Review Article

Advances in Nutrition & Food Science

Knowledge, Attitudes, and Practices of Tomato Producers and Vendors in Uganda

Aggrey Atuhaire[*1], David Ocan[2] and Erik Jørs[3]

[1]*Uganda National Association of Community and Occupational Health, Kampala, Uganda*

[2]*Makerere University School of Agricultural Sciences, Kampala, Uganda*

[3]*Dialogos/ICOEPH, Dept. of Occupational Medicine Odense University Hospital, Denmark*

[*]Corresponding author
Aggrey Atuhaire, *Uganda National Association of Community and Occupational Health, Kampala, Uganda*; E-mail: atuagrey3@gmail.com

Submitted: 19 Oct 2016; **Accepted**: 23 Oct 2016; **Published**: 27 Oct 2016

Abstract

Background: *Uganda's horticultural sub-sector is growing at a fast rate and tomato is one of the major horticultural crops with wide spread production in peri-urban and rural areas. However tomato is susceptible to different pests and diseases and this has resulted into use of synthetic pesticides as the main control strategy. There is wide spread pesticide misuse behavior amongst tomato farmers owing to different social, economical and regulatory factors. This misuse includes among others inadequate personal protection and failure to follow the recommended pre-harvest no spray interval. This puts the health of millions of tomato farmers and consumers at risk. In Uganda, information on such misuse, consumer safety, and residues in food is limited.*

Objectives: *This article presents findings from a survey of knowledge, attitudes and practices of tomato farmers and vendors. The article also draws conclusions from the findings and recommends areas that could help to improve or avert the foregoing.*

Methodology: *This study was carried out in Nangabo Sub-County, Kyadondo County, Wakiso District in the Central Region of Uganda. Quantitative and qualitative data was gathered using an interviewer administered structured questionnaire and Focus Group Discussion guides, respectively from 50 tomato farmers and 6 tomato vendors in June 2013. Quantitative data analysis was done using the Epi Info statistical package software, while the qualitative data were audio recorded, transcribed and analysed on the basis of the themes/objectives of the study, namely, pesticide use and handling knowledge, attitudes and practices by farmers and vendors.*

Results: *41.4 years was the average age of farmer respondents. 26% were females. 56% had completed secondary education. 92% spray with synthetic pesticides as their main control tactic against pests and diseases. 44% reported spraying three times in a week during the wet season. 24.5% were not aware of any health risks of spraying tomatoes close to harvest time. 45.8% reported spraying their tomatoes less than a week to harvest time while 29.2% of the respondents sprayed their tomatoes at/after harvest; with reason for this spraying being to extend the shelf-life (according to 70% of respondents), to attract customers (50%) and to control pests and diseases (46%). Class II pesticide, especially organophosphates were the most used.*

Conclusion: *Recommended pesticide usage is not followed. Inadequate personal protection and use of pesticides for wrong purposes are prevalent misuse behavior. Market demand, lack of knowledge, financial constraints and community beliefs influence pesticide use behavior. Shelf life and tomato appearance are the key drivers of non-observance of the pre-harvest no spray period. Education influences farmers' safe use but doesn't guarantee producer concern towards the consumer. Money takes precedence compared to health, amongst these tomato farmers.*

Keywords: Farmers, Consumers, Health, Pesticide use, Pesticide residues, Tomatoes, Harvest time

Introduction

Uganda's horticultural production is one of the fastest growing agricultural sub-sectors with a growth rate of 20% per year. It contributes to value addition, income diversification and foreign exchange earnings through exports [1]. Horticultural production in Uganda is dominated by small scale producers (2ha. or less) who produce for both local and export markets. The most important horticultural crops in the vegetable category include tomato, green beans, cowpea, pepper, onion, crucifers, and Amaranthas spp. Because of ravages of pests and diseases on these moderate to high value crops, pesticides are among the key inputs on these crops [2].

Tomato is the most important vegetable crop in Uganda, being produced mainly in the peri-urban areas for the fresh market. Major diseases on tomatoes include Early and Late Blights (Alternaria solani and Phytophthora infestans). The blights, especially Phytophthora, are very common and if left unchecked result in crop losses greater than 75%, as stems, leaves, and fruits are all affected. Blight is more prevalent during heavy rains, and is controlled using Dithane M45, a contact fungicide, which is washed off if it rains soon after spraying. Bacterial wilt has also become wide spread in tomato growing areas and can kill up to 100% of the crop [3].

Failure to follow the recommended pre-harvest period poses a great risk to consumers. Measures to monitor pesticide residues in agricultural products are dismal although there are existing food laws like the Public Health Act, Draft Food Law, Uganda Bureau of Standards Act and implementing authorities include Ministry of Health, Ministry of Local Government, Ministry of Trade and Industry. However implementation is constrained by corruption, obsolete regulations, responsibility lying with several authorities and weak coordinating authority [4].

A study amongst tomato farmers and vendors in Uganda found that no farmer was applying the recommended concentration of 2.5g/l of Dithane M-45. The concentration varied from 3-7 times the recommended level with all farmers applying 16.7g/l. 40% of farmers were found to apply doses higher than 16.7g/l. Majority of retailers (91.6%) wanted to see Dithane M-45 on the surface of tomato fruits before purchasing those [5].

European Food Safety Authority Scientific Report showed of the 12 samples of pepper in EU market imported from Uganda, 58.3% had pesticide residues above the Maximum Residue Limit [6]. On country level, Uganda had 23.7% MRL exceedence rates following Thailand (30.7%), Guyana (33.3%) and Bolivia (75%) [6]. A recent food safety alert also showed that Uganda coffee beans are contaminated with excessive Chlorpyrifos pesticide residues with quantity of 0.9000 PPM beyond the limit of 0.1000 PPM [7].

The increased use of chemical pesticides on horticultural crops has raised a number of economic, ecological and health concerns. Economic concerns arise from the over reliance and use of chemical pesticides which increase the costs of production. Indiscriminate use of pesticides has resulted in ecological problems of common pests developing resistance, elimination of natural enemies and other beneficial arthropods, and environmental pollution. Human health concerns focus on risks from shortcomings in protective clothing, large deviations from recommended doses/situations, and excessive run-off into the soil and water sources. These concerns are exacerbated by poorly regulated internal markets for pesticides that have fostered usage of banned/restricted or outdated pesticides by minimally educated farmers. These pesticides pose a serious threat to human health and the environment [2]. The problem is particularly widespread in Sub-Saharan Africa, where the advent of liberalisation of agrochemical input markets has weakened quality control [8].

Methodology

Sample size and selection

The targeted study sample size was 50. A sampling frame of 70 was compiled from tomato farmers in the area. This list was entered in a spreadsheet, assigned random numbers and then sorted to obtain a sample of 50 farmers. 6 vendors were purposively selected from different nearby markets to participate in the discussion.

Study area

This study was carried out in Nangabo Sub-County, Kyadondo County, Wakiso District in the Central Region of Uganda. The Sub-County is located fifteen kilometers north east of Kampala City and it covers an area of about 130 sq km [9]. The subcounty is divided into 9 parishes; Nangabo, Gayaza, Wampeewo, Kabubbu, Bulamu, Kiteezi, Wattuba, Masooli and Katadde. Wakiso is the second most populated District in Uganda with a population of 2,007,700 with a growth rate of 4.1% as per the 2014 census and covers a total area of 2,807.75 square kilometers. The climate in Wakiso is warm and wet with relatively high humidity. These conditions favour rapid plant growth and also encourage disease out breaks. The rainfall in Wakiso is bi-modal. There are two wet seasons running from April to May and October to November. The dry months are January to February and July to August. The annual rainfall mean is 1320 mm though in many areas of the lake zone is between 1750 – 2000mm (http://www.wakiso.go.ug/wakiso/location-geography).

Data collection and analysis

Quantitative data was collected using a structured questionnaire administered by the research team. The 50 farmers were interviewed at their respective homes and gardens by reading to them the questions and their responses filled in directly in the questionnaire. The questionnaire was pretested amongst few selected farmers attending trainings organized by Uganda National Association of Community and Occupational Health (UNACOH).

Qualitative data was gathered by holding two Focus Group Discussions (FGDs); farmers and vendors. 6 tomato vendors were purposively selected to participate in the discussion while the 8 farmers for the discussion were randomly picked from the 50 who had answered to the questionnaire. The FGDs were recorded using an audio/voice recording device, and later transcribed to compile a report. The team gathered the data for a period of five days in June, 2013. Information gathered covered individual farmer demographics, tomato growing and pesticide use attitudes, practices and knowledge.

Data analysis

Using Epi Info version 6, quantitative data collected was entered, coded and analysed. Descriptive graphs, charts and tables were derived describing the Knowledge, Attitudes and Practices (KAP) amongst the respondents. Qualitative data in the FGD report was cleaned by aligning the discussants' relevant submissions to the theme of the discussion.

Ethical considerations

No samples were taken from the target group other than information. This study was conducted under the auspices of Pesticide use, Health and Environment Project whose approaches in assessing community Knowledge, Attitudes and Practices were approved by the Institutional Review Board and Uganda National Council of Science and Technology.

All respondents were adults and their consent was sought prior to the interview by explaining to them reason for the study and they granted us permission by appending their signatures or thumb print on the consent form. In the FGDs, the purpose of the discussion was explained to the discussants and their permission sought to record their voices. No information was obtained from children or farmers without sound mind.

Results

Demographic characteristics

Fifty farmers participated in this study and their mean age was 41.4 ± 13.3 years. 74% were males, 48% belonged to a farmers' group, and 56% had completed secondary level education. Majority had tomato gardens less than one hectare. Regarding gender, females use smaller pieces of land to grow tomatoes and actually none of the interviewed women had a garden bigger than two hectares. In terms of age, older farmers grow pieces of tomato gardens (Table 1).

	Age		Sex	
	<40 years	**>39 years**	**Male**	**Female**
Size of tomato garden <1 ha	59.3	56.5	51.4	76.9
1-2 ha	37	39.1	43.2	23.1
>2ha	3.7	4.3	5.4	0

Table 1: Size of tomato garden.

Spraying with pesticides

98% of farmers mentioned 'pests and diseases' as their biggest constraint in tomato production. Other constraints included intensive labour, and costs of pesticides among others. The most commonly mentioned method of dealing with pests and diseases was through spraying with synthetic pesticides [Table 2a].

Method	Frequency	Percentage
Spraying with pesticides	46	92.0%
Use of resistant varieties	26	52.0%
Weeding	8	16.0%
Crop rotation	17	34.0%
Organic Pesticides	6	12.0%
Rouging	8	16.0%
Pruning	7	14.0%
Mulching	8	16.0%

Table 2a: Pest and disease management methods (multiple responses). Also 44% of the farmers reported spraying three times in a week during the rainy season but 60% spray once in a week during the dry season. The frequency in the wet season was attributed to incidence of pests and diseases but also to the fact that rain washes away the just sprayed pesticide from the crop's leaves. During the Focus Group Discussion, a farmer mentioned that he had started mixing pesticides with some oil which helps the pesticide to stick on the leaves.

In regard to spraying tomatoes after harvest, the younger, male farmers, those belonging to a farmer group and who had acquired secondary education sprayed more. The older farmers and female farmers are more careful with fewer spraying their tomatoes after harvest and we see a nearly significant difference in a X2-test with 17.4% of older farmers versus 82.6% who are not spraying, and 8.3% of females who are spraying versus 91.7% who are not (Table 2b).

						Group			
Spraying tomatoes after harvest		<40 years	>39 years	Male	Female	Yes	No	Primary	Secondary
	Yes	40	17.4**	36.1	8.3**	30.4	28	28.6	29.6
	No	60	82.6	63.9	91.7	69.6	72	71.4	70.4

Table 2b: spraying of tomatoes after harvest; **nearly significant X^2-test $p<0.10$.

When asked why they sprayed close to or after harvest the most common reason was to extend the shelf-life of the tomatoes. Others sprayed to attract customers, and to control pests and diseases (Table 2c). "I cannot afford the cost of pesticides throughout the season, and therefore i choose to intensify spraying only towards harvest time so that my tomatoes look attractive when I take them to the market" said male tomato farmer in the Focus Group Discussion.

To control pests and diseases	23	46.0%
To extend the shelf-life of tomatoes	35	70.0%
To attract customers	25	50.0%
Other	1	2.0%

Table 2c: Why do you spray close to and after harvest? [Multiple responses].

Pesticides used

Farmers mentioned several pesticides that they use in tomato production. Organophosphates were the highest number of the pesticides mentioned and the most common being WHO toxicity class II (Table 3). Mancozeb (Dithane M45) was mentioned by majority and they reported using this fungicide throughout the season including towards harvest time. "When used towards harvest, Dithane makes the tomato fruit shinny thus attracting consumers" said a male tomato farmer during the FGD.

Use of personal protective clothing

According to table 4, being an older farmer, belonging to a farmer group, being male and having attained a secondary education, influenced farmers' use of more personal protection when spraying. Out of the fifty farmers 38% used normal clothes for spraying, special long sleeved shirt/trousers (52%), hat (14%), gumboots

Trade name (Mentioned by respondents)	Active ingredient	WHO Toxicity Class	Chemical group (Targeted use)	No. of Responses	% of Responses
Ambush	Permethrin	II	Pyrethroid (Insecticide)	3	6.0%
Tafgor	Dimethoate	II	Organophosphate (Insecticide)	16	32.0%
Chlorpyrifos	Dursban	II	Organophosphate (Insecticide)	8	16.0%
Dithane M45	Mancozeb	IV or U	Dithiocarbamate (fungicide)	41	82.0%
Sumithion	Fenitrothion	II	Organophosphate (Insecticide)	10	20.0%
Sherpa	Cypermethrin	II	Pyrethroid (Insecticide)	25	50.0%
Rocket	Profenofos 40% + cypermethrin 4%	II	Organophosphate + pyrethroid (Insecticide)	13	26.0%
Weed Master	Glyphosate	IV or U	Organophosphate (herbicide)	1	2.0%
	Copper hexachloride	III	Inorganic Copper Salt (fungicide)	1	2.0%
Organic Pesticides				1	2.0%

Table 3: Pesticides used by the tomato farmers (multiple responses).

Using more than two pieces of PPEs		Age		Sex		Farmers' group		Education	
		<40 years	>39 years	Male	Female	Yes	No	Primary	Secondary
	Yes	18.5	34.8	27	23.1	33.3	19.2	22.7	28.6
	No	81.5	65.1	73	76.9	66.7	80.8	77.3	71.4

Table 4: Use of at least three pieces of protective clothing when spraying.

Experienced symptoms after spraying		Age		Sex		Farmers' group		Education	
		<40 years	>39 years	Male	Female	Yes	No	Primary	Secondary
	Yes	81.5	60.9	67.6	84.6	75	69.2	77.3	67.9
	No	18.5	39.1	32.4	15.4	25	30.8	22.7	32.1

Table 5: Farmers experiencing symptoms after spraying with pesticides.

Do you think pesticide use can be lowered without hampering yield/harvest		Age		Sex		Farmers' group		Education	
		<40 years	>39 years	Male	Female	Yes	No	Primary	Secondary
	Yes	57.7	47.8	52.8	53.8	66.7	40**	42.9	60.7
	No	42.3	52.2	47.2	46.2	33.3	60	56.1	39.3

Table 6: Reducing pesticide use versus yield/harvest.

Can the practice be controlled by teaching farmers		Age		Sex		Farmers' group		Education	
		<40 years	>39 years	Male	Female	Yes	No	Primary	Secondary
	Yes	55.6	34.8	43.2	53.8	62.5	30.8*	27.3	60.76*
	No	44.4	65.2	56.8	46.2	37.5	69.2	72.7	39.3

Table 7: Farmer education versus the practice of spraying towards harvest or already harvested tomatoes.

(72%), gloves (28%), overall (10%), face goggles (2%).

Knowledge and experience of health effects

53.41% of the farmers were aware that spraying tomatoes at/after harvest poses health risks to consumers, 24.5% were not aware while 22.4% were not sure.

Out of 50 farmers 76% felt symptoms after spraying, with skin irritation being the most prevalent among 48 % of the farmers, followed by headache (34%), dizziness (16%) and salivation (2%). "Here is the scar on my back when Roket burnt me after I sprayed using a faulty leaking knapsack sprayer" demonstrated one male farmer during the FGD. According to results in table 5; Younger, female farmers with primary education and a farmer group reported to have experienced health effects after spraying. Analysing whether symptoms or not after spraying depends on the number of Personal Protection Equipment (PPE) used, we see a significant difference in a χ^2-test with 86.1% (31/36) of those using two or fewer PPE having experienced symptoms after spraying versus 13.9% (5/36) of those using three or more PPE ($p=0.00$).

Pesticide use and yield

More educated, younger female farmers who belonged to a group think that pesticide use can lowered without affecting harvest (Table 6). Analyzing whether not belonging to a farmer group influences farmers' attitude, we see a nearly significant difference at χ^2-test with 60% thinking that pesticide use cannot be lowered without affecting yield versus 40% who think pesticide use reduction doesn't necessarily affect harvest ($p<0.10$).

Proposals on how to stop spraying towards/after harvest

Respondents in this study suggested various measures on how the practice of 'spraying towards or after harvest' can be stopped; education of farmers was mentioned by many and significant differences were seen for those who belonged to a farmers' group and those who had a higher education mentioning 'education of farmers 'more frequently as an option.

Other less mentioned solutions for improvement were use of organic pesticides (20%), use of resistant varieties (16%), consumer awareness rising (8%), use of church announcements, radio programmes and labelling of pesticide containers in a language understood by farmers (2%) but without significant differences among the groups – although difference were seen regarding use of organic agriculture mentioned by more farmers from farmers groups (29,2%) compared to 11,5% among those not belonging to a farmers group.

During the FGD, vendors mentioned that it is a common belief amongst customers (who usually buy in large quantities and mainly for resale/retail) that tomatoes with 'whitish stains' have a longer shelf-life but those who buy in small quantities (usually for immediate home consumption) prefer non-stained tomatoes. The vendors reported to have enough knowledge of what their different customers want and they use a piece of cloth to rub off the stains. Although they confessed that after touching these stained tomatoes, sometimes they forget to wash their hands while going to eat something. None of the vendors confessed to spraying tomatoes while in their store, they mentioned to have heard of other vendors who do it.

Discussion

From the results of this study, the male farmers had bigger sizes of tomato gardens. We observe that this may be promoted by culture of the study community in which males assume headship of families and therefore hold in trust assets of families including agricultural lands. Our observation agrees with that by Masterson who noted that in many parts of the world women has the least probability of owning land [10]. Also in the case of rented land, males usually fronted or initiate negotiations as observed by Masterson. In Uganda indigenous and customary land inheritance systems driven by patriarchal norms persist, and women's claims to land are made primarily through husbands or male kin [11].

In our study 98% of the respondents listed 'pests and diseases' as their biggest constraint and specifically tomato blight (kubabuka) and bacterial wilt (kiwotoka) disease were repeatedly mentioned in the FGDs. Our findings are consistent with a Participatory Appraisal conducted 8th March 1999 [3]. Our study also shows that 92% of farmers spray with synthetic pesticides as their major tactic of dealing with pests and diseases, with the fungicide Mancozeb the most used. These results are in agreement with a baseline study conducted in 1999 amongst peri-urban farmers in the districts of Wakiso and Mpigi and a study conducted among farmers operating on a University campus in Ghana [2,12].

Our results also show that some farmers mix different pesticides together or with oil. However Karungi, et al. study in 2011 discourages indiscriminate combinations of pesticides or pesticides with other materials, attributing this to the simultaneous development of resistance and increase in incidences of insect pest infestation [2].

Results show that some farmers spray few days to harvest and even after harvest. This is line with findings of Pesticide Action Network, Africa but Kaaya et al. [2004] findings revealed that no farmer was found to apply Dithane M-45 after harvesting the fruits [13]. However, there was no consistent time between Dithane M-45 application and fruit harvesting such that some farmers may spray in the morning and harvest in the evening.

Ironically a slightly bigger proportion of farmers with better education were spraying towards or after harvest. We can attribute this to farmer attitude, cultural belief, poverty, and market demand. Regarding farmer attitude, as observed during the FGD in this study, some farmers know that the practice poses health risks to the tomato consumer but they don't care as long as they sell their product. Despite acquiring secondary education, farmers' pesticide use is partly influenced by cultural beliefs; in this case, theories on extending tomato shelf life. There is also a strong belief amongst tomato vendors that recently sprayed tomatoes have a longer shelf life; this market behavior directly influences pesticide use at farm level.

This is in agreement with results from a study in Egypt which showed that there is a significant statistical relation between internal beliefs and behaviors related to pesticides use [14]. This was also evident in Kaaya et al. [2004] findings where majority of retailers (91.6%), wanted to see Dithane M-45 on the surface of tomato fruits before purchasing them. Retailers believe DithaneM-45 protects the fruits against postharvest decay pathogens.

Pesticides which are classified as moderately hazardous (WHO class II) were the most common in this study and this puts farmers at risk since the use of PPEs is also limited. Mancozeb which was the most used pesticide is a Class IV thus less hazardous; however as a Dithiocarbamate, Mancozeb is associated with skin irritation and irritation of mucous membranes, allergic reactions (skin rashes, asthma), gastro-intestinal irritation manifesting as stomach upset or diarrhea and cardiac arrhythmias among others [15]. The foregoing explains why skin irritation was the most mentioned acute health effect that farmers experienced after handling these pesticides.

A radiotracer technique study has shown that half-life values for total Mancozeb residues on tomato leaves and in soil are 9.5 and 7.6 days, respectively. Deposit of sprayed Mancozeb on the fruit skin was another important factor leading to the contamination of fruits. Fruit skin contained higher levels of residues than the pulp. Washing with water could remove more than 50% of the residues on the skin. It was also found that 20-30% of the residual Mancozeb degraded to ETU (Ethylenethiourea) during cooking process [16].

Better educated farmers were more cautious about personal protection and in turn reported experiencing fewer symptoms after handling pesticides. These findings are supported by Sherine Gaber's findings which showed that higher level of education and lower level of internal beliefs were related to better knowledge and safer use of pesticides among Egyptian farmers [14]. Farmers who belonged to a farmers' group apparently use more pieces of PPEs than their counterparts. This result is consistent with an observation common amongst farmer groups where they pool funds and procure inputs, market their produce collectively and advocate for certain issues. Although face goggles were the least used PPE, we also don't think its use is so much necessary when spraying a low crop like tomato where droplets are less likely to reach the eyes unless one is spraying under windy conditions. Feola and Binder (2010) pointed out Adverse health effects, Social consequences, Interference of PPE, Cost of PPE, Cost of doctors, Cost of medications, Work days lost, education, technical assistance, age, past health effects, organization of work and weather conditions among behavioral drivers that influence use of personal protection equipment.

Categories that reported using more than one piece of PPEs, also reported experiencing no or less symptoms after spraying; this justifies the importance of personal protection. However a bigger proportion of farmers belonging to a group reported experiencing symptoms after spraying; this could be attributed to different factors such as use of old or non-functioning or wrong PPEs, and failure to take precautions after working with pesticides.

Conclusion

Pest and disease management is the biggest challenge tomato farmers in Nangabo Sub-County are facing. Spraying with synthetic pesticides is their main control strategy; Organophosphates and 'WHO Class II' pesticides are the most used.

Improper pesticide use amongst tomato farmers is a key issue of concern that is putting both producers' and consumers' health at risk. This misuse is mainly driven by inadequate knowledge, community beliefs, and market demand. This study also shows that age, education, gender, and belonging to a farmer group determine pesticide use behavior. However post-handling of their product is also an underlying factor that is driving the improper pesticide use behavior.

Limited personal protection, failure to observe recommended pre-harvest no spray interval, and use of pesticide for non-recommended purposes have been notably identified by this study as common improper behavior amongst tomato farmers in Nangabo.

Farmers and retailers pay more attention to monetary profit over the health of the consumer. Farmers think that with proper awareness raising and training, pesticide use behavior can be improved.

Recommendations

This study also recommends farmer/producer and consumer sensitisation, strengthening enforcement of food safety and public health laws. There is need for laboratory studies to test foods for chemical residues; this study calls upon the Uganda government analytical laboratories to incorporate these tests in their work. This will inform policy on consumer safety and also serve to address factors that drive pesticide misuse and dependency.

Safer, more sustainable methods of pest and crop management exist and are being used successfully by smallholder farmer's worldwide, delivering substantial yield, income and welfare benefits in some of the most challenging agro ecological environments. This study calls upon the Government of Uganda to help farmers grow tomatoes economically, ecologically and without exposing themselves, fellow farmers or consumers to hazardous levels of pesticides. The IPM/Farmer Field School approach has proved to be valuable world-wide; with government backing and supportive policies this approach could help to transform production, and bring real benefits to small-scale vegetable producers [2]. Therefore the Government of Uganda should invest in adapting and refining these methods, in training, post-harvest infrastructure and knowledge exchange as a priority in new agricultural programs, in conjunction with crop varieties which do not lead to reliance on pesticides.

References

1. UIA (2009) Uganda investment authority: Investing in Uganda - potentials in fresh and minimally processed fruits and vegetables for export.

2. Karungi J, Kyamanywa S, Adipala E, Erbaugh M (2011) Pesticide Utilisation, Regulation and Future Prospects in Small Scale Horticultural Crop Production Systems in a Developing Country. Agricultural and Biological Sciences ISBN: 978-953-307-459-7.
3. Akemn MC, Kyamanywa S, Luther G, Ssekyewa C, Erbaugh JM (1999) Developing IPM systems for tomato in central and eastern Uganda. IPM CRSP 6: 117
4. Food safety regional assessments. WHO country profiles.
5. Kaaya NA (2004) Dithane M45 residues in tomatoes on Ugandan markets may be above safe levels. African Journal of Food, Agriculture, Nutrition and Development 4.
6. Scientific report of European Food Safety Authority (2009) EU Report on Pesticide Residues. EFSA 9: 2430.
7. Uganda- coffee beans contaminated with excessive Chlorpyrifos pesticide residues.
8. Williamson S (2003) Pesticide provision in liberalized Africa: out of control? Agricultural Research and Extension Network. ISBN 0 85003 639 9.
9. http://kyadondoeast.wordpress.com/constituency/nangabo/
10. Feola G, Binder CR (2010) Why don't pesticide applicators protect themselves? Exploring the use of personal protective equipment among Colombian smallholders. International Journal of Occupational and Environmental Health 16: 11-23.
11. Zhang LZ, Wang HF Mo HH (1991) Radiotracer study on mancozeb residues in tomato plants. Research Centre for Eco-environmental Sciences, Academia Sinica, Beijing, People's Republic of China. Biomed Environ Sci 4: 409-14.
12. Sherine Gaber, Soha Hassan Abdel-Latif (2012) Effect of education and health locus of control on safe use of pesticides: a cross sectional random study. Gaber and Abdel-Latif Journal of Occupational Medicine and Toxicology. 7:3.
13. Hanna-Andrea Rother, Ricado Jacobs (2016) Booklet on Pesticide Health risks for South African emerging farmers.
14. Thomas Masterson (2007) Female land rights, crop specialization and productivity in Paraguayan Agriculture 504.
15. Pesticide Action Network UK (2007) Hazardous pesticides and health impacts in Africa. Food & fairness briefing 6.
16. N.O.B. Ackerson (2010) Urban Agriculture Practices and Health Problems among Farmers. Field Actions Science Report.