Dangers of Pesticide Misuse: Challenges and Strategies

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Dangers of Pesticide Misuse : Challenges and Strategies

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Abstract

Organic agriculture is a viable alternative because it enlivens the soil, strengthens the natural resource base and sustains biological production at levels to commensurate the carrying capacity of the managed agro eco-system. In addition to this export market can also be tapped by group initiatives in organic farming. In a country like India, food production has to grow steadily. A sudden switch over to organic farming is not feasible. The minimum food requirement for the year 2001 is 240 million tonnes. The stage will be set in due course for a smooth transition to organic farming without causing any decline in production. The efforts from extension, research, supply of inputs, development of market channels, for disposal of organic foods are needed to facilitate the successful adoption of organic farming by the farmers. The approach shall be farmer centered and the programmes developed shall create conditions for the conservation and efficient use of locally available resources as inputs in agriculture.

Key Words: Pesticides misuse, Pesticide residue

Introduction

The problem of pests on agricultural crops was known to man since adoption of crop husbandry in a systematic way. This awareness f problem led methods for their control. The current annual loss due to insect, pests and diseases in the agricultural sector is around Rs.15,000 crore and over 20 million man days are lost due to the vector borne diseases. The country is in no position to accept the loss of food grain caused by pests in the agricultural fields as well as the damage caused to stored grain of which losses by insects and pests are of most economic importance. Chemical means of plant protection occupy the leading place as regards their total volume of application in integrated pests management and diseases of plants. But pesticides cause toxicity to humans and warm-blooded animals. Therefore, there is a need to develop bio-pesticides which are effective, biodegradable and do not leave any harmful effect on environment.

Agriculture is the back-bone of Bihar's economy and up to 80% of the population is engaged in farm sector directly or indirectly. Growing population needs sufficient farm produce. Farming and the agriculture crops are susceptible t attacks by various kinds of pests in form of insects, fungus, bacteria or virus or weeds and control of these has

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become necessary to reduce losses to a minimum. Heavy use of synthetic chemicals for pest control started from 1940s. Till then we were using natural insecticides namely rotenone from the roots of derris plant, and pyrethrum from the flower heads of a species of chrysanthemum. After twenty years it was found that the level of synthetic pesticides were building and were not biodegradable and their harmful effects started coming out.

A study of the pesticides-use pattern in the country has revealed that cotton, which accounts for just 5 per cent of the cropped area, consumes about 52 to 55 percent of the pesticides. Rice grown over 24 per cent of the cropped area uses about 18 per cent, vegetables raised over 3 per cent area, about 14 per cent plantation crops covering 2 per cent of the area, 8 per cent and cereals, millets and oilseeds extending over 58 per cent of the area, 7 per cent. Sugarcane uses 2 per cent of pesticides and other crops grown over 6 per cent of the cropped area account for another 2 per cent. Though the per hectare consumption of pesticides in the country is far lower than that in some of the developed countries. But the number of chemicals that are sold in the country and the indiscriminate use of plant protection chemicals are matter of grave concern.

Although, demand for pesticides will continue to grow for agricultural production cannot be cut down but alternatives will have to be developed before pesticides targets human beings.

Pesticides management has become very important and they should only be applied when either cultural or biological control means may not be effective or pests population have reached to a high level. Other components like presentation, cooperative efforts, rotation of crops, timing of sowing have been mentioned which all form the overall control scenario. Changing pests' scenario with respect to environment, pesticides have been discussed.

To make out necessity for biological control, some of the harmful effects, so far noticed have been compiled including build up of BHC, DDT residue. The report of various agencies has been included to emphasize the need for biological control. The chapter also contains average dietary intake of DDT and BHC residues in various countries (expressed as mg/person/day).

The Magnitude of Pesticide Misuse

In the process of development of agriculture, pesticides have become an important tool as a plant protection agent for boosting food production. But there indiscriminate use, apart from being an occupational hazard in the developing world, has been posing a serious threat to human health. There is a great concern over the growing incidence of cancer due to their excessive use. Some of these agricultural chemicals being poisonous leave behind residue in food and thereby produce ill-effects when the concentration exceeds the safe tolerance level.

Pesticide Use Pattern in India

India currently uses about 60 000 t of pesticides, a decline of one-third since 5 years ago. Worldwide, there has been a 44% increase in the use of herbicides over the past decade, with a concomitant reduction in insecticides by 30%. Since insecticides still account for 70% of total pesticide use in India, it is likely that insecticide residues will continue to be an issue for at least another decade, even if the declining trend in use continues.

Notorious Chemicals

Among the pesticides that have acquired notoriety, DDT and BHC (=HCH, =Gammaxane, =Lindane) are particularly important. In India DDT and BHC were the two major chemicals used in agriculture and public health programs. Although now partially banned, they are still very much in use because of their wide spectrum of activity and ready availability at low cost. Our biggest concern is that these molecules are stable in the environment. More than 600 000 t of HCH (Hexa choloro cyclo hexane) and 270 000 t of DDT have been added to the environment since their respective introductions in 1949 and 1952. It is suspected that most of our water bodies and soils are contaminated with these chemicals or with their degradation products. DDT persists with a half life of about 10 years, with only minor conversion to p, p' DDT, DDE, TDE, o, p DDT, etc. The uptake and accumulation of DDT and its metabolites in different plants and animal species varies considerably.

Here is a list of some common pesticides that affect humans, animals and the environment in adverse ways. They can be found in practically every food source today. To know about the usual contaminants in the food you eat, click here.

Trade name	**Long-term effects**
Camphechlor	Cancer suspect, toxic to fish, very persistent
Chlordane/Heptachlor	Leukemia suspect, toxic to wildlife, very persistent
Chlordimeform	Cancer suspect, bladder damage, toxic to wildlife
DBCP	Cancer risk, male sterility, persists in water
DDT	Cancer causing, damage to liver, nerve, brain, extremely persistent, toxic to wildlife
Aldrin/Dieldrin/Endrin	Cancer suspect, birth defects, very persistent, toxic to wildlife
EDB	Potent cancer cause, birth defects, lung, liver damage, very persistent
BHC/Lindane	Proven cancer cause, miscarriage, leukemia suspect, very persistent, toxic to fish
Paraquat	No antidote, lung scarring
Endosulfan	Nervous system damage
PCP	Nervous system damage, liver damage, skin disease
2,4,5-T	Potent cancer cause, birth defects, toxic to fish, very

persistent

Health Effects Associated with Pesticide Exposure

- ☐ Organophosphate pesticides have gained popularity worldwide in preference to organo-chlorines, which are persistent and more damaging to the environment.
- ☐ Organophosphates are associated with well-known acute health problems such as nausea, dizziness, vomiting, headaches, and abdominal pain, and skin and eye problems.
- ☐ Pesticide exposure is associated with chronic health problems or health symptoms such as respiratory problems, memory disorders, dermatologic conditions, cancer, depression, neurological deficits, miscarriages, and birth defects.
- ☐ Studies have established links between pesticide exposure and cancer in children.
- ☐ Recent reviews have examined the link between pesticide exposure and neurological outcomes and cancer, arguably the two major end points examined in organophosphate-exposed workers.
- ☐ In these extensive reviews, it has been pointed that carcinogenicity and neurotoxicity reflect different mechanisms of toxicity that require different epidemiologic investigations to assess the effects.
- ☐ Non-Hodgkin lymphoma (NHL) has been one of the most extensively studied cancers, with more than 30 studies in the scientific literature. Associations between NHL and exposures to phenoxyacetic acid, organochlorine, and organophosphate compounds have been reported.
- ☐ Leukemia has also been studied extensively, again with more than 30 studies showing associations with insecticide and herbicide use.
- ☐ Similar associations have been shown with prostate cancer, multiple myeloma, and soft tissues sarcomas.
- ☐ There is less supportive literature of an association between pesticides and other types of cancer, although there is some literature of an association between chlorinated compounds and breast and testicular cancer and Hodgkin disease.
- ☐ In the review by Kamel and Hoppin (2004) of the health effects of pesticide exposure, the authors report that chronic pesticide exposure is associated with a broad range of nonspecific symptoms, including headache, dizziness, fatigue, weakness, nausea, chest tightness, difficulty in breathing, insomnia, confusion, and difficulty concentrating.
- ☐ Many of the studies indicate that pesticide exposure is associated with deficits in cognitive function.
- ☐ There is also extensive literature supporting the association of Parkinson's disease and other neurological diseases and pesticide exposure. Kamel and Hoppin (2004) point out studies to date have been unable to identify specific associations between pesticide exposure and Parkinson disease risk.
- ☐ Occupational exposures to pesticides and adverse reproductive effects have also been reviewed (Hanke and Jurewicz 2004).
- ☐ Many pesticides known to have reproductive effects are no longer used in the United States, but employment in agriculture appears to be associated with specific morphologic abnormalities in sperm, and studies suggest that parental employment in agriculture could increase the risk of congenital malformations in offspring, particularly orofacial cleft, as well as musculoskeletal and nervous system defects.

Thus, the dangers posed by these chemical poisons to human and animal life, and their environmental pollution and persistence of residues in air, water, soil and food material have become a global phenomenon.

Pesticides in food and water

Their continuous use has also been affecting ground water sources through seepage into the soil. As a result, rivers, streams and ponds have become highly polluted with these harmful chemicals, and thereby adversely affecting drinking water sources. Drinking water from ponds in Hasan district of Karnataka was found to contain 0.02 to 0.2 ppm (parts per million) of pesticide. The level of the BHC in water taken from the Cauvery (Karnataka) was over 1,000 ppb (parts per billion) and of methyl parathion 1,300 ppb. The Yamuna, which has been a source of drinking water supply for Delhi and Agra cities, is reported to contain 21.8 ppm of the DDT.

The different food commodities like wheat, rice, groundnut, fish, meat, butter, ghee and cheese are found to contain good amount of pesticide residue. On an average India's daily diet contains about 0.27 mg of the DDT and the level of accumulated DDT in the body tissue of an average Indian is the highest in the world, varying between 12.8 and 31.0 ppm.

The pesticide problem is compounded in India because many pesticides banned abroad are manufactured / dumped and sold freely here. Pesticides are not bio-degradable, are highly toxic and find their way into ground water and water bodies, contaminating them and rendering them unfit for drinking purposes. Remember that even if you blame (and rightly-so) so a beverage manufacturer for allowing pesticide residues in their products and treating human life so cheaply, the fact remains that pesticides got into the water supply in the first place only because of the agriculture system which uses them.
These are some of the pesticides you can find in the food you eat. The list is not, unfortunately, exhaustive. To know how some of these pesticides affect humans and the environment,.

Pesticide residues (ppm) in market samples of fruits and vegetables
Sampling site Andhra Pradesh Punjab Karnataka Haryana Maharashtra Delhi Veg. oils Delhi & Punjab

Pesticide detected	**Range of residues**
DDT,	Traces to 35.0
HCH,	Traces to 6.0
Aldrin ,	Traces to 2.0
Endosulfan,	Traces to 6.0
Endrin,	Traces
Heptachlor,	Traces
DDT,	Tr. to 25.7
HCH.	Tr. to 0.8

Food product	**Contaminant pesticides**
Apples	Diphenylamine, Captan, Endosulfan, Phosmet, Azinphos-methyl
Bananas	Diazinon, Thiabendazone, Carbaryl
Broccoli	DCPA, Methamidophos, Demeton, Dimethoate, Parathion

Cabbage	Methamidophos, Dimethoate, Fenvalerate, Permethrin, BHC
Carrots	DDT, Trifluralin, Parathion, Diazinon, Dieldrin
Cauliflower	Methamidophos, Endosulfan, Dimethoate, Chlorothalonil, Diazion
Corn	Sulfallate, Carbaryl, Chlorpyrifos, Dieldrin, Lindane
Cucumbers	Methamidophos, Endosulfan, Dieldrin, Chlorpyrifos, Dimethoate
Grapefruit	Thiabendazole, Ethion, Methidathion, Chlorobenzilate, Carbaryl
Grapes	Captan, Dimethoate, Dicloran, Carbaryl, Iprodione
Green Beans	Dimethoate, Methamidophos, Endosulfan, Acephate, Chlorothalonil
Lettuce	Mevinphos, Endosulfan, Permethrin, Dimethoate, Methomyl
Onions	DCPA, DDT, Ethion, Diazinon, Malathion
Oranges	Methidathion, Chlorpyrifos, Ethion, Parathin, Carbary
Peaches	Dicloran, Captan, Parathion, Carbaryl, Endosulfan
Potatoes	DDT, Chlorpropham, Dieldrin, Aldicarb, Chlordane
Spinach	Endosuslfan, DDT, Methomyl, Methamidophos, Dimethoate
Sweet Potatoes	Dicloran, DDT, Phosmet, Dieldrin, BHC
Tomatoes	Methamidophos, Chlorpyrifos, Chlorothalonilo, Permethrin, Dimethoate
Watermelon	Methamidophos, Chlorothalonil, Dimethoate, Carbaryl, Captan

Other Dangers of pesticides

Pesticides can present danger to consumers, bystanders, or workers during manufacture, transport, or during and after use. There is concern that pesticides used to control pests on food crops are dangerous to the consumer. These concerns are one reason for the organic food movement. Food crops, including many fruits and vegetables such as potatoes, onions, brijal, cucubits, ladyfinger, cole crops like cauliflower, spinach and tomtoes, may contain pesticide residues after being washed or peeled. Residues, permitted by the government safety standards, are limited to tolerance levels that are considered safe, based on average daily consumption of these foods by adults and children.

Tolerance levels are obtained using scientific risk assessments that pesticide manufacturers are required to produce by conducting toxicological studies, exposure modelling and residue studies before a particular pesticide can be registered, however, the effects are tested for single pesticides, and there is no information on possible synergistic effects of exposure to multiple pesticide traces in the air, food and water.

The remaining exposure routes, in particular pesticide drift, are potentially significant to the general public. Risk of exposure to pesticide applicators, or other workers in the field after pesticide application, may also be significant and is regulated as part of the pesticide registration process. Children have been found to be especially susceptible to the harmful effects of pesticides. A number of research studies have found higher instances of brain cancer, leukemia and birth defects in children with early exposure to pesticides.

Besides human health risks, pesticides also pose dangers to the environment. Non-target organisms can be severely impacted. In some cases, where a pest insect has some controls from

a beneficial predator or parasite, an insecticide application can kill both pest and beneficial populations. The beneficial organism almost always takes longer to recover than the pest. Pesticides sprays in an effort to control adult mosquitoes, may temporarily depress mosquito populations, however they may result in a larger population in the long run by damaging the natural controlling factors.

Misuse of pesticides can cause pollinator decline, which can adversely affect food crops. An early discovery relating to pesticide use, is that pests may eventually evolve to become resistant to chemicals. When sprayed with pesticides, many pests will initially be very susceptible. However, not all pests are killed, and some with slight variations in their genetic make-up are resistant and therefore survive. Through natural selection, the pests may eventually become very resistant to the pesticide. Farmers may resort to increased use of pesticides, exacerbating the problem.

‘'Persistent Organic Pollutants’' (POPs) are one of the lesser-known environmental issues raised as result of using pesticides. POPs may continue to poison non-target organisms in the environment and increase risk to humans by disruption in the endocrine system, cancer, infertility and mutagenic effects, although very little is currently known about these ‘chronic effects’. Many of the chemicals used in pesticides are persistent soil contaminants, whose impact may endure for decades, and adversely affect soil conservation. A new study conducted by the Harvard School of Public Health in Boston, has discovered a 70% increase in the risk of developing Parkinson’s disease for people exposed to even low levels of pesticides.

Harmful Effects of excessive pesticide use

On the environment

Pesticides have been found to pollute virtually every lake, river and stream in India also pesticide runoff has been found to be highly lethal to amphibians. Pesticide impacts on aquatic systems are often studied using a hydrology transport model to study movement and fate of chemicals in rivers and streams.

The use of pesticides also decreases biodiversity in the soil. Not using them results in higher soil quality with the additional effect that more life in the soil allows for higher water retention. This helps increase yields for farms in drought years where there is less rain. For example, during drought years, organic farms have been found to have yields 20-40% higher than conventional farms.

On farmers

In recent years, vegetables are being considered as one of the major constituent in daily dietary menu of average Indian people. Most people these days consume good amount of vegetables possibly in both meals and if not at least in one meal as a supplement of nutrition particularly vitamins and minerals. Thus the demand of vegetables is increasing every year. Vegetables particularly off-season vegetables are getting popular among farmers as a high priority and high value crop mainly to generate employment and to increase the income of a rural people. However the produce needs to be safe because it is consumed by people of all age. The

produce could be contaminated with pesticides knowingly or unknowingly by farmers either during growing period or during storage.

There have been many studies of farmers with the goal of determining the health effects of pesticide exposure. Organophosphate pesticides have increased in use, and in addition to being more damaging to the environment they are more persistent than organochlorine pesticides. These are associated with acute health problems such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems. Additionally, many studies have indicated that pesticide exposure is associated with long-term health problems such as respiratory problems, memory disorders, dermatologic conditions, cancer, depression, neurologic deficits, miscarriages, and birth defects. Summaries of peer-reviewed research have examined the link between pesticide exposure and neurologic outcomes and cancer, perhaps the two most significant things resulting in organophosphate-exposed workers.

On consumers

A study published by the National Research Council of USA in 1993 determined that for infants and children, the major source of exposure to pesticides is through diet. A recent study in 2006 measured the levels of organophosphorus pesticide exposure in 23 school children before and after replacing their diet with organic food (food grown without synthetic pesticides). In this study it was found that levels of organophosphorus pesticide exposure dropped dramatically and immediately when the children switched to an organic diet. They were also able to test for multiple pesticides within a single sample and found that:

Most people quite frequently might have been consuming vegetables with certain level of pesticide residue. This might cause ill effect on human health depending upon type and amount of pesticide used. At the same time, pesticides as applied in the field will have indirect impact on the deterioration of the environment such as invisible effect on wildlife, pollution of surface and ground water and of course pollution of the soil and air.

Managing pest resistance

Pest resistance to a pesticide is commonly managed through pesticide rotation or tankmixing with other pesticides. Rotation involves alternating among pesticide classes with different modes of action to delay the onset of or mitigate existing pest resistance. Different pesticide classes may be active on different pest sites of action. Pesticide manufacturers may, on product labeling, require that no more than a specified number of consecutive applications of a pesticide class be made before alternating to a different pesticide class. This manufacturer requirement is intended to entend the useful life of a product.

Tank mixing of pesticides is the combination of two or more pesticides with different modes of action. This practice may improve individual pesticide application results in addition to the benefit of delaying the onset of or mitigating existing pest resistance, but it may also create situations where the resultant cocktail may become highly toxic and dangerous for plants and human beings alike.

The Enormity of the Problem

The priority on vegetable farming given by the government, NGOs, and multilateral donors with the purpose to improve the quality of life of resource poor farming communities is certainly a positive step at the national perspective. But at other hand, because of the increased demand of vegetables with good market outlets and better price, farmers have been using pesticides in these vegetables indiscriminately at higher dozes with frequent and cocktail spray to protect the increasing incidence of insects, pests and diseases. Thus there is enough reason to assume the fact that there might be certain level of pesticide residue on the produce the farmers harvest at close frequency. Farmers hardly care for waiting period as prescribed for each pesticide.

It is quite clear that almost all pesticides can cause illness and to the worse situation, death to the human. The produce might content different levels of pesticide residue however; it should not exceed the maximum residue limit (MRL) for consumption purposes. There is an international code of conduct for MRL on foodstuff. However each country has set their own standard for MRL showing the government's great concerns on the public health. It is interesting to note that most farmers for their home consumption purposes grow vegetables in a separate plot wherein they virtually use none or only limited amount of pesticides. It has been observed that the farmers dipped brinjal in insecticide solution to give it an extra shiny appearance.

Strategies for checking the Pesticide Abuse:

Integrated Pest Management (IPM)

With the changing cropping pattern, there has been major shift in insect, pest and diseases. This problem can be controlled by integrated pest management technique. Farmers have to take key position in implementing the technique through appropriate timely and precise adoption of package of practices. Skill oriented farmers education, therefore, becomes more relevant and has to be encouraged to make agriculture sustainable.

This is not only cost-effective but also ensures optimum plant population per unit area and higher yields. For instance, wheat seeds treated with vitavax/bavistin @ 2 g/kg and 20 ml. Neem oil/Neem rich-I reduce loose smut infection upto 98%. Similarly, sorghum and pulses seeds treated with monocrotophos @ 4 ml/kg. and 20 ml neem oil/neem rich-I of seed reduce shoot fly and stem fly incidence by 95%. Pre-monsoon ploughing helps reduce soil pest population through exposure to sun and predator birds. Bajra intercrop in groundnut helps reducing the incidence of leaf minor and sorghum bean combination helps in curbing the stem borer in sorghum and aphids in bean.

Pesticides management has become very important and they should only be applied when either cultural or biological control means may not be effective or pests' population has reached to a high level. Other components like presentation, cooperative efforts, rotation of crops, timing of sowing have been mentioned which all form the overall control scenario. Changing pests' scenario with respect to environment, pesticides have been discussed.

In India, the neem plant has been in use from the first century BC for medicinal purposes and control of certain diseases. Since then, it had been used in various ways to protect greenery. It has been found that chemicals extracted out of their seeds and seed kernels are effective bio-pesticides. This has been verified by various field trials and India has got a potential of about 6.0 million tonne of neem seeds per year and potential to produce up to one lakh tonne of neem oi. The neem products are competitive in prices and quality. As a result of the extensive research all over the world, neem based products have been formulated and are in the market. To name a few, Margosn O and Bio-neem developed by W.R. Grace International Co., Philadelphia, USA, and Azation and Turplex developed by Agri Dyne Technologies, Salt Lake City, USA, are being marketed after registering with Environmental Protection Agency, USA. Neem Azal developed by Trifolio M GmbH, Lahnau, W. Germany also is in the market. In contrast, there are more than two and a half dozen products developed in India and of them about a dozen are in the market after registering with Central Insecticide Board, Faridabad.

In addition to the toxic chemical available from neem, there are a thousand plant species found to possess insecticidal properties. Some of them are:

- Pyrethrum obtained from Chrysanthemum Cinerarifoliumt flower,
- Nicotine sulphate from waste tobacco materials,
- Rotenone obtained from extraction of ground roots of derris and
- Alium oil fraction of garlic and bitter gourd seeds

All these have been in use prior to developing synthetic pesticides and were effective. Their use has now been re-established by field trials and effectiveness has been checked against various pests and the various pesticides out of them have been developed in patented for use needs to be promoted. This source for toxic chemicals which is biodegradable is getting wasted because they are somewhat slower in action and secondly large scale manufacturing and supply distribution is not possible for them. Therefore, higher advertising cost and low profitability discourage their utilization.

Recommendation and action plan for eco-friendly pest control measures:

- Training materials like video cassettes for display on TV and Village demonstrations even audio cassettes on biocontrol of pests could be useful along with other publicity / information material.
- Biopesticides can be economically produced. However, large scale field trials have only to be carried out in USA.
- Another useful product and such dangerous status has to be protected and therefore the production and use of the predators and parasitoids has to be done under the supervision of the research associates, who can keep watch on future development of the predators.
- The technologies essentially developed in laboratory and field trials are now well established and ready for transformation to manufacturing units. However, in some cases, the product shelf life is limited.

- Biopesticides need to be produced by small insectories, catering to the need of a small area in each village by educated farmers can be trained by research institutes and later on the technologies can be transferred to village level.
- Need of educating farmer by training and retraining and making available books on subject,
- Video presentation and broadcasting of programmes over TV and Radio Receiver's
- Creating a team of trainers under the guidance of research and plant protection laboratories, with equal interest by local authorities in promoting such efforts.
- Establishing R&D laboratories for bio-control promotion.
- Field demonstration to farmers.

This will benefit the farmers and keep the cost under control.

- It is high time for immediate initiation by the concerned authorities/organizations for the study on level of pesticide residue on vegetables and also on other foodstuff. It is in fact most tedious, pain taking and skillful task. However it needs to be focused initially at potential pocket areas where higher amount of pesticides are used.
- Proper attention need to be given for benefit-risk ratio which though may vary depending upon the perception of different socio-economic groups.
- This type of study requires multi-disciplinary team with field-based observation, good laboratory facilities, trained manpower, and an integrated approach. This study should take place extensively both at laboratory and at farm levels. Farmers should be well aware of the type, amount and frequency of pesticides they use it to make the study successful.
- Several samples at different time of the year need to be collected from the field as well as from the wholesale market. Proper procedures need to be followed in sample collection and in transportation.
- Efforts should be made to avoid highly toxic and over use of pesticides. Pesticides should be used judiciously strictly on a need basis.
- To minimize the hazardous effects, attempts should be made to develop plant-based pesticides. The director of the Tata Energy Research Institute has recently suggested introducing certain genes in crops to make them resistant to pests and insects to avoid use of toxic chemicals. Its success would have far-reaching implications. Also, there is a greater need to focus on naturally occurring biological control.
- The neem tree grows wild and holds great promise of becoming a major source of natural insecticide. Many insecticides from neem has been developed in India and abroad, both as a dust and spray they should be popularized.
- A safe herbal pesticide from garlic and chillies has been developed in Pune, which is reported to be highly effective. Such safe pesticides can certainly avoid human tragedies in the near future.
- Promoting organic farming and declaring some prominent vegetable growing areas as organic area and supporting the vegetable growers through some initial incentives for going organic can be another way to lessen this burden.
- Exclusive sales outlets for selling organically grown produce should be opened in and around the major cities which could provide a better cost realization to the farmers, in short run and sustainable agriculture with better incomes in long run.

- Long felt need for certification and testing of vegetables and other food materials be opened in the state capital to provide easy and cheaper certification facility to the growers in the state.
- Lot of awareness needs to be done to educate the farmers about the harmful effects of indiscriminate use of pesticides, which not only harm the consumers but also put the lives of the farmers and their families in danger.
- Efforts should be made to popularize the IPM and use of bio control agents like trycoderma, NPV, pheromone traps, bird perchers among the vegetable growers on priority basis and also make these available locally so that their use can be promoted.

Future Outlook

There is a critical need to link studies of exposure to pesticides to investigations of potential health effects. The barriers to studying health effects in this population have contributed to this lack of new knowledge regarding the health risks associated with pesticide exposure.

Given the significant issues related to lack of national surveillance systems to capture the health status of farm workers and disparities related to access to care, investigators should be encouraged to include biomarkers of health effects in their study designs.

After seeing the deleterious effects arising with the use of agro chemicals coupled with the degradation of cultivable land and increasing agricultural pollution has created an unhealthy situation in the country. In order to balance this situation, organic farming, which aims at cultivating the land and raising crops in such a way as to keep the soil alive and in good health may be an alternative to the present system of farming solely depending on chemicals.

It is a method of farming which avoids or largely excludes the use of compound chemicals such as chemical fertilizers, pesticides and herbicides. Instead of that natural resources such as organic matters, minerals and microbes are used. It gives an idea to use all sources which are natural so that soil health is maintained.

Organic farming systems rely on large scale application of animal or FYM, compost, crop rotations, cooperative residues, green manuring, vermin compost, bio-fertilizers, bio-pesticides and biological control.

Alternatives for Chemical Fertilizers

In India the use of organic manures in subsistence forming is an age old practice. Organic manures improve physical, chemical and biological properties of the soil. Addition of organic manure improves structure aeration, water holding capacity of soils, reduces phosphorous fixation in acidic soil forms chilates with metallic ions and reduces their toxicity in crops. For substituting the chemical fertilizers various forms of organic manures and bio-fertilizers are explained below:

FYM cow dung is an important source of pl. nutrients. FYM is composed of drug, urine, bedding and straw. FYM contains approximately 5-6 Kg N, 1.5-2 Kg phosphorus and 5-6 Kg potash/ ton. It builds up soil health considerably.

1. Green Manuring: It is considered a good source of 'N' and it increases the availability of P, K and secondary and trace elements to the soil.
2. Coir Pith: The annual production of coir pith in India is about 7.5 million tonnes. Preferably bio-degraded and amended coir pith can serve as a substitute for FYM or similar organic manure, plenrotus sojorcaju. As per gillus and Trechoderma are found to be potent degrading of coir pith.
3. Vermicompost: is 5 times richer in N, 7 times in P, 11 times in K, 2 times in Mg, 2 times in Ca & 7 times in actinomy and than ordinary soil. It is a rich source of vitamins and growth hormones like gibberling which regulate the growth of plant and microbes. The compost prepared by using earth wiring is called vermi-compost.
4. Biofertilizers: These are living cells of different types of micro organisms which have an ability to mobilize nutritionally important elements from non usable to usable form. They influence the avalability of major nutrients like nitrogen, phosphorus, potassium and sulphur to the plants. Rhizobium, Azotobacter, Azospirillum, Blue green algae, Azolla, Mycorrhizae, phosphate solubilizing bacteria can be used as biofertilizers to increase the crop production. These micro organisms require organic matter for their growth and activity in the soil and provide valuable nutrients to the plants in the soil.

Many of the pesticide applications may be unnecessary and are economically unsound. A range of alternative methods of pest control to be used inorganic farming are detailed below:

1. Deep ploughing the fields during summer season help in killing pests, larval & eggs.
2. Clean cultivation by destruction of weeds and other alternate hosts breaks the carry over of the pest in succession which considerably reduces the pest numbers.
3. Adopting crop rotations to avoid carry over of pests from one season to next season.
4. Change in time of sowing
5. Draining of water out of fields at times of pests growing in number
6. Use of resistant varieties
7. Growing of trap crops
8. Release of parasites and predators
9. Use of pheromone traps and light traps
10. Use of biological insecticides
11. Use of mechanical weed control
12. Cover cropping to control weed-seed germination

Conclusion:

Organic agriculture is a viable alternative because it enlivens the soil, strengthens the natural resource base and sustains biological production at levels to commensurate the carrying capacity of the managed agro eco-system. In addition to this export market can also be tapped by group initiatives in organic farming. In a country like India, food production has to grow

steadily. A sudden switch over to organic farming is not feasible. The minimum food requirement for the year 2001 is 240 million tonnes. The stage will be set in due course for a smooth transition to organic farming without causing any decline in production. The efforts from extension, research, supply of inputs, development of market channels, for disposal of organic foods are needed to facilitate the successful adoption of organic farming by the farmers. The approach shall be farmer centred and the programmes developed shall create conditions for the conservation and efficient use of locally available resources as inputs in agriculture. The role of MANAGE will be taking up specialized programmes in organic farming for training of extension personnel.

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