan	I	14	Insecticide	41.8
5	Phorate	I	23	Insecticide	87.2
6	DDT	I	Banned	Insecticide	40
7	Eldrin	I	Banned	Insecticide	24.5

Factors Affecting the Choice of Pesticide

The cost of product, efficiency of pest control and ease of availability of that pesticide always matter for choosing the pesticides. On the basis of these factors around 60% farmers go by cost effectiveness, whereas the efficacy matters for 38% farmers and only two present farmers are choosing pesticides by their ease of availability. Farmers generally opt for quick results and apply most toxic chemicals, even while the safer ones are technically suitable.

Maximum number of farmers (40%) revealed they normally apply pesticide either on the presence of pest or just before the pest occurrence period. Recommendation and advice of agro-chemical dealers (24%) and the fellow farmers (20%) were also major contributing factors towards deciding the time of application of the pesticide. However, a significant proportion of the farmers (16%) confirmed the pesticide application on a regular basis throughout the crop season without considering the presence of pest or disease symptoms. The frequency of spray varied from 1-4 times to 4-6 times and most of the farmers avoid pesticide spray before harvesting. The spray interval which was followed by most of the farmers was weekly (69%). 28% farmers repeated the spray within the week. 3% farmers spayed the pesticides after the onset of the disease. Time interval between last spraying and harvesting was variable. The most followed pattern was 10-14 days before harvesting. All the respondents confirmed morning or evening as the time for applying the pesticides the spraying percentage in the peak noon hours was nil which we can consider a good practice.

In social behaviour, personal health and hygiene is comparatively less. Moreover, the social impact is higher when the ecological impact of pesticide spray is assessed by the spraying pattern and disposal habits of empty containers. The direction of the wind is important for the farmers. However, the farmers rarely postpone the spraying due to the wind factor, resulting in the increased chances of drifting and affecting the non-targeted population.

Mode of Application and Safety Precautions

It has been observed that 70% application of pesticides was done manually without motorized spray. Though the farmers take the basic precautions like fully covering their bodies, along with covering of mouth and nose with cloth. The recommended precautions for complete protective measures like wearing protective clothing, hand-gloves, goggles, nose-masks and taking bath immediately after application are still not being adopted.

Health Issues

Most of the farmers denied any interim as well as chronic health effects of the pesticides on their health; however, the most common problems observed in survey were headache and dizziness (35%), followed by eye problems like itching and redness etc. (13%). The third most widespread problem was allergy on hands, face, neck, feet and skin of other exposed body parts (10%) followed by vomiting and nausea (5%). Though, serious health problems such as asthma, migraine, development of permanent skin patches etc. were abnegated by the farmers of this zone

DISCUSSIONS

In 21st century, national agencies and social activists have been emphasizing on the use of bio pesticides as an alternative to chemical pesticides. However; the fact is, that despite rising awareness, chemical pesticides continue to be used in large quantities. Haryana is among the top five pesticide consuming states of India, which is a huge matter of concern[11]. The present study was conducted to determine the use and impact of the pesticides in the Gurgaon district of Haryana. The results of present study indicate that the use spray pesticide is popular and is a routine affair amongst the farmers; and there is widespread use of moderately hazardous to carcinogenic chemical pesticides for the control of pests in the annual crops. The farmers consider it as the simplest and most effective mode of disease control for crops. In contrast to the international scenario where herbicides are the most widely used pesticides, in India pesticide consumption is more inclined towards insecticides[12]. It was reported by the farmers that the efficiency of the product to control the pests and its cost factor are crucial factors towards determining the choice of pesticide.

The availability of the product on the other hand did not seem to be an inhibiting factor, as farmers confirmed the easy availability of chemical pesticides. It was observed that in order to avoid the risk of crop loss due to pest attack, majority of the farmers tend to use pesticides even before the onset of symptoms of disease and they follow a continuous application of pesticides throughout the crop season until harvesting. Though, insecticide resistance management strategy given by Peshin[14], emphases on zero spray upto 90 days after sowing to conserve natural enemies; and no organophosphates/carbamates/synthetic pyrethroids until 90 days after sowing. Synthetic pyrethroids/organophosphates/carbamates should be used 90– 110 days of sowing, and profenophos/quinalphos/triazophos be used after 110–140 days of sowing. These guidelines are not being adhered to by the farmers of this area. This is indicative of unregulated, rampant and careless pesticide usage practices amongst the farmers; which leads to serious environmental and health problems. A number of studies have reported the presence of pesticide residues in food

commodities[15], groundwater and water bodies[16,17], bottled water[18] etc. in various parts of India. In addition, in India 20% of the pesticide contaminated food commodities have a pesticide residue level that is higher than the maximum residue level values on a worldwide basis[15]. Traces of DDT and endosulphan were observed in the Ghaggar River[16] of Haryanaand Yamuna River[19] of Delhi; while traces of pesticides have been observed in the blood samples[20], packed milk[21] and buffalo milk[22]. Although, in this study, the farmers did not responded negatively on the impact of pesticide on their health. The impact has, however been observed in previous studies. As regards the observations on the adoption of adequate safety and protective measures related to pesticide application practices, the same were not up to the mark as observed in previous studies[11,18]. More than half of the interviewed farmers confirmed that no safety measures are being followed by them except covering of their mouth and nose with cloth while handling pesticide.

Only a percent of farmers (3%) reported on the adoption of almost all safety guidelines. Lack of proper awareness and education regarding the undesirable health and environmental effects was established as the chief cause behind this approach of the farmers[23]. Such inappropriate and unsafe practices concerning the handling and use of pesticides have been commonly reported in other parts of the world, primarily among the rural farmers[23,24]. World-wide deaths and chronic illnesses due to pesticide poisoning is about one million per year[25]. However, we observed in this study, that in some cases in spite of satisfactory levels of awareness on these issues, the farmers were unable to use the protective material like goggles, gloves and suitable clothing etc. due to cost involved, which was a factor. As a result of such compromised pesticide handling practices leading to continuous exposure of farmers to high concentrations of these toxic chemicals; a number of farmers interviewed reported of acute, as also of chronic health problems.

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