A SURVEY ON SAFE USE OF PESTICIDES BY KENYAN TEA GROWERS IN EAST AND WEST OF RIFT VALLEY

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Abstract

Surveys were undertaken between June 2008 and June 2009 to evaluate safety measures undertaken by Kenyan tea growers while handling pesticides in their farms and to determine whether there is danger of tea contamination. The result of the survey indicated that the most popular enterprise undertaken is livestock keeping with a mean of 77.9%, thus, most of the pesticides mentioned in the study which can be encountered in the farms are those for the management of ticks in livestock which includes amitrax containing formulations (Triatix, Tixfix and Almatix), synthetic pyrethroids (Ectomin and Dominex) and an organo-phosphate (Stelladone). In the East of Rift Valley, 21.9% of the sampled tea growers use herbicides for weed management against 60% in the West of Rift-Valley. Most of the tea growers take care of drift based on the responses in which a mean of 76.1% consider the direction of the wind and drift before application. When it comes to observing the waiting period (pre-harvest interval) 61.8% of tea growers adhere to the label recommendations. The study revealed a mean percentage of 72.7 and 69.3 untrained farmers on safe use of pesticides for East and West of Rift-Valley, respectively. There is minimal danger of tea being contaminated from pesticides use and there is need to train more farmers on safe use of pesticides.

Introduction

Pesticides play a major role in crop protection and control of vector borne diseases in all agricultural sectors. Throughout the world pesticides are effective, relatively simple and quick method of pest and disease control. In many cases without chemical control man's crops would be ravaged by diseases, insect pests and weeds hence severe loss of food production occurs. About 50% of global agricultural production is lost before or after harvest due to combined effects of disease, pest attacks and weeds [8].

A pesticide is any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies [6]. The term includes substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport

Pesticides are used as an effective method of pest containment. These chemicals are safe for use in the environment and protect human life from disease, illness and annoyance when used as recommended. Chemical crop protection in most cases is effective and profitable in controlling pests and diseases. But: pesticides expose operators and consumers to risks e.g. small amounts of pesticides and their degradation products (residues) can turn up in food supplies. Reports from experiments using rats, rabbits, guinea pigs or from observation on personnel exposed to pesticides in manufacturing firms shows that exposure to pesticides can lead to health problems which can range from mild skin irritation to birth defects, tumours, genetic changes, blood and nerve disorders, endocrine disruption and even coma or death [10, 17].

Literature Review

Despite the risk involved in pesticide usage, pesticides use is here to stay. The world cannot do without chemical pesticide; for example, population explosion is expected to increase globally from 6 billion to about 9 billion by the year 2050 [19,22] In growing economies it is expected that increased living standards will increase global food needs. Cereals must increase by 70% by 2020 to provide guaranteed feed supplies for the 6.5 billion inhabitants (most of which would be from developing countries). Two ways to increase production is either through increased land under

cultivation or through increased productivity per acre. But farmers are faced by limited availability of arable land and a decrease in soil fertility due to degradation and erosion. Therefore options to increase production may include increased productivity/acre and reduction of post-harvest losses. Increasing of production using agri-products such as fertilizers and plant protection agents (pesticides) are required. Use of agri-products implies reduced need to cultivate marginal land and preventing fragility caused by deforestation, erosion and rapid degradation. Pesticides can save farmers' money by preventing crop losses to insects and other pests; e.g. in the US, a study revealed that, farmers get an estimated fourfold return on money they spend on pesticides [11, 14, 16]. One study found that not using pesticides reduced crop yields by about 10% [16]. Another study, conducted in 1999, found that a ban on pesticides in the United States may result in a rise of food prices, loss of jobs and an increase in world hunger [15].

In essence pesticides are biological active compounds designed in the most part to kill target organisms, but unfortunately, pesticides are dangerous when they are not used properly or as recommended in crops, human, livestock and the environment. There are always risks with agricultural chemicals and care is needed to avoid accidental poisoning, irritation of eyes, nose and skin, allergies, chemical residues on food, environmental damage and pollution, build up of resistance, fire, corrosion and problems with disposal [4, 13, 20]. Exposure routes other than consuming food that contains residues, in particular pesticide drift are potential hazards significant to the general public. Therefore safety measure has become a big concern worldwide when handling pesticide [3, 12]. Safety must be ensured for users of pesticide when handling, for consumers on treated crops from pesticides residues [7] and the environment during application and disposal of left-over of spray mixtures, obsolete or unwanted chemicals and empty pesticide containers. Thus the establishment of Pest Control Products Board in1984 which regulate pesticides in Kenya according to laws Chapter 346 was enacted to protect the public from pesticides dangers/hazard. The Board regulates importation, exportation: manufacture, distribution, sale and use of pesticides. They also create public awareness on pesticides management and pesticides hazards and advice government and relevant authorities on pesticides.

Infact, with regard to consumers' tea importing countries like UK or Japan and the entire EU have very strong legislations that strictly imposed maximum residue levels (MRLs) on all food products in their markets. Permitted residue levels are set by bodies such as the Codex alimentarius [6], the EU member states or individual countries on the basis of pesticide toxicity studies and supervised field trials conducted under Good Agricultural Practice (GAP) defined through: applied rate, conditions of applications, number of applications, formulation type and active substance content, Pre-harvest Interval (PHI), spraying equipment among others. These standards are used to reject any teas or other foods which exceed the set MRLs [6] It is therefore important for Kenya to take necessary measures to ensure that our tea products adheres to required standards in order to be competitive in the market.

Through surveys (unpublished) in Kenya it is estimated that only 0.2 percent of the total planted tea area is affected by serious pests, diseases and weeds. The most prevalent pests and diseases occurring in tea gardens include; tea mites, scales, mosquito bug, armillaria root rot, hypoxylon wood rot, leaf spots, tea weevils, aphids and branch and collar canker. Very few pesticides have been tested and recommended for use in tea when need arise; they include insecticides and acaricides such as Karate WG. for control of aphids, tea mites, tea weevils and helopeltis; Dursban 48% E.C. for thrips and termites, Murphoil mixed with Karate for scale insects, Gladiator for termites and tobacco cricket; Omite for Red Crevice mites and Red Spider mites and Malathion (Kelthane) for Red Spider mite and purple mite (all stages except the eggs); Fungicides such as Dithane M45 for control of grey blight (in the nurseries) and stem canker, Copper based formulation for hypoxylon, stem canker; brown and grey blight and Ridomil for damping off; Herbicides such as products formulation which contain glyphosate acid/salts as the active ingredient i.e. Kalach, Touchdown and Roundup for grasses, sedges and broad leaved weeds and formulations containing Glufosinate ammoniun i.e. Basta [1, 21].

Kenyan tea is unique in many ways, one being that pests and diseases management practices have focused on Integrated Pest and Disease Management for the last 3 decades where pests and diseases constraints to tea production are managed through cultural practices, biological control and restrictive use of chemicals pesticides (use of less toxic chemical pesticides as a last resort). Cultural practices such as use of planting materials released to growers which have been carefully selected by plant breeders to ensure only high quality, high yielding and pest and disease resistant elite clones. Also well grown tea will always outgrow any short- term infestations such as with mites, scales and tea thrips. Additionally, Kenyan climate where tea grows does not favor proliferation of pests and diseases in tea [18]. The result is that Kenya tea is natural, pure and chemical pesticides residues free. Kenyan tea has also consistently been certified as meeting the highest standards set by various world bodies such as the report (unpublished) of Japan tea association in March 2008 where samples of Kenyan tea were analyzed by Japan Food Research Laboratories for 277 pesticides' molecules and none was detected.

Nevertheless, enterprises which are within the vicinity of tea plantations such as horticultural crops or livestock keeping uses chemical pesticides to control pests and diseases in them and tea can be contaminated with these pesticides in the process of farmers handling them in cases such as where drift is not taken care when applying, in transportation, storage and disposal [5]. In addition no surveys or documentation have been done to ascertain that Kenyan tea farmers do not use chemical pesticide in tea production for the management of tea pest and diseases. Based on this information a survey was conducted to determine the other enterprises tea growers undertake, the pesticides they use on them and in tea if any and how growers handle pesticide to determine whether there is danger of tea being contaminated.

Objectives and Methodology

The overall objective of the survey was to determine whether there is danger of tea being contaminated when farmers are handling pesticides in their farms such as through drift. Other objectives were to; - Evaluate safety measures undertaken by tea growers starting from buying the pesticides, transportation, storage, application and disposal of dilute remaining chemical, empty containers and obsolete chemicals and document the pesticides, if any, that the tea growers may be using on tea and to determine whether farmers have had any form of training on safe use of pesticides. In addition, determine the kind of chemical pesticides which are be likely to be found in the tea growers' premises based on the most popular enterprises.

Tea growers who participated in the survey from East of Rift Valley were from Kiegoi, Makomboki, Njunu, Kimunye and Kangaita KTDA Factory catchment areas. The West of Rift valley consisted of tea growers from Chebut, Kapsara, Tegat and Mudete KTDA factory catchment areas. Pesticide usage survey was conducted using a questionnaire which asks questions on other enterprises undertaken by the tea growers, chemicals used on these enterprises and in tea (if any) and precautions undertaken while sourcing, storage, use, pre-harvest observations and disposal of containers or remaining diluted chemicals and whether the grower have had any training on safe use of pesticides. Three hundred and eighty (480) questionnaires were given to be distributed to the 9 catchments area and the tea growers were assisted by extension unit coordinators in filling them. Two hundred and thirty eighty (238) questionnaires were duly filled and returned; these being 22 from Kiegoi, 22 from Njunu, 23 from Makomboki, 25 from Kimunye, 30 from Kangaita, 35 from Tegat, 52 from Mudete, 24 from Chebut and 5 from Kapsara. Kapsara had the lowest response by returning five (5) questionnaires out of the fifty (50) given.

Results and Discussion

Enterprises and Pesticides used

In all the catchments the most popular enterprise undertaken is livestock keeping an average 77.9% of all the sampled tea growers keep livestock (Table 1) i.e. 91% for Njunu, 77% Kiegoi, 74% Makomboki, 80% from Kiminye, 57% from Kangaita, 80% in Tegat and 90% in Mudete, 60% Kapsara and 88 % Chebut K.T.D.A. Thus, most (77.9%) of the pesticides mentioned

in the study are those for the management of ticks in livestock which includes amitrax containing formulations (Triatix, Tixfix, and Almatix), synthetic pyrethroids (Ectomin and Dominex) and an organo-phosphate (Stelladone) [2] .However, a few uses pesticides on tea to control mainly weeds. In the East of Rift Valley, 21.9% of the sampled tea growers use herbicides for weed management against 60% in the West of Rift-Valley. i. e. 39% in Njunu, 17% in Makomboki,8% in Kimunye, 23% in Kangaita, 68% in Tegat, 61 % in Mudete, 60% in Kapsara, 50% in Chebut and none in Kiegoi. (Table1). Weed management recommendation is based on integrated management where herbicides are used in the early years of establishment.

Table 1: Type of Enterprises and pesticide chemicals used by Tea growers in East and West of Rift Valley KTDA Factory catchments

Category	Response	East of Rift Valley					Mean (East of Rift Valley)	West of Rift Valley				Mean (West of Rift Valley)	Overall mean
		Njunu Response %	Kiegoi Response %	Makombo ki Response %	Kimunye Response %	Kangaita Response %		Tegat Response %	Mudete Response %	Chebut Response %	Kapsara Response %		
Enterprises in the farm	Horticultural crops	64	45	65	84	90	69.6	40	67	67	40	53.5	61.6
	Livestock	91	77	74	80	57	75.8	80	90	88	60	80.0	77.9
	Field crops	59	50	39	64	33	49.0	26	63	71	100	65.0	57.0
	Others	0	0	30.4	8	-	7.68	0	-	8	-	2.0	4.8
Those who use chemicals	Yes	95	90	65	72	80	80.4	86	85	88	100	89.8	85.1
	No	5	10	35	24	20	18.8	14	15	12	0	10.3	14.4
	On tea	39	-	17.4	8	23.3	21.9	68	61	50	60	60.0	41.0
Chemical pesticide used	Horticultural crops	Karate	Dithane M45 Karate Dimethoate	Karate Diazinon Herb kill	Karate	Dinadine		Dithane M45 Duduthrin Eraser	Round-up	Karate	Karate		
	Livestock	Triatix Nilzan Tick-fix Almatix	Triatix Tick-fix	Triatix Tick-fix Stelladone	Triatix Tick-fix	Triatix Stelladone Wormicide		Triatix Dominex Ectomin Almatix Stelladone	Triatix	Triatix	Triatix Nilzan Almatix		
	Field crops	Fungicides Karate	Dithane M45 Karate Dimethoate	Round-up Dithane Gramaxone	Fungicide s	Fungicides		Round-up Weedal Glyphosate	Karate	Round-up Dithane	Round-up Gramaxo ne		
	Tea	Copper oxychloride	-	-	-	Herbicides		Round up Weedal	Herbicides	Herbicides	Round-up		

Table 2: Responses to questionnaire on safe use of Pesticide by tea growers in East and West of Rift Valley KTDA Factory catchments

Category	Response	East of Rift Valley					Mean (East of Rift Valley)	West of Rift Valley				Mean (West of Rift Valley)	Over all mean
		Njunu Response %	Kiegoi Response %	Makombokoi Response %	Kimunye Response %	Kangaita Response %		Tegat Response %	Mudete Response %	Chebut Response %	Kapsara Response %		
Sourcing	Agro vet	82	100	100	96	100	95.6	97	71	79	100	86.8	91.2
	Local shops	18	0	0	4	-	4.4	3	29	13	0	11.3	7.9
	Other sources	0	0	0	0	-	0	0	-	8.3	0	2.0	1
Means of transport	Farm workers	41	0	22	32	23.3	23.7	20	21	-	20	15.3	19.5
	Public transport with other goods and passengers	32	72	27	48	47	45.2	1	61	86	40	47.0	46.6
	Public transport separate from other goods and passengers	27	18	30	20	13	21.6	31	18	14	40	25.8	23.7
Storage	General store	9	18	61	44	37	33.8	29	63	13	-	26.3	30.1
	Safe chemical store	68	72	30	52	27	49.8	71	37	83	100	72.8	61.3
	House	23	0	0	8	6.7	7.54	0	-	4	-	1.0	4.27
Duration of storage	Less than 1 week	23	9	4	4	21.7	12.3	9	8	40	-	14.3	13.3
	Less than 3 months	27	40	0	28	17.3	22.5	17	35	13	60	31.3	26.9
	Less than 1 year	32	0	4	24	40	20.0	3	-	6	20	7.3	13.6
	As recommended in the label	18	22	83	44	17.3	36.9	71	58	40	20	47.3	42.1
Application	Those who use protective clothing when mixing	38	80	41	56	78.2	58.6	83	83	76	75	79.3	69.0

Category	Response	East of Rift Valley					Mean (East of Rift Valley)	West of Rift Valley				Mean (West of Rift Valley)	Over all mean
		Njunu Response %	**Kiegoi Response %**	**Makombokoi Response %**	**Kimunye Response %**	**Kangaita Response %**		**Tegat Response %**	**Mudete Response %**	**Chebut Response %**	**Kapsara Response %**		
	Those who use protective clothing when applying	42	86	36	60	60.8	57.0	82	61	79	75	78.0	67.5
Those who consider the direction of the wind and drift	Yes	59	82	83	68	67	71.8	91	62	88	80	80.3	76.1
	No	41	18	13	24	33	25.8	6	38	12	20	19.0	22.4
Those who give cautionary notices	Yes	73	82	27	60	70	62.4	80	60	60	80	70.0	66.2
	No	27	18	70	40	30	37.0	20	40	40	20	30.0	33.5
Disposal of excess diluted chemical	Store for later use	9	0	4	8	-	4.2	10	16	-	40	16.5	10.4
	Sell to others	0	9	16	-	-	5.0	6	-	-	-	1.5	3.3
	Re-sprayed	23	59	22	88	63.2	51.0	20	43	74	40	44.3	47.7
	Pour in latrines	68	18	58	-	31.6	35.1	64	40	26	20	37.5	36.3
Pre-harvest interval	When I wish	27	9	27	28	27	23.6	3	28	-	40	17.8	20.7
	As recommended in the label	50	90	60	56	30	57.2	80	56	89	40	66.3	61.8
	N/A	23	1	13	16	43	19.2	17	16	11	20	16	17.6
Those who have undergone training	Yes	18	68	22	12	6.7	25.3	11	49	17	40	29.3	27.3
	No	82	32	78	88	83.3	72.7	83	51	83	60	69.3	71.0

Source and Transport

Majority of tea growers (91.2%) purchase their pesticides from licensed agro-vet. On transportation, those who transport their pesticide safely, separate from other goods and passengers have an overall of 24% with 27% in Njunu, 18% in Kiegoi 30% in Makomboki, 20% in Kimunye, 13% in Kangaita, 31% in Tegat, 18% in Mudete, 40% in Kapsara and 14% in Chebut factories. Others use public transport with other goods and passengers and others use farm workers. Where possible pesticides should be transported on their own, if not unavoidable, then they should be separated as much as possible from passengers, livestock and other materials for human or animal consumption or use. The purpose is to make such operations safe as possible and be able to deal effectively with accidents where they occur.

Storage and Storage period

Tea growers seem to have knowledge on the safe storage of chemical. An average of 61.3% of tea growers store on safe chemical stores i. e. 68% in Njunu, 72% in Kiegoi, 30% in Makomboki, 52% from Kimunye, 27% from Kangaita, 71% in Tegat, 31% in Mudete, 100% in Kapsara and 87% in Chebut though still a large number of farmers in Makomboki 61% use general chemical stores (Table 2). When it comes to storage/keeping duration of pesticides the tea growers, especially in the East of Rift Valley, seems not to be aware on the valid length of period they should consider, a mean of 36.9 store chemicals as per the label's recommended duration in East of Rift-Valley and a mean of 47.3 in the West of Rift-Valley. Pesticides should be store in a chemical separate from other goods and under lock. Length of storage period is per the label recommendation

Application, Pre- harvest Period and disposal

The tea growers' awareness on the need to use protective clothing ranged from 38% when mixing in Njunu to 83% in Tegat while when applying awareness ranged from 36% in Makomboki to 86% in Kiegoi. Most of the tea growers are aware that they need to take care of drift based on the responses in which those who consider the direction of the wind and drift before application being 59% in Njunu, 82% in Kiegoi, 83% in Makomboki, 68% in Kimunye, 67% in Kangaita, 91% in Tegat and 62% in Mudete, 80% in Kapsara and 88% in Chebut (Table 2)

Apparent dangers seem to arise when it comes to disposal of excess diluted chemical or left overs of spray mixture since most farmers; 74% in Chebut, 59% in Kiegoi 88% in Kimunye and 63% in Kangaita re-spray the field with it, hence increasing concentration of the chemical on the crop or on the field and in the long run the chemical residues (Table 2). Others pour the excess diluted chemical to the pit latrines 68% in Njunu, 18% in Kiegoi, 58% in Makomboki, 32% in Kangaita, 64% Tegat, 40% Mudete, 20% in Kapsara and 26% in Chebut. (Table 2) This danger may not affect tea in Kenya in that pesticides used in tea are mainly herbicides (See above) which are targeted at the weeds not tea. All the same, efforts should be made to ensure they will be no excess chemical diluted through mixing the required amount and calibration of the spray equipment. Small quantities of left-overs and unwanted concentrate should be disposed of in a safe manner such as tipping into a hole in the ground away from dwellings, wells, waterways and crops [9].

When it comes to observing the waiting period (pre-harvest interval)- interval period between spraying and harvesting) farmers adhere to the label recommendations (mean -61.8) with 90% in Kiegoi, 60% in Makomboki, 56% in Kimunye, 30% in Kangaita, 80% in Tegat, 59% in Mudete, 40% in Kapsara and 86% in Chebut hence dangers of residues are avoided. (Table 2).

When asked whether they have had any training on safe use of pesticides the responses revealed that several farmers in Njunu 82%, Makomboki 78%, Kimunye 88%, Kangaita 83% Tegat 83%, Mudete 51%, Kapsara 60% and Chebut 83% have not undergone training on safe use of pesticides; it is only in Kiegoi where 68% of tea farmers in this survey have been trained on safe use of pesticides. This reveals a mean of 72.7 and 69.3 untrained farmers for East and West of Rift-Valley, respectively (Table 2).

Conclusion

Tea growers use herbicides which are targeted at weeds. Both regions (East and West) of Rift Valley score highly (percentages about 76.1%) when considering the directions of the wind during spraying hence a good aspect in safe -guarding the user and drift on other crops or environment. Therefore, there is minimal danger on tea being contaminated from pesticides use. Regular studies of this type and related status such as random tea sample analysis for presence of residues so as to continually assure tea consumer of the quality standards in the produce need to be carried out. As concerning all other enterprises, it is important to note that safety for all forms of pesticides irrespective of the class must be adhered to and must conform to the laws of Kenya. These will safe-guard the lives of the users, consumers of food products, aquatic life and environment in general. This an area which requires continued combined efforts between all stakeholders, agricultural extension officers, tea extension, service advisory units of institutions among others to create awareness on safe use of pesticides.

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