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A Study of Pesticide Usage and Pesticide Safety Awareness among Farmers in Commewijne in Suriname

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Abstract In Suriname, the use of pesticide application is widely used in the production of rice, banana and vegetables. Even though, the pesticide law has not been enforced in Suriname, the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV) has taken several steps to reduce chemical application, such as the introduction of Good Agricultural Practices (GAP) since 2003. Despite these actions between 2003 at present, L.V.V. is still receiving notifications from the Netherlands, which is Suriname's largest vegetable export market. However, it is important that farmers comply with food safety requirements to protect themselves and the consumers, because the concerns of health impacts are rapidly growing. A survey was conducted with sixty farmers in district Commewijne to investigate how farmers are cultivating their crops and if they are cultivating according to minimum food safety rules. Findings revealed that farmers didn't cultivate their vegetables in a sustainable matter. Results further indicated that most farmers do not use bio- pesticides, nor did they know what biological control is.

Keywords: Pesticides, food safety, food security

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However, it is important that farmers comply with food safety requirements to protect themselves and the consumer, because the concerns over their health impacts are rapidly growing.

There are concerns that pesticides used to control pests and diseases on food crops are dangerous to people who consume the food. In Suriname farmers in district Commewijne are cultivating a variety of vegetables including tomatoes (*Lycopersicon esculentus* Mill.), eggplant (*Solanum melongena* L.), African eggplant (*Solanum mascropan* L.), pepper (*Capsicum frutescens* L.), and cabbage (*Brasica oleracea* L). Most of the farmers are also using chemicals to destroy unwanted pests and diseases.

A study by Ori (2009) revealed that vegetable farmers spray pesticides both as a preventive measure and when the pest is seen. This report furthermore states that farmers need guidance in crop management aspects, including soil characteristics, and farmers should be trained in a practical manner on all aspects of pest management including alternative methods on how to satisfactory and efficaciously control pest problems in their crops Therefore, the purpose of this research was to conduct a study of pesticide usage and pesticide safety awareness under farmers of Commewijne in Suriname.

The purpose was to investigate whether or not the Surinamese agricultural entrepreneur (farmer) complies with the minimum food safety requirement to produce sustainable products.

Material and methods

This research used published scientific articles, conference papers on sustainable agriculture and food safety, reports of international organizations and books on agriculture, sustainable agriculture and the use of pesticides.

The study also conducted an excessive review of government documentation, newspaper/internet articles that were relevant to the objectives of the study.

This study was descriptive in nature. In his study a combination of quantitative research (survey) and a qualitative research method (interview) was used to collect data. In the survey 60 farmers who are living and working in the district Commewijne had participated in this study. The farmers were surveyed on the obstacles they face with and why legally actions cannot take place by the authorities. After the survey was completed, the data was processed in SPSS for statistical results.

Results and discussion

Demographic characteristics of surveyed farmers

The ages of the 60 farmers ranged from 26-56 years, with an average age of 50.5 years. The respondents were placed into four age categories. The largest group (63.3%) is in their 50s, twenty-five percent of the farmers were between 21-40 years and 11.7% is above 60 years. The results of this research study also indicated that 90% of the farmers were male and only 10% of them were women. The majority of the farmers (70%) are part-time farmers, while 30% are full-time farmers. The results showed that the time spent by farmers

ranged from 2 to 9 hours, and the average time spent by them was 4 hours a day. Approximately, 26.7% of the farmers were spending 3 hours in farming, while 25% were spending 4 hours in farming. Only 11 farmers were spending more than 8 hours in farming. Forty percent (40%) of the respondents indicated that they employed workers to help them to cultivate.

About 58.3% of the farmers attended the secondary school (secondary school/vocational school). Only 5% attended high school, while 16.7% of the respondents upgraded themselves by attending agricultural basic training.

The most frequent cultivated crops by the farmers are tomato (16.9%), pepper (16.9%), African Eggplant (14.4%), cabbage (11.8%) and eggplant (7.2%). The years of agricultural experiences of the 60 farmers ranged from 1-20, with an average age of 23 years. The respondents were classified into five categories based on their agricultural experience. The largest group (35%) has more than 20 years of agricultural experiences. Only 21.7% had 11-15 years experience, while 10% had 16-20 years. Most of the respondents (71.7%) were cultivating on borrowed property. Only 26.7% of the farmers are cultivating on their own property. The minority (1.7%) of the farmers in this study is cultivating on government property. The cultivating areas are mostly (91.7%) located near the house of the farmer. Only 8.3% of the respondents indicated that their cultivating area is at another place. Most of the farmers (25.3%) used imported chicken manure. Synthetic fertilizers are used by 18.8% of the farmers. Local chicken manure is used by only 10.4% of the respondents. Fifty percent (50%) of the land preparation on which the farmers are cultivating is mostly done manually. Only 38.3% of the respondents are using a tractor. The diseases and pests the farmers were burdened with are listed in Table 1. From the response of the farmers, it appeared that the most frequently occurring pest problems were borers (56.6%), white flies (53.3%) and fungi

(48.3%). Borers and white flies were the most troublesome pest problems according to the majority of the respondents in all three stages of several crops, including tomatoes, cabbage, string beans and lettuce.

Table 1. Diseases and pests listed by respondents (n=60)

Diseases & insects	***Scientific names***	**f**	**%**
Borers	*Agrotis replete*	34	56.6
White flies	*Aleurodidae*	32	53.3
Fungi	*Cercospora* sp.	29	48.3
Bacteria	*Pseudomonas* sp.	22	36.6
Caterpillars	*Diaphania nitidalis*	13	21.6
Beetles	*Gryllotalpidae*	6	10.0
Ants	*Dasymutilla occidentalis*	4	6.6
Honeybees	*Trigona spp*.	4	6.6
Aphids	*Lipaphis erysimi*	3	5.0
Snails	*Helix aspersa*	1	1.6

Agricultural knowledge of the surveyed farmers concerning farming and the use of pesticides

All sixty farmers responded that they know that pesticides are toxic to humans and animals. However, when farmers were confronted with something which is unfamiliar to them (like an unknown pest or disease), the majority (26.7%) ask LVV for information, while 18.3% of the respondents stated that they asked a farmer's friend for more information. Unfortunately, 8.3% of the respondents indicated that they try to mix their own chemicals and experiment with the effect of it. During farming the most used pesticides were Gramaxone

(15%), Malathion (11.4%), Bravo (6.7%), Glyphosate (5.9%) and Karate (5.5%).

Some of the least used pesticides by the respondents included Teasen (0.4) and Bactaral (0.4%). The purpose of the use of pesticides was mostly for combating diseases and pests (67.8%), while 32.2% of the study participants used the pesticides to destroy weed.

As a response to the question "how do you choose what chemical to use" all 60 respondents indicated that they have learned from experience and through transfer of information and knowledge from their fathers, other farmers and agricultural input retailers.

Fifty percent of farmers said they spray early in the morning as well as late in the late afternoon. Nine farmers said they spray only late in the afternoon and one farmer indicated to spay only in the morning.

An overview of where the excess pesticide water is disposed is illustrated in Table 2. Most of the removed excess water goes into a creek (33.3%), a drain (21.7%), a river (16.7%) or a canal (11.7%). Fifty percent of the farmers indicated that they either spray

Table 2. Disposal of excess pesticide water

Source disposal of excess water	f	%
Bay/creek	20	33.3
Drain	13	21.7
River	10	16.7
Canal	7	11.7
Pumped into a ditch	4	6.7
Self-dugged well	3	5
Swamp	2	3.3
Agricultural field	1	1.7
Total	60	100.0

Most of the farmers (91.7%) purchased the pesticides at an agricultural store and store them in a shed (43.3%). (Table 3)

Table 3. Purchase of pesticides (n=60)

Farmers purchase pesticides at	N	**%**
Importers	2	3.3
The agricultural store	55	91.7
Agricultural cooperatives	3	5.0
Total	60	100.0

Table 4 reveals that the majority of the respondents (53.3%) do not store their used safety clothes but wash them daily, while 30% of the farmers leave these safety clothes in their camp.

Table 4. Storage of safety (n=60)

Farmers	N	**%**
do not store clothes because they wash them everyday	32	53.3
store clothes in a camp	18	30.0
store clothes in a warehouse	4	6.7
store clothes in a shed	6	10
Total	60	100

From Table 5 it can be seen that 26.7% of the respondents in this study are keeping a record of the chemicals they use.

Table 5. Keeping Records of Chemicals they use (n=60)

Farmers.	n	**%**
keep records	16	26.7
do not keep records	44	73.3
Total	60	100

However, the majority of farmers indicated that they needed training in record keeping.

A few farmers (10%) are flushing their empty pesticide bottle three times with water. However, the majority respondents (41.7) are flushing it only once, while 28.3% of the participating farmers do not even flush their bottle out. After flushing, 38.3% dispose the water on the grass at the back of the house. Only 11.7% of the farmers interviewed are throwing the empty pesticide bottles on their agricultural fields, while 10% keeps it in the knapsack for re-use (Table 6).

Table 6. Disposal of water flushed from empty pesticide bottle (n=60)

Farmers dispose of empty pesticide bottle.	**n**	**%**
On the grass at the back of house	23	38.3
In the creek	13	21.7
On their agricultural field	7	11.7
Do not flush, do not dispose water	6	10.0
In the knapsack for re-use	6	10.0
On the soil	5	8.3
Total	60	100

The empty pesticide bottles were mostly (58.3%) gathered in a trash bag which is picked up by a garbage truck.

Twenty percent of the farmers burry the empty pesticide bottles in the soil, while some other respondents (10%) burn them or throw them into the gutter/ drain (8.3%). Only 3.3% of the respondents take these empty pesticide bottles to an agriculture store for proper disposal.

The majority of farmers (33.3%) have learned from their parents how to use pesticides, while 23.3% of these farmers indicated that they learned it by themselves by experimenting while 18.3% of the respondents interviewed stated that they have learned pesticide usage from LVV. (Table 7)

Table 7. Pesticide usage (n=60)

Farmers learned how to use pesticides	n	**%**
by themselves	14	23.3
from LVV	11	18.3
from other farmers	10	16.7
from parents	20	33.3
from the Agriculture shop	4	6.7
from the cooperatives who provide assistance	1	1.7
Total	60	100.0

Knowledge about biological control, integrated pest management, good agricultural practices and food safety

The majority of respondents (85%) were familiar with bio- pesticides, while 53.3% of the farmers indicated that they were not aware that microorganisms such as Dipel (*Bacillus Thurgiensis*) can be used against plagues and pests. Only 8.3% of the respondents indicated that they are making use of some insects (e.g. spiders) to kill specific insects (e.g. aphids). These respondents said to have heard about biological control and bio-pesticides. Two farmers indicated to know little bit about biological control of the Hibiscus mealy bug.

One farmer knew that beetles are eating mealybugs. Subsequently neem (*Azadirachta indica*) and Dipel (*B. Thurgienses*) were mentioned as a component of biological control by two of the three farmers. The majority of the farmers (85%) indicated that they are not aware of the difference between conventional pesticides and bio-pesticides. Only 15% of the respondents were aware of it (Table 8).

Table 8. Farmers' awareness of the difference between conventional pesticides and bio-pesticides (n=60)

Farmers	n	**%**
Are aware of the difference between conventional and bio-pesticides	9	15.0
Are not aware of the difference between conventional and bio-pesticides	51	85.0
Total	60	100.0

Most respondents (91.7%) were unfamiliar with Integrated Pest Management, while 5% of them heard of IPM from LVV.

Only 1.7% of the farmers indicated that they are applying the IPM concept while cultivating. These results concur with the earlier research by Oo *et al.* (2012).

In this study it was revealed that out of a study of 130 respondents 80% of these respondents were not familiar with IPM, while 20% of these respondents know what IPM was.

Only 1.7% of the respondents got trained in IPM, while 76.7% of them indicated that they were interested in getting IPM training.

Most of the farmers (85%) were registered as a farmer at LVV and 30% were trained by LVV, mostly in 2013 in agricultural subjects (13.3%). All 60 farmers (100%) indicated that it is important that farmers are regularly trained by LVV.

Only 15% of the respondents indicated that they were familiar with GLOBALG.A.P. (Table 9) About 12% of the respondents heard of IPM trough LVV and 1.7% heard of it from the media. Ten percent (10%) of the respondents indicated that GLOBALG.A.P. is a good to follow instrument for agricultural practices.

Only 13.3% of the farmers received a GLOBALG.A.P. handbook from LVV of whom only 5% returned it after filling it in. Six point seven percent (6.7%) indicated that they always follow the guidelines in order to meet GLOBALG.A.P. requirements.

Table 9. Familiar with GLOBALG.A.P. (N=60)

Farmers **.**	n	**%**
Are familiar with GLOBALG.A.P.	9	15.0
Are not familiar with GLOBALG.A.P.	51	85.0
Total	60	100.0

Protective equipment was always used by 88.3% of the farmers. Only 3.3% of the respondents never used protective equipment. Boots, long pants, long-sleeved shirt, gloves, hat, cap or hard hat and mask were used by 90% of the farmers.

Research by Oo *et al.* in 2012 also showed that 86.2% of the respondents always were protective accessories during pesticide application

while 12 respondents sometimes use protective clothing when spraying, while five respondents never use protective clothing.

The crops of 83.3% of the farmers were never controlled/ checked or approved by someone or an institute. Only 16.7% of the respondents were controlled by advice given by extension field officers. About 2% of the farmers have received informative sessions from LVV about plant techniques (1.7%). Mostly (11.7%) the control took place in not exact periods. Crop screening happened mostly by observation.

Farmers' opinions on the role of government (LVV) in agricultural production and future opportunities

The results showed that none of the farmers received incentives from the government. Most of the farmers (48.3%) thought that LVV can do a better job in providing leadership and restructuring agriculture in Suriname. Fifteen percent of the respondents indicated that they were satisfied with LVV, while 11.7% of the respondents were dissatisfied. LVV should provide more information and training according to 8.3% of the farmers. The majority of the farmers (66.7%) are dissatisfied with the current assistance of LVV (Table 10).

Table 10. Farmers satisfied with present contribution of LVV (n=60)

Farmers	n	**%**
are satisfied with present contribution of LVV	20	33.3
are not satisfied with present contribution of LVV	40	66.7
Total	60	100.0

The results indicated that 81.7% of the farmers keep in touch with LVV by an Extension Field Officer, and that 18.3% of the respondents showed that nobody of LVV is keeping in touch with them. Many farmers (81.7%)

indicated that their income as a farmer is feasible, especially in periods when vegetables are scarce. The main reason for many farmers (73.3%) for cultivating is to sell the vegetables at the market. Less than 2% of the farmers stated that they were cultivating for the export. The reasons why other farmers are not cultivating for the export were as follows: 33.3% of the respondents indicated that they are small farmers. 21.7% of the farmers stated that they have to work harder and it will require more time, 10% of the farmers mentioned that the export requirements are strict while 8.3% of the respondents indicated that there is no guarantee of consumers for large production. (Table 11).

Table 11. Reasons for not cultivating for export (n=60)

Reasons for not cultivating for export	n	**%**
Lack of adequate information on cultivation	20	33.3
Cultivating for export is hard work and requires a lot of time	13	21.7
Export requirements are strict	6	10.0
No guarantee of consumers for large-production	5	8.3
No interest for cultivating for exports	4	6.7
No buyers for export	4	6.7
Large areas of land are needed	4	6.7
Vegetables that are produced are exported	2	3.3
Vegetables that are produced are not exported	2	3.3
Total	60	100.0

Conclusions

From the results it can be concluded that most of the respondents are literate, but some of the m never up-graded themselves. These farmers are still

depending on their knowledge they have gained from years of agricultural experiences.

They are also using toxic pesticides on their vegetables, whereby endangering the health of the consumer, the environment and their own health by inhaling it. They are not sustainably handling their empty pesticide bottles. The surveyed farmers are not aware of environment friendly pesticides. They are not cultivating crops in a sustainable manner and they prefer to purchase pesticides which show results in short time.

They also don't comply with the described permitted dosage written on the pesticide bottle, because they want to see immediate results on the crops. The farmers of the researched areas in Commewijne find it difficult to cultivate cropsand to be guaranteed of an income without suffering loss. They are cultivating according to their own experiences, no matter if it is unsustainable and even if it may result in unsafe food production, because they don't get incentives from the government. They feel that incentives and good policy are the key to successful agriculture, and that they need support from the government.

Recommendations

In order to make the surveyed farmers in Commewijne aware of the fact that it is important to handle pesticides in a responsible manner, the following recommendations are proposed:

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1. Informative meetings between LVV and farmers should be held regularly, so that the collaboration strengthens and information can be

spread further about pesticides, pests and diseases. In this manner LVV can avoid that farmers are experimenting with pesticides.

2. Pesticide control should be monitored on regularly basis by LVV.
3. Farmers should be made aware of the positive effects of using bio-pesticides by giving information through folders and/or by Extension Field Officers.
4. GAP should be further promoted and must be required by the government to encourage the farmers to produce safe food.

References

Bhanti, M. and Taneja, A. (2007). Contamination of vegetables of different seasons with orghanophosphorous pesticides and related health risk assessment in northern India. Chemosphere 69:63-68.

Darka, G. and Akoto, O. (2008). Dietary nitrates of organophosphorous pesticide residues through vegetables from Kumasi, Ghana. Food Chemical Toxicology 46:3703-3706.

Food and Consumer Product Safety Authority (2008). Report of pesticide residue monitoring results of the netherlands for 2008. Amsterdam: Voedsel en Waren Autoriteit.

Grube, A., Donoldson, D., Kiely, T. and Wu, L. (2011). Pesticides industry sales and usage 2006 en 2007 market estimates. Washington D.C.: U.S. Environmental Protection Agency.

Malgie, W. (2013). Food safety requirements for sustainable agricultural production according to international standards. (Master's thesis). Faculty of Social Science, University of Suriname.

Ori, L. (2009). De Landbouwsector in het district Commewijne. Baseline Questionnaire Agriculture, Department of Agricultural Production, University of Suriname, Paramaribo, Suriname.

Oo, M., Yabe, M. and Khai, M. (2012). Farmers' perception, knowledge, and pesticide usage practices: A case study of tomato production in Inlay lake, Myanmar. Journal of the Faculty of Agriculture, Kyushu University. 57:327-331.

Von Gerbmer, K. Ringler, C. and Rosegrant, M. (2012). Global hunger index: the challenge of hunger: ensuring sustainable food security under land water and energy stresses. Germany, Washington D.C. and Ireland: Deutsche Welthungerhilfe, International Food Policy Research Institute and Concern Worldwide.

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