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Pesticides use by smallholder farmers in vegetable production in Northern Tanzania.

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Abstract

Small-scale farmers in Northern Tanzania grow vegetables that include tomatoes, cabbages and onions and use many types of pesticides to control pests and diseases that attack these crops. Based on the use of questionnaires and interviews that were conducted in Arumeru, Monduli, Karatu, and Moshi rural districts, this study investigates farmers' practices on vegetable pest management using pesticides and related cost and health effects. The types of pesticides used by the farmers in the study areas were insecticides (59%), fungicides (29%) and herbicides (10%) with the remaining 2% being rodenticides. About a third of the farmers applied pesticides in mixtures. Up to 90% had a maximum of 3 pesticides in a mixture. In all cases there were no specific instructions either from the labels or extension workers regarding these tank mixtures. Fifty three percent of the farmers reported that the trend of pesticide use was increasing, while 33% was constant and 14% was decreasing. More than 50 percent of the respondents applied pesticides up to 5 times or more per cropping season depending on the crop. Insecticides and fungicides were routinely applied by 77% and 7%, respectively by these farmers. Sixty eight percent of farmers reported having felt sick after routine application of pesticides. Pesticide-related health symptoms that were associated with pesticides use included skin problems and neurological system disturbances (dizziness, headache). Sixty one percent of farmers reported spending no money on health due to pesticides. These results can be used to develop a tool to quantify the cost of pesticide use in pest management by small-scale vegetable farmers in Northern Tanzania and contribute to the reformation of pesticide policy for safe and effective use of pesticides.

Keywords

Northern Tanzania; Small-scale farmers; Vegetables; Pesticides; health; cost

Introduction

A wide range of pesticides is used for pest management and vector control in agricultural areas, but many farming communities in Northern Tanzania are not adequately informed about the hazards associated with the chemicals. As a result, farmers use pesticides without full understanding of their impact on human health and the environment. Human contacts with pesticides, whether in the field, during pesticide application, weeding, pruning, harvesting, re-entry to collect fire wood, vegetables or in the house killing mosquitoes, cockroaches, fleas and flies. Storing pesticides may lead into acute and/or chronic exposures, with adverse health

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consequences. Although the inhalation, dermal and oral routes of exposure are the most common, pesticide residues in food and water may add to indirect exposures common in the general population.

Illness suffered by one or more members of household can result from exposure to pesticides. Ill health may affect the overall performance and the productivity of the family farm since labour input in agriculture is normally supplied by households especially in small-holder agriculture in developing countries. The level of health costs has been estimated in some studies in other countries and is believed to be closely related to the level of socio-economic development and the context of the prevailing culture (Ajayi, 2000). However, in Northern Tanzania there has never been a comprehensive study to determine the costs of adverse effects of pesticides usage on the environment and human health. There is therefore the need to develop appropriate tool for estimating the real cost of pesticide usage in Tanzania to fill a knowledge and information gap so as to provide better means to develop appropriate pesticide policy in the country.

The costs of health problems and other environmental effects due to pesticides use in agriculture and public health are generally externalized in estimations of the economic burdens and benefits of pesticides in Tanzania and other parts of the world. Medical expenses (consultation fees and medicine); costs of recuperation (meals, medicines, doctors or hospitals); transportation costs (to health care facility); labour losses (for victims and their caretakers); are rarely included in analysis of the costs of pesticides. The main reason for not costing health problems particularly, the medical costs is due to the fact that local health officials do not often diagnose symptoms in relation to exposures, and are not adequately trained to identify adverse effects of pesticides (Ngowi et al, 2001; Ngowi and Partanen, 2002). Similar findings of low awareness amongst health care providers of the problem of pesticide poisoning have been reported in other parts of East Africa (Mbakaya, 1994; Ohaya-Mitoko, 1997), South Africa (London and Bailie, 1999), Costa Rica (Wesseling et al, 1997) and in Côte d'Ivoire (Ajayi, 2000). In addition most farmers do not keep records of their expenditures, as they do not appreciate its importance. Also, many of those vulnerable to pesticide-related symptoms are poor farmers who are often illiterate.

Objectives of the study

This study, which involved interviews with small-scale farmers in Northern Tanzania was conducted as part of a collaborative South African – Tanzanian programme of research into the health and economic consequence of pesticide exposure. This particular study aimed at generating data to be used to develop a tool to collect information on cost of pesticide usage. The purpose of the research is to provide data for pesticide policy aimed at pesticide exposure reduction and hence reduced health consequences due to pesticides, whilst still allowing farmers to produce cost-effectively sustainably and environmentally friendly. This paper reports findings on practices and use of pesticides by small-scale vegetable farmers in Northern Tanzania.

Material and methods

General study design and information

The study entitled "Health and Economic Consequences of Pesticide Usage" was launched in October 2003 in Tanzania (Tropical Pesticides Research Institute) and South Africa (University of Cape Town) under the sponsorship of the Fogarty International Center through the National Institutes of Health, United States of America (USA). The study aimed at exploring the relationship between health, the environment and economic development in relation to pesticide exposure in the two developing countries of Tanzania and South Africa. The study

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included developing robust, valid and reliable methodologies for assessing exposure, health outcomes, and to pilot risk perception methodologies applicable for developing countries and methods to cost the consequences of pesticide exposures and effects. The study also gathered descriptive policy data and preliminary pesticide poisoning prevalence and incidence estimates. The present study is based on the sub-study to develop methods to cost the consequences of pesticide exposures and effects.

Target areas and population

The study was conducted between March and June 2005. It consisted of interviews with farmers and farm workers in rural areas in Northern Tanzania where horticultural crops (vegetables, flowers, fruits) were mostly cultivated using farm inputs, particularly pesticides. The sample farmers from whom information was collected comprised of 61 small-scale farmers selected from Arumeru, Monduli, Karatu, and Moshi rural districts. The sites were selected based on crops grown (horticultural crops), pesticide usage, ease of accessibility and closeness to the TPRI (furthest was Mang'ola which is about 300 km), cooperation from local leaders and willingness of farmers/farm workers to participate. The study group was selected with the help of village leaders and agricultural extension staff on the grounds that they cultivate crops that require application of chemical pesticides.

Data collection

A questionnaire consisting of structured, semi-structured and unstructured items was designed based on published literature on the subject as well as experiences of the authors in the field. Data was collected through a farm survey by face-to-face interviews with farmers/farm workers during farming activities. The questionnaire was designed in English and translated into Kiswahili, the national language, which is understood by the majority of the farmers and pre-tested using small samples of farmers in the same areas before using it in this study.

The data collected included the biodata such as name, sex, date of birth, contact address; source of income from the farm and other sources; duration in farming; crops and production per season; pest problems; pesticides used and source; pesticide purchase and transportation costs; characteristics of pesticide stores and storage costs; type and cost of spray equipment; spares and repair, pesticide activities, pesticide exposure and cost, knowledge on impact of pesticide to environment; disposal of pesticides containers; application techniques; pesticide resistance; trends in pesticide use; symptoms due to exposure to pesticides; and expenditures incurred in treating the illness. Data were recorded between March and June 2005 by the investigators, who are scientist with long experience in pesticide related research. Computer data entry in Microsoft access was done with assistance from a statistician from the National Medical Research Institute, Muheza, Tanga and analysis was done using SAS statistical software. Statements made on open-ended questions that were not coded were also used to substantiate the numerical data.

Results

Types of pesticides used by farmers

The farmers, the majority of whom were males (89%) with mean age of 50 years, ranging 25 to 76 years, reported the use of 41 different pesticides. The study showed that of the different pesticide formulation types used by farmers in the area most were insecticides (59%), fungicides (29%) and herbicides (10%) with the remaining 2% being rodenticides (Table 1). Carbofuran, a nematicide, Zinc phosphide, a rodenticide and methomyl an insecticide were the only WHO Class Ib (highly hazardous) recorded in use. Of the Class II (moderately hazardous), III (slightly hazardous) or U (Unlikely to present acute hazard) types in use, 20% contained chemicals that were suspected to be endocrine disruptors, 24% were cholinesterase inhibitors

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and 7% each carcinogens and potential carcinogens. Eight out of 42 were unregistered for general use.

Insecticides used included pyrethroids (such as cypermethrin, deltamethrin, permethrin, and lamda-cyhalothrin); Organophosphates (such as pirimiphos-methyl, profenofos, chlorpyrifos, fenitrothion) and carbamates (carbofuran). The most popular fungicides were copper based such as copper oxychloride, copper hydrochloride and copper sulphate although mancozeb was also in use. The type and amount of pesticides used in different crops depended on the pest population and their potential damages to the crop as well as farmers' perception regarding pest management practices. The pesticides were supplied in containers ranging from 0.5 liters to 5 liters or in packets ranging from 0.5 kilograms to 25 kilograms. In most cases one liter and one kilogram were common as well as dispensing of smaller quantities by vendors.

About a third of the farmers apply pesticides in mixtures. There were combinations of up to 5 pesticides in a single tank mixture. Up to 90% had up to three pesticides in a mixture (Table 2). Farmers did not have specific instructions either from the label or from extension staff regarding these tank mixtures.

Frequency of pesticide application

More than 50 percent of the respondents applied pesticides using knapsack sprayers up to 5 times or more per cropping season (Figure 1) depending on the type of crop. More than three quarters of the farmers interviewed (77 %) reported routine application of insecticides and 7% reported routine application of fungicides. The fact that more than 15% of farmers reported applying pesticides 16 times or more per cropping season indicates an increasing trend in pesticide use, since respondents were farming relatively similar surroundings (Table 3).

Farmer's perception on trend in pesticide use

Fifty three percent of farmers who responded to the question on "What is the trend of your pesticide use during the past 5 years?" said the trend was increasing, while 33% felt it was constant and 14% felt it was decreasing. Table 3 shows the reasons given by farmers for the trends in pesticide use.

Perception of pesticide poisoning symptoms

Sixty eight percent of farmers reported having felt sick after routine application of pesticides. The most common symptoms that were reported by the interviewees are shown on Table 4.

Among the symptoms reported included dermal effects, (34%), neurological system disturbances (dizziness, headache) were (31%).

Costing

Valuation of the monetary costs for pesticides showed that 61% of farmers reported spending no money on health costs of pesticides while others reported spending between 20 and 130,200 Tanzanian shillings (0.018 – 116 US dollars). However, there were no records of such expenditures and farmers were only relying on memory. This is an area that needs to be studied in the future to substantiate actual expenses that farmers incur on their health after pesticide use.

Discussion

The use of pesticide was observed to be high, with over 40 different formulations, probably because farmers assume that the only solution to pest problems is to spray more frequently and using different types of pesticides (Dinham, 2003). In previous studies conducted in some of

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the study areas (Ngowi, 2003) it was revealed that farmers were not receiving agricultural extension service hence have attempted various means especially in pesticides use when dealing with pest problems but were constrained by the lack of appropriate knowledge. However, pesticide usage in the study area seems to be highly influenced by manufacturers and pesticides vendors who were carrying out their business right in the farming communities and very interested in achieving large sales of their pesticides. This is a typical situation in many developing countries where the choice of pesticides to be used by farmers is influenced by the suppliers (Snoo et. al., 1997; Epstein and Bassein, 2003). In African countries, many government extension programs encourage the use of pesticides (Abate et al., 2000), but do not consider their effects in the environment and health risks. As a result and coupled with lack of basic knowledge of pesticides, farmers' decisions on what pesticides and how to use do not have a bearing on health or safety of the environment. Epstein & Bassein, (2003) observed that farmers used more pesticides because they based the applications on calendar spray pesticides program without necessarily giving much priority to health and environmental considerations.

Insecticides were the most used because insect pests were the most serious problem in vegetable production in the study area. This was followed by fungicides usage, indicating that fungal attacks ranked second to insect pests. Herbicides were least in use probably because weeding could easily be done manually by deploying community members. The community members were deployed in duties such as transplanting and harvesting. It was common scenery in these studies to see women and children transplanting, weeding and harvesting especially in onion farms. This trend of labour division exposed the whole community to pesticides hence the majority of households in the farming communities were likely to be adversely affected by pesticides in one way or the other. Although in this study it was observed that insecticides were the most commonly used pesticides, usually amounts and types of pesticides used have been reported (WHO/UNEP, 1990) to show important differences among countries and among regions within one country depending on the type of agricultural production and level of economic development.

The tank mixture of pesticides observed in this study indicates that farmers lack basic knowledge of pesticides. Smit et al, (2002) observed that there was an interaction between fungicides, insecticides and water mineral content that influenced the efficacy of individual pesticide against fungal pathogens and insect mortality and some tank mixtures induced phytotoxicity on tomato. There is limited information on the reaction and effects of the mixtures observed in this study.

The trend of pesticides use by farmers over years is probably based on farmers' knowledge on pesticide application in relation to effectiveness of pesticides, pests, farm size, and price and weather condition. The use of carbofuran, a highly hazardous carbamate pesticide which is applied as granules in the soil to control nematodes can cause acute effects despite the fact that the formulation type is solid to mitigate risks from pesticides exposure to farmer's health, non-target organisms and the environment. This pesticide can be fatal if inhaled, swallowed, or absorbed through the skin, even though the effects of contacts and/or inhalation may be delayed due to its formulation (Santo et al., 2002). The effects of exposure even of a short duration can be delayed but there is a possibility of cumulative effects (Gupta, 1994).

The risk of long-term effects of the pesticides that were being used in the study area is high especially due to exposure to carcinogens, possible carcinogens and suspected endocrine disruptors. The pesticides were being mixed wrongly, mishandled and misused. Although fungicides are not easily observed to cause serious and acute damage to farmer's health, they have been reported to cause some harm to farmer's skin and eyes (Novikova et al., 2003). It is also reported that there is a long-term risk for cancer development and endocrine disruption resulting from farmer's exposure to fungicides containing mancozeb (Novikova et al., 2003).

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In general, the frequencies of pesticides application by farmers were high. Such heavy use of pesticides may result in frequent contact with pesticides, which can lead to significant health problems.

Usually farmers assume that pesticides poisoning symptoms are normal so they get used to them (Kishii et al., 1995). However, the symptoms reported in this study are not specific to pesticides exposure, but could be due to different causes, including general fatigue and malaria. In addition there were few farmers who reported to the health care centres for treatment resulting from pesticides use and hence the reason for low expenditure on health costs. Similar studies carried out in Indonesia (Kishi et al., 1995) and in Côte d'Ivoire (Ajayi, 2000) report that pesticide applicators tended to accept a certain level of illness as an expected and normal part of the work of farming and, do not report the symptoms in official health centres for formal medical assistance.

Health and environmental problems cannot be isolated from economic concerns due to the fact that incorrect pesticide use results not merely in actual yield loss but also in health and possible effects of air and water pollution. The problem of farmers' health should be an important concern for policymakers when looking at the economic efficiency of horticultural production. Therefore, there is a need to carry out studies in order to confirm that the various symptoms reported were caused by the pesticides exposure hence advice farmers on how to protect themselves and/or cure from such effects and avail appropriate costs.

The high dependence on pesticides by vegetable farmers is an indication that they are not aware of other pest management strategies that are effective, inexpensive and yet friendly to the environment. Pest management strategies including intercropping (Legutowska et al., 2002) and tillage type and crop rotation (Humel et al., 2002) have been shown to significantly reduce insect pests. There is a need to bring to the attention of these farmers existing alternative pest management strategies that are cost effective and environmentally friendly. In Zimbabwe, although small-scale vegetable farmers use some cultural control methods and occasionally botanical pesticides, pest control is predominantly by the use of synthetic pesticides (Sibanda et.al., 2000)

Conclusion

This study provides valuable information on the pesticides used, exposures, and perceptions on pesticide use, trends, and health symptoms by small-scale vegetable farmers. It can also be used to develop a tool to quantify the cost of pesticide use in agriculture and hence contribute to the reformation of pesticide policy in Tanzania. There are strong indications that there are human health problems that are associated with the use of pesticide in horticultural farming in Tanzania but inadequately documented. In addition, the costs of farmers' health effects and environmental problems caused by pesticides use have not been included in the total cost of vegetable production by small-scale farmers in Northern Tanzania.

Acknowledgement

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References

Abate T, van Huis A, Ampofo JKO. Pest management strategies in traditional agriculture: An African perspective. Annu. Rev. Entomol 2000;45:631–659. [PubMed: 10761592]

NIH-PA Author Manuscript

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Ajayi, OC. Pesticide use practices, productivity and farmer's health: The case of cotton-rice systems in Cote d'Ivoire, West Africa. Hannover, Germany: A publication of the Pesticide Policy Project; 2000. p. 172Special Issue Publication Series, No. 3

Dinham B. Growing vegetables in developing countries for local urban populations and export markets: problems confronting small-scale producers. Pest Manag. Sci 2003;59(5):575–582. [PubMed: 12741526]

Epstein L, Bassein S. Patterns of pesticide use in California and the implications for strategies for reduction of pesticides [Review]. Annu. Rev. Phytopathol 2003;41:351–375. [PubMed: 14527333]

Gupta RCJ. Carbofuran toxicity. Toxical. Environ. Health 1994;43:383–418.

Hummel RL, Walgenbach JF, Hoyt GD, Kennedy GG. Effects of production system on vegetable arthropods and their natural Enemies. Agric. Ecosyst. Environ 2002;93(1–3):165–176.

ILO. Encyclopaedia of Occupational Health and Safety. 4th Edition. 2005. Pesticides.

Kishi M, Hirschon N, Djajadisastra M, Satterlee LN, Strowman S, Dilts R. Relationship of Pesticide Spraying to Signs and Symptoms in Indonesian Farmers Scand. J. Work Environ. Health 1995;21:124–133.

Legutowska, H.; Kucharczyk, H.; Surowiec, J. Control of thrips infestation on leek by intercropping with clover, carrot or bean. In: Paroussi, G.; Voyiatzis, D.; Paroussis, E., editors. Proceedings of the second Balkan Symposium on Vegetables and Potatoes (579). 3001 Leuven 1, Belgium: International Society Horticultural Science; 2002. p. 571-574.

London L, Bailie R. Notification of Pesticide Poisoning: Knowledge, Attitudes and Practices of doctors in the rural Western Cape. S A Fam Pr. 1999 1990;20:117–120.

Mbakaya CFL, Ohayo-Mitoko GJA, Ngowi AVF, Mbabazi R, Simwa JM, Maeda DN, Stephens J, Hakuza H. The status of pesticide usage in East Africa. Afr J Health Sci 1994;1:37–41. [PubMed: 12150642]

Ngowi AVF. A study of farmers' knowledge, attitude and experience in the use of pesticides in coffee farming. Afr Newslett on Occup Health and Safety 2003;13:62.

Ngowi AVF, Maeda DN, Partanen TJ. Assessment of the ability of health care providers to treat and prevent adverse health effects of pesticides in agricultural areas of Tanzania. Int J Occup Med Environ Health 2001;4:347.

Ngowi AVF, Partanen T. Treatment of pesticide poisoning: A problem for health care workers in Tanzania. Afr Newslett on Occup Health and Safety 2002;12:71.

Novikova II, Litvinenko AI, Boikova IV, Yaroshenko VA, Kalko GV. Biological activity of new microbiological preparations alirins B and S designed for plant protection against diseases. I. Biological activity of alirins against diseases of vegetable crops and potato. Mikologiya i Fitopatologiya 2003;37(1):92–98.

Ohaya-Mitoko, GJA. Occupational pesticide exposure among Kenyan agricultural workers. PhD thesis. Wageningen University: 1997.

Santo MEG, Marrama L, Ndiaye K, Coly M, Faye O. Investigation of deaths in an area of groundnut plantations in Casamance, South of Senegal after exposure to Carbofuran, Thiram and Benomyl. Journal of Exposure Analysis and Environmental Epidemiology 1998;12:381–388.

Sibanda T, Dobson HM, Cooper JF, Manyangarirwa W, Chiimba W. Pest management challenges for smallholder vegetable farmers in Zimbabwe. Crop Prot 2000;19(8–10):807–815.

Smit, ZK.; Indjic, D.; Belic, S.; Miloradov, M. Effect of water quality on physical properties and biological activity of tank mix insecticide-fungicide spray. In: Paroussi, G.; Voyiatzis, D.; Paroussis, E., editors. Proceedings of the second Balkan Symposium on Vegetables and Potatoes (579). 3001 Leuven 1, Belgium: International Society Horticultural Science; 2002. p. 551-556.

Snoo, GR de; Jong, FMW de; van der Poll, RJ.; Jansen, SE.; van der Veen, LJ.; Schuemie, MP. Variation of pesticides use among farmers in Drenthe: A starting point for environmental protection. Med Fac. Landbouww. Univ, Gent 1997;62/2a:199–212.

Wesseling C, Hogstedt C, Picado A, Johansson L. Unintentional fatal paraquat poisonings among agricultural workers in Costa Rica: A report of 15 cases. Am J Ind Med 1997;32(5):433–441. [PubMed: 9327065]

World Health Organization; United Nations Environmental Program. Public Health Impact of Pesticides used in Agriculture Geneva 1990. 1990.

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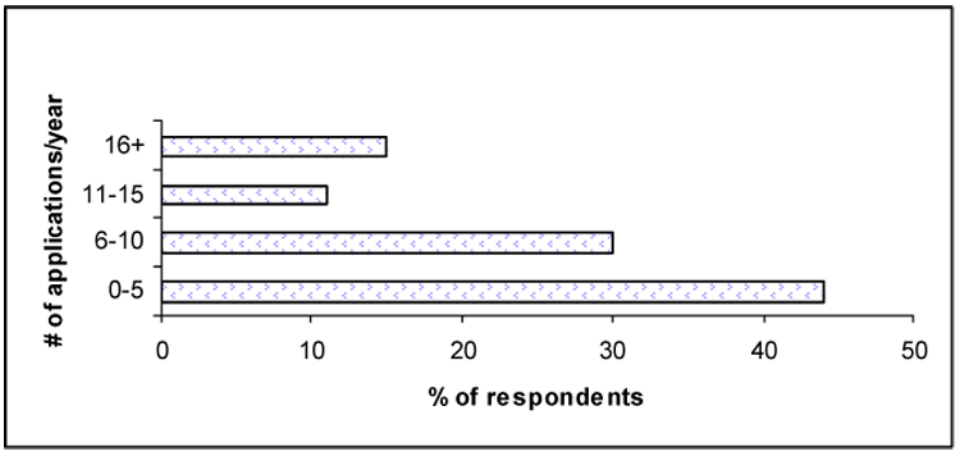

Figure 1.
Number of pesticide applications in vegetable farms in Northern Tanzania per cropping season

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Table 1

Types of pesticides used in small-scale vegetable farms in Northern Tanzania, classified using the WHO Hazard Class and health effects, 2005

Trade Name	Common Name	WHO Class[a]	Health Effects[b]	Target pests	Registration status[c]
2–4D	2–4D amine	II		weeds	R
Actellic 50EC	pirimiphos-methyl	III	CI,SE, PC	weevils	R
Actellic Super dust	pirimiphos-methyl+permethrin	NK	CI, SE, PC	cutworms, armyworm stem-borer	R
Alto	Cyproconazole	III		leaf-rust	R
Ashes		NK		stem-borer, stalkborer	U
Bayleton	triadimefon	III	PC, SE	blight	R
Blue Copper	copper sulphate	II		leaf-rust, blight	U
Cobox	copper oxychloride	III		fungus	R
Cypercal	cypermethrin	II	SE, PC	larger-grain-borer	R
Decis	deltamethrin	II		fruit-borer	R
Diazinon	diazinon	II	CI	stalkborer, stem-borer, leafhopper, leaf-miner, beetle	R
Dimethoate	dimethoate	II		insects	R
Dithane M45	mancozeb	U	SE, C	fruitfly, blight, downy-mildew, leaf-rust, wilting	R
Dursban	chlorpyrifos	II	CI	stem-borer, cutworms, armyworm, bollworm, thrips, beetle, aphids, leafminer, stalkborer	R
Dynamec	abamectin	II		insects	R
Fenesta		NK		weeds	U
Fenom c		NK		thrips, insects, fruitrote	U
Funguran	copper hydoxide	III		leaf-rust	R
Furadan	carbofuran	Ib	CI	stalkborer, nematodes	R
Helarat	lamda-cyhalothrin	II	SE	thrips	R
Impact	Flutriaflo PP	III		leaf-rust	R
Ivory 80WP	mancozeb	U	SE, C	blight	R
Karate	lamda-cyhalothrin	II	SE	armyworm, beetles, stem-borer, caterpillar, cutworms, larger-grain-borer, weevils, aphids, fruitfly, spidermite, stalkborer	R
Keshet	deltamethrin	II		insects	R
Lannate	methomyl	Ib		butterfly	U
Majester		NK		spidermite	U
Mamba	Glyphosate	U		weeds	R
Phostoxin	aluminium phosphide	NC		thrips	R
Polytrin	cypermethrin	II		thrips, insects	R
RedCat	Zinc phosphide	Ib		rats	U
Ridomil	mancozeb+metalaxyl	NK	SE, C	blight, spidermite	R
Rogor	Dimethoate	II		stalkborer	U
Ronstar	Oxadiazon	U		stem-borer	U
Roundup	glyphosate	U		weeds	R
Selecron	profenofos	II	CI	whitefly, spidermite, fruit-borer, stem-borer, insects, thrips, aphids	R
Shumba dust	fenitrothion+deltamethr in	II	CI	larger-grain-borer	R
Sumithion	fenitrothion	II	CI	stem-borer	U
Thiodan	endosulfan	II	SE	larger-grain-borer, stem-borer, leafminer, red-ants, beetle	R
Thionex	endosulfan	II	SE	american-bollworm, aphids, mites, insects, leafminer, stalkborer	R
Thiovit	Sulphur	U		blight, leaf-rust	R
Tilt	Propiconazole	II		insects	R

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[a] 1a = Extremely hazardous; 1b = Highly hazardous; II = Moderately hazardous; III = Slightly hazardous; U = Unlikely to present acute hazard in normal use; NC = Not classified; NK = Not known.

[b] CI = Cholinesterase Inhibitor, C = Carcinogen, PC = Possible Carcinogen, SE = Suspected Endocrine Disruptor (ILO, 2005).

[c] R = Registered for General Use (Full, Provisional or Restricted); U = Not registered for General Use (not in the register, experimental use)

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Table 2

Pesticide mixtures used by small-scale vegetable farmers in Northern Tanzania

Pesticides combination	Types of pesticides	Target crops
Impact and 2 – 4D	Fungicide + herbicide	Onions and tomatoes
Ridomil, and Selecron	Fungicide + insecticide	Tomatoes, onions and cabbages
Selecron and Fenom C	Two insecticides	Onions and cabbages
Thiodan and karate	Two insecticides	Onions and cabbages
Thiodan and Blue Copper	Insecticide + fungicide	Onions, cabbages and tomatoes
Selecron, Karate and Fenom C	Three insecticides	Onions and cabbages
Polytrin, Fenom C, Dursban and Cypercal	Three insecticides + one fungicide	Onions, cabbages and tomatoes
Thiovit, Selecron, Ridomil Dithane and karate	Four insecticides + two fungicides	Tomatoes

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Table 3

Reasons given for the trends in pesticide use in vegetable farms in Northern Tanzania, 2005

Increasing trend	Constant	Decreasing trend
Ineffective pesticides	Pesticides are effective	Good farm preparation
Pest resistance	Same acreage, farm size	Heavy rains
Increase in pest population	Correct instructions and effective pesticides	Drought
Increase in pest numbers	Drought and same farm	Less crop
Increase in insect damage	Fewer insect pests	Price increase
Increase in farm acreage	Same application throughout	Reduced farm area
Increase in insect pests	Same pesticides used	Unavailability of pesticides
Increase in plants		

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Table 4

Self reported pesticide-poisoning symptoms in vegetable farming in Northern Tanzania, 2005

Symptom	Frequency	Frequency (%)
Skin problems	21	34
Dizziness	19	31
Headache	19	31
Excessive sweating	19	31
Sneezing	17	28
Poor vision	14	23
Cough	13	21
Nausea	11	18
Stomach-ache	9	15