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Water pollution potential from agrochemicals

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Abstract

One of the many ways of increasing agricultural production to meet the food and fibre requirements of the ever increasing population of the country is the use of agrochemicals. Some ingredients of these agrochemicals which may not be indicated on the product label could be injurious to human health if they enter the food chain. Fertilisers could also lead to the eutrophication of surface water sources which often serve as the only source of drinking water for most rural areas.

In Ghana, the cultivation of vegetables, especially tomatoes are done intensively with agrochemicals. A preliminary survey with questionnaires was undertaken to find out about agrochemicals in use in the Akomadan and Agogo tomato growing areas and their mode of application. The study showed that most farmers do farm along river banks during the dry season and handling, storage, formulation, application and disposal were unsatisfactory. No protective clothing are used and signs of rashes and chemical burns were evident. Improper application seemed to have rendered some pesticides ineffective. The dosage of agrochemicals applied was related to the financial status of the farmer. Farmers perception of certain measurements were blurred and in Agogo where extension services are minimal, farmers are left at the mercy of advice from colleagues who are illiterate or had primary education. Pollution of water sources looked likely from runoff, seepage and direct disposal of agrochemicals.

Introduction

The population growth rate in Ghana is estimated at 3% (PPMED, 1991) and to ensure that there is sufficient food for all, food production must outstrip or be equal to the growth rate. The food and fibre requirements of the nation can, however, be increased in four basic ways. These are:-

- Increasing productivity or yield per unit area of the land
- Reducing postharvest losses
- Increasing the productive land area and
- Finding or developing new food sources.

In order to address problems (a) and (b) and to some extent (c) agrochemicals are increasingly being used. In some West African countries, notably Ghana, and Cote

D'Ivoire, the sale of pesticides have even been found to be the fastest growing market averaging at about 182% per annum between 1980-84 (WHO, 1990). It is to be expected that a rational decision on the use of agrochemicals will be based not only on cost-benefit analysis alone but also on environmental impact assessment as well.

Increasingly, the cost-benefit for the short term has been the overriding factor determining the use of these agrochemicals.

In Ghana, agrochemicals are used mainly on cash crops like cocoa, coffee, maize, tomatoes and pineapples. The impact of these agrochemicals on the fragile agro-ecosystem has however not been studied. It is, however, known that many of these agrochemicals are deadly not only to the intended organisms but also to other life forms including man. For example levels of nitrates above 45 mg/l can harm children who drink water (Barrow, 1987). One effect of excess nitrates is methemoglobinemia which occurs in baby mammals. Many chemicals, including some pesticides, become carcinogenic or teratogenic at certain concentrations (Donahue et al, 1990). These may, however, not be mentioned on the product label. Accumulation of these toxic substances in lower organisms notably water microbes and other plant life can be magnified biologically until toxic concentrations are consumed by higher animals. For instance, accumulation of toxic substances as in fish, crabs and shrimps could pose health hazards to consumers (Donahue et al, 1990).

This project therefore sought to obtain baseline information on the present status of agrochemical usage in tomato growing areas and their possible effects on surface and groundwater sources and to generate factual data to help policy makers see the extent of the problem in order for them to act to ameliorate the situation.

Study area and methodology

Akomadan and Agogo which are well noted for tomato cultivation in the Ashanti Region were used for the study and the two towns are situated at the fringes of the transitional and semi-deciduous forest zones of Ghana respectively.

The preliminary study was mainly by observations, interviews and the administration of specially designed questionnaires to farmers (i.e. users) and dealers in agrochemicals.

Results and discussion

It was realised from the study that tomato cultivation during the dry season known locally as "petra" is done within valleys at banks of river and streams. Farms could be as close as 5 metres or even less to the river or stream since the limiting factor for crop growth which farmer has to supply is water. Tomatoes cultivated during this period tend to earn higher prices so farmers are keen to apply any means to their production methods in order to make money. On the average farm sizes are in the order of 0.4 ha even though some could be as large as 4 ha. Normally cultivation is by slash and burn but ridges are hardly made on the contour.

The most popular fungicides and nematicides used in the study area are kocide, champion, dithane, furadan, caocobre and topsin. Actellic, karate, furadan, thiodan, cymbush and elocron are the most popular pesticides used. The pesticides, fungicides and nematicides are mixed together in a drum without regard to whether these will eventually react to give a new product and sprayed with mistblowers. A few use knapsacks and others add fertilisers to aid solubility in the drum containing the others and sprayed together. The formulation and spraying are done with old tattered clothing. NPK fertilizers are normally applied at the rate of 5 bags per ha, two weeks after transplanting and ammonium sulphate at flowering stage at the same rate. Samppi, a liquid fertilizer, is used sparingly by some farmers. The quoted figures notwithstanding, the financial status of the farmer governs the application rate. Richer farmers use more and poorer farmers less. Varying concentrations of pesticides, fungicides and nematicides were applied at about five times on the average during the three month cultivation period. One major problem of farmers is how to comprehend certain units of measurements. In Akomadan where extension services are available, measurements are reduced to simple terms like a certain number of milk tins of the chemical in an oil drum of water and so on. In Agogo, however, extension services to farmers are minimal, they are therefore left at the mercy of advice from friends or colleagues who might be illiterate or had some form of primary education. There was allegations of farmers trying all sorts of chemicals to aid ripening which is yet to be proven.

Excess fertilizer application and absence of soil conservation measures had meant that fertilisers are leached to groundwater and/or washed by runoff into nearby streams which serve as the only source of water for drinking and other culinary activities. For example, in Agogo the main stream which was perennial is now partly silted and overgrown with weeds and no longer perennial. Most often increased amounts of phosphorus (which is usually scarce in water because it has low solubility) are the cause of eutrophication, but nitrogen and other nutrients contribute to the problem. Although the green algal growth is unsightly, the anaerobic (low O_2) condition of the water body is the most deleterious effect of eutrophication (Donahue et al, 1990).

Farmers were of the view that chemicals used over the years are no longer potent and were eager to embrace any new and more potent agrochemical irrespective of whether it is recommended for tomatoes or not or approved by the Environmental Protection Council (EPC) or not. Some chemicals which are unapproved are smuggled into the country. Farmers attribute ineffectiveness of some old chemicals to manufacturers reducing the quality of their products. One manifestation of careless and/or excessive use of pesticides is the increased resistance of insect pests to them (Barrow, 1987).

Agrochemicals drifted during spraying to streams and rivers. Containers for some chemicals are washed in these streams and later used as drinking cups. Sometimes groundwater are contaminated by agrochemicals (Barrow, 1987). Skin rashes and chemical burns were evident. Some farmers did complain of occasional dizziness after spraying.

Dealers sold small portions of products to farmers in containers other than the original. Great care is needed in storing, handling and applying agrochemicals especially pesticides and herbicides. High tropical temperatures may make agrochemicals unstable and prone to decompose into harmful compounds (Barrow, 1987).

Conclusions and recommendations

It can be concluded from the study that pollution of surface and groundwater sources looked likely from runoffs, seepage, drifting of agrochemicals to streams and from direct disposal. In the light of this the use of agrochemicals by farmers should be controlled and education by extension service on proper application procedures should be intensified. Where it is possible to use more safer agrochemicals, it must be encouraged. Studies should be conducted into more effective integrated pest management techniques. The study will continue with a wider coverage statistically of the questionnaires, and samples of soil, water and edible parts of plants will be tested.

References

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