IMPACT ON HUMAN HEALTH AND ENVIRONMENT OF EXPOSURE TO CHEMICALS FERTILIZERS AND PESTICIDES

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Abstract

The industrialization of the agricultural sector has increased the chemical burden on natural ecosystems. Pesticides are agrochemicals used in agricultural lands, public health programs, and urban green areas in order to protect plants and humans from various diseases. However, due to their known ability to cause a large number of negative health and environmental effects, their side effects can be an important environmental health risk factor. The urgent need for a more sustainable and ecological approach has produced many innovative ideas, among them agriculture reforms and food production implementing sustainable practice evolving to food sovereignty. It is more obvious than ever that the society needs the implementation of a new agricultural concept regarding food production, which is safer for man and the environment, and to this end, steps such as the declaration of Nyéléni have been taken.

Keywords: pesticides, agrochemicals, environmental health, endocrine disruptors, food sovereignty.

INRTRODUCTION

A goal of agriculture is to meet the present food need of the society with the surplus amount of availability for exporting and future purposes. For increasing agricultural production and productivity, use of chemical inputs such as pesticides has increased. Pesticides are chemical substances that are meant to kill pests. In general, a pesticide is a chemical or a biological agent such as a virus, bacterium, antimicrobial, or disinfectant that deters, incapacitates, kills, pests. It is commonly used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity. Pesticides have proved to be a boon for the farmers as well as people all around the world by increasing agricultural yield. Basically, the input of pesticides in Indian agriculture increases after the announcement of Green Revolution which in turn helps our country to fight the

major problem of food crises. Although the application of pesticides serves as a boon but also had a long term negative effect of harming the environment and human health. Currently, India is the largest producer of pesticides in Asia and ranks twelfth in the world for the use of pesticides. Although Indian average consumption of pesticide is far lower than many other developed economies, the problem of pesticide residue is very high in India (Abhilash and Singh 2008).

The current issue of hazard posed by pesticides to human health and the environment has raised concerns. Production of better alternative to reduce pesticide formulations is an answer to this destruction condition. If the pesticides are used in appropriate quantities and used only when required or necessary or opting for organic farming, then pesticide risks can be tackled to some extent. Water pollution is on the rise due to these pesticides, even at low concentration, these pesticides have serious threat to the environment (Agrawal et al. 2010).

The data for the last two decades regarding pesticide exposure and human health revealed that several pesticides cause neuronal disorder and degenerative diseases, some effect fetal growth and cause congenital anomalies and other are carcinogenic for human (Asghar et al. 2016). Over the past three decades, the indiscriminate use and improper handling of pesticides in agriculture have caused serious human health problems in many developing countries (Dasgupta et al. 2007).

EFFECTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON HUMAN HEALTH

Bhandari (2014) studied an overview of agrochemicals and their effects on the environment in Nepal concluded that agrochemicals are considered as a powerful weapon or magic bullets in the developing countries in order to enhance the agriculture productivity. However, it has been observed that agrochemicals are causing serious hazards and certain pesticides may affect the human endocrine and immune systems and may promote the development of cancer.

It has been administered that farmers do not use the safety masks, gloves and other protective gears during the spraying of pesticides which results into the access of pesticides in the blood stream through inhalation and dermal exposure which can adversely affect their eyes, skin and the respiratory system. The study shows relationship between the extent of pesticide used and signs and symptoms of illnesses due to exposure among spray farmers of Bhopal, Madhya Pradesh India, who sprayed pesticides by themselves and therefore were directly exposed to pesticides were assessed. The 18 months exposed spray farmers reported maximum acute signs and symptoms like burning/stinging of eyes (18.42%), blurred vision (23.68%), skin redness/itching (50%), excessive sweating/shortness of breath (34.2%), dry sore throat (21.05%) and burning of nose (28.9%). The signs and symptoms were found to be duration dependent among the sprayers. It is concluded that there is need for creating more awareness among the farm sprayers and authorities in implementing and ensuring the use of protective gear while handling pesticides (Choudhary 2014).

When fertilizers and pesticides are used in farmlands, they are transmitted directly or indirectly into the corns and vegetable that affects the human health. Moreover, as pesticides are applied over the vegetable which are directly entered into human or livestock bodies. Excessive use of fertilizers may pollute the underground water with nitrate and it is so much hazardous to humans or livestock. Nitrate concentrated water can immobilize some of hemoglobin in blood. Organophosphate pesticides have increased in application, because they are both less persistent and harmful for environment than organochlorin pesticides. But, they are associated with acute health problems, such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems. There have been many studies intending to establish cancer – pesticides association. Organophosphate pesticides used in the vegetables gradually get deposit into human body and has a link with cancer (Miah et al. 2014). Wimalawansa and Wimalawansa (2014) assessed the impact of changing agricultural practices on human health in Srilanka and concluded that detrimental agricultural habits, including the excessive and indiscriminate use of toxic agrochemicals, allowing continued environmental contamination and contamination of the human food chain. Contamination of soil and water with toxic agrochemicals (e.g., phosphate fertilizer contaminated with heavy metals, pesticides and herbicides etc.) are a particular concern. These pollutants in water generally are in small quantities, and thus, cannot be seen or tasted. Therefore, their harmful effects do not manifest in humans for several years but led to the escalation of deadly disease like chronic kidney disease.

Green Revolution makes India self-dependent in term of food grains but indiscriminate use of synthetic fertilizers and pesticides contaminated our food and environment. Punjab, an agricultural state of the Indian Republic known as the grain bowl of the country is facing serious problems. Nutrient imbalance in the soil and surface water contamination, pesticide residues in food and bovine milk and increasing cancer rate in farmers are some of the example of Green Revolution (Rahman and Debnath 2015).

The study shows that DDT was the most popular and effective pesticide to help people combat unwanted organisms and gain dramatically improvement in agriculture. However, since a number of adverse effects of this insecticide were reported, usage of DDT was banned international wide. Despite the severe restriction, DDT is still illegally used in many areas, especially in developing nations. Negative impacts of DDT on the human health were acknowledged and disseminated widely to warn population and prevent unexpected situations occur. Nevertheless, although DDT was not used in recent time, it still impacts on human health due to long residual efficacy and accumulation through food chain. In term of human health, DDT is the cause of many kinds of cancer, acute and persistent injury to the nervous system, lung damage, injury to the reproductive organs, dysfunction of the immune and endocrine systems, birth defects (Thuy, 2015).

The use of pesticides was introduced in India during the mid-sixties as a part of green revolution and malaria prevention programs. While pesticides turned useful for pest control they were at the same time responsible for human health injuries. Today these chemicals in particular those which accumulate in food chain, impose several human health hazards. Intake of food containing pesticide residues is documented to result in highest exposure,

about 103 –105 times higher than that arising from contaminated drinking water or air. Pesticides have been reported to cause several adverse health effects which depend on the extent and duration of exposure. Health effects of pesticides range from mild allergies, rashes, breathing difficulties, neurotoxicity and reproductive abnormalities to deadly chronic diseases like cancer. This challenge to food safety may be addressed by preventive strategies which include the use of alternative sustainable agricultural practices or mitigating strategies which are based on reducing pesticide exposure from food and water by different processing techniques (Tomer et al. 2015).

EFFECTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON ENVIRONMENT

Soil, the basic need of farming may happen to pollute by the accumulation of various heavy metals, through emissions by industries, mining process, disposal of high metal wastes, gasoline, application of fertilizers, sewage sludge, pesticides, wastewater irrigation, coal combustion residues, etc. Historically, a large amount of chemicals is annually applied at the agricultural soils as fertilizers and pesticides. Such applications may result in the increase level of heavy metals, particularly Cd, Pb, and As in the soil (Atafar et al. 2010). Usage of pesticides, insecticides and other various chemicals in agriculture is very easy, quick and inexpensive solution for controlling weeds and insect pests. However, use of chemicals comes with a significant cost. They have contaminated almost every part of our environment and their residues are found in soil, water, land and air.

Kumar et al. (2013) concluded that pesticides are often considered a quick, easy and inexpensive solution for controlling weeds and insect pests in urban landscapes. Pesticides have contaminated almost every component of our environment. Pesticide residues are found in soil and air, and in surface and ground water across the nation, and urban pesticide uses contribute to the problem. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds. Contrary to common misconceptions, even herbicides can cause harm to the environment.

The study performed in the surface water of Sharda river region in Lakhimpurkheeri, Uttar Pradesh-India reports the concentration levels and distribution patterns of the 21 organ chlorine pesticide residues in Solid Phase Extraction (SPE) is used for the extraction of organ chlorine pesticide residues in water sample. The most commonly encountered Organochlorine pesticides in surface water were dieldrin, heptachlor epoxide, isomers of hexachlorocyclohexane and DDT. In some cases the concentrations detected were higher than the quanlitative target levels set by the European Union, especially for γ-hexachlorocyclohexane&pp'- DDT. The concentration levels found are lower than the EU maximum acceptable concentration of 0.10 µg l-1 for all compounds examined, except for δ-HCH in seven samples (0.2772, 0.1950, 0.2210, 0.2045, 0.1994, 0.1523, 0.1390 µg l-1) and four samples (0.1877, 0.2365, 0.1478, 0.1269 µg l-1) of pp'-DDT during 2008-2010.

The occurrence of these compounds in Sharda river region surface waters can be attributed to intense agricultural activity as well as to transboundary pollution (Maurya and Kumar 2013). Pesticides have contaminated almost every part of our environment and pesticide residues are found in soil, air and in surface and groundwater. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms to insects, plants, fish, and birds. Recent studies have indicated that our environment is chronically polluted by pesticides and levels of biocidal contamination have increased tremendously. The environmental deterioration due to pesticides is endangering the situation of future (Sitaramaraju et al. 2014).

Soil analysis is carried out in the villages of Loni, Adgaon, Chinchpur, Sadatpur, Gogalgaon, falling in Taluka of Rahata & Sangamneer. Chemical fertilizers and pesticides are continuously being applied to agricultural fields for past many years boosting the agricultural yield and increasing chemical fertilizer consumption. The requirement of agricultural product (sugarcane, bajra, vegetables, food & fodder for animals) to cater to the domestic and industrial needs have made farmers to use fertilizer and pesticide beyond the prescribed dosage. The soil pH varied between from 7.46 to 8.9 and soil was found to be moderate alkaline. The soil is found to be free from salt accumulation. Organic carbon in soil was found to vary from moderate to very low indicating the need for improving the soil fertility. Available Nitrogen was found to be low in about 80% of soil sample, indicating lack of nitrogen status and the need for adequate application of nitrogenous fertilizer.50% of the sample tested revealed very low Available Phosphorous content, remaining with moderate to low content. More than 80% of soil sample showed high value of Available Potassium as high as 963.2kg/ha, remaining have moderate to low values. Micronutrients, Zn, Cu, had moderate to low value and Fe showed very low value, but about 48% of sample had Mn higher value. This nature of micronutrients may probably due to the moderate alkali value in the soil Groundwater studies in the region have shown growing alkalinity, Nitrates and other fertilizer and pesticide residue in the water. The growing soil contamination can lead to further deterioration of ground water quality, which needs to be controlled through controlled application of water and application biofertilizer, organic manure (Natraj and Katyal 2014).

A research has been done in (Ardabil- Iran) Moghan's irrigation and drainage network in order to evaluate long term effects of pesticides and chemical fertilizers usage on soil properties and heavy metals accumulation. The results showed that soil physical characteristics such as bulk density were changed in long-term and it was increased compared to control soil. The heavy metals accumulations in soil were highly affected and the concentration of some metals such as cadmium has reached a limit beyond the standard for agricultural purposes. The results also showed that fortunately the concentration of other metals is not beyond the standard. In this context, given the state of the soil and gained results, considering pesticides and fertilizers management is essential and it requires planning to reduce or replace pesticides and fertilizers usage in this region (Yargholi and Azarneshan 2014).

URGENT NEED TOWARD CLEANER AND SAFER AGRICULTURAL PRACTICES

Current agricultural practices include the wide production and extensive use of chemicals known for their ability to cause negative health effects in humans and wildlife and to degrade the natural environment. Therefore, an urgent strategic approach is needed for a reduction in the use of agrochemicals and for the implementation of sustainable practices. Furthermore, current agriculture has to implement environmentally friendlier practices that pose fewer public health risks. Reforming agricultural practices aligned to fulfill these criteria is a step toward the sustainability of the agricultural sector in contrast to precision agriculture.

However, the reduction in the use of agrochemicals by applying them only when and where they are necessary, the spatiotemporal variability of all the soil and crop factors of a given field must be taken into consideration. This variability includes yield, field, soil, and crop variability but also factors, such as wind damage or flooding. Technological systems, such as geographical information systems, global positioning systems, and various sensors, can be useful. These technological systems are developed by precision agriculture which of course we do not endorse, but we consider that selected technological tools can be used to decrease risks for environmental pollution and water pollution and to enhance economic benefits stemming from the reduction in the use of chemical products.

It should be clear that the reform into an aggregate of machine-centered procedures and losing a human-centered character are not the desired. In contrast, the reduction in the use of pesticides assisted by innovative technological methods we strongly believe that may reduce the use of chemical substances or maybe it can lead to a total abandonment in many cases, such as in the case of urban green areas. The decision of the Italian village of Mals near the Austrian and Swiss borders to ban the use of pesticides and produce pesticide-free foods can be considered as a pioneer example across Europe. In 2014, more than 70% of the inhabitants of Mals who participated in a referendum voted against the use of pesticides. This historical decision apart that is consistent with the food sovereignty concept, which is discussed in the following section, also declares the need for disseminating information for raising awareness of the public in order to develop informed consents.

An innovative idea developed by the international movement “Via Campesina,” was the democratic concept of food sovereignty that has accompanied the progress toward sustainability for more than 20 years. It acquired a strong basis in 2007 in the African village Nyéléni in Mali, where representatives from more than eighty countries adopted the “Declaration of Nyéléni.” According to its principles, all the people of the world have the right to choose their own national and local policies to eliminate poverty, malnutrition, and hunger, to protect their traditions and also the natural environment.

The industrialization of agriculture has brought a series of problems including economic, social, and environmental impacts that local populations cannot manage. Furthermore, the overproduction of food, export-oriented monocultures, the demand for cheap labor, and the other characteristics of industrialization have clearly

failed to solve the problems of hunger and malnutrition. On the contrary, inequitable food distribution, overexploitation of land and water sources, the overuse of agrochemicals, and the degradation of the natural environment are some of the results of the dominant agricultural model. Food sovereignty promotes social, economic, and environmental sustainability, for instance, through the protection of the indigenous population and the production of food for distribution in local markets, and there is an ongoing effort for its recognition as a basic human right.

The dominant agricultural model has increased the chemical burden on natural environment. Moreover, international agrochemical companies absorb traditional agricultural companies, leading to an industrialized agriculture model and leaving the local farmers and small producers to face the consequences. In many cases, these people are obliged to adopt environmentally unfriendly techniques to increase their production in order to survive in the market, causing more environmental degradation. However, due to the fact that food sovereignty does not necessarily mean pesticide-free, organic food production, and because it does not determine pesticide use levels, for this reason, international eco-friendly standards should be implemented. People must be free to decide the method of production of their own food, and an important component of this decision concerns agrochemical products. The decision of the people of Mals to reject pesticides can be considered a step in this direction.

CONCLUSION

By reviewing the literature, it can be concluded that the farmers do not follow appropriate safety precautions with regard to pesticide application, large amounts of pesticides are inappropriately used by these farmers, leading to several human health disease, polluting our air, land, water. Since about major proportion of the population relies on agriculture for subsistence, the pesticides are used very widely in agricultural field to increase the production by protecting the yields from potential threat. To safeguard human life and environment from the toxic effects of pesticides, adequate steps need to be taken. Now it is a well-established fact that there is the foremost need to step forward towards our mother earth by nurturing it by going for the organic farming system. An answer to this havoc is the organic farming, an environmentally friendly agricultural approach which ultimately leads to proper human health. Moving back to our ancestor's course by performing organic agriculture is a step towards sustainability. Organic agriculture is a holistic production and management system which is supportive of the environment, health and sustainability (Dubey, 2013). Though the Government of India has been making concerted efforts to encourage farmers and people regarding organic produce and product, but it has not resulted in bridging the gap between the demand and supply of organic product in the market. A proper training should be given to the farmers regarding organic farming, its scope, potential, and profit and environment sustainability. It has been administered that organic food consumption is increasing in India and this

is evident from the fact that many organic food stores are prompt up in India. So, working upon niche area of organic farming is yet to be explored and flourish.

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