

Investigation on Pesticide Cocktail Mixture usage among Rice Farmers in the Kadjebi District of Ghana

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ABSTRACT

Pesticide "cocktail" mixtures are described as global phenomenon especially among farmers despite potential disadvantages. This study aimed to investigate the presence of the practice among rice farmers in the Kadjebi district in the Volta region of Ghana. The study involved a descriptive survey of rice farmers in the district using structured questionnaires. A total of 200 farmers from 8 communities were interviewed, out of which 195 questionnaires were found good enough for analyses. Data from the study was analysed using SPSS version 16 and the results expressed in simple descriptive statistics including frequency counts, percentages etc. It was realised that herbicides were the only pesticides used by the farmers on their fields and it was mainly for land preparation and weed control among plants. As much as 13 brands of herbicides were used among the farmers. It was also realised that mixing pesticides into pesticide "cocktail" mixtures was common among the farmers with about three-quarters of the farmers (73.8%) involved participating in the act. It is recommended that the potential health and environmental effects of the practices of the farmers be assessed.

KEY WORDS:
Pesticides, herbicides, pesticides "cocktail" mixture, rice farmers

1. INTRODUCTION

There has been growing concerns in recent years over the health and environmental effects associated with the use and inappropriate handling of these chemicals (Asante and Ntow, 2009; Clarke et al. 1997). Pesticide exposure and residues have been found to be correlated with various ailments (Plianbangchang et al 2009); and they are held responsible for contributing to biodiversity losses and deterioration of natural habitats (Sattler *et al.*, 2006 in Ntow 2008).

Despite the fact that pesticides are also applied in other sectors, agriculture is seen as the most important source of adverse effects (Sattler *et al.*, 2006 in Ntow 2008). This is because agriculture is generally fraught with abuse, misuse and overuse (Asante and Ntow 2009), usually through: not correctly following instructions on chemical labels (Horna et al, 2008), the use of extremely and highly hazardous pesticides including officially banned ones, and the unhealthy practice of mixing of several pesticides in a "cocktail" formula with inadequate information on the agents being used (Plianbangchang et al, 2009; Cloyd, 2011).

While some insecticides can be "cocktailed" successfully a majority of them cannot (Plianbangchang et al. 2009). Cloyd (2011) explains that pesticide mixtures are world-wide-spread partly because combinations of some selective pesticides are sometimes able to better deal with certain pest issues due to synergistic interaction or potentiation among pesticides mixed; but cautioned that despite the associated benefits, potential problems like plant injury, pesticide incompatibility, and antagonism may transpire. According to Alexander et al., (2008), chemical mixtures may produce enhanced combined effects due to both toxicokinetic and toxicodynamic mechanisms, which is difficult to predict. In order to predict the toxicological properties of chemical mixtures, detailed information on the composition of the mixture, the mechanism of action and potency of each compound, as well as proper exposure data is required, but mostly such detailed information is not available (Alexander et al., 2008). Thus on the purpose of personal and public health, Kepner (2004) and PAN (2007) cautioned against pesticide mixtures. According to Horna et al. (2008) Owusu-Ansah et al. (2001) suggested that some vegetable farmers in Ghana spray their crops with "cocktails" of synthetic insecticides, and may even spray the mixture of different formulas in a single application. The limitation is that, there is no information on the extent to which other produce farmers engage in the practice. This study is therefore designed to assess the extent to which rice farmers engage in pesticide "cocktail" mixtures with a focus on farmers in the Kadjebi district. The question is: what are the main pesticides used by the farmers? Do the rice farmers engage in pesticide mixtures? What pesticides do the farmers mix?

2. MATERIALS AND METHODS

2.1. Study area

The study involved a descriptive survey on rice farmers in the Kejebi district, which is one of the six northern districts of the Volta region. The district lies on latitude 8°W-30°Wand longitude 0°S -30°S. It is bordered to the North by Nkwanta South district; to the South by Jasikan district; to the South West by Biakoye district; to the North West by Krachi East district, and to the East by the republic of Togo of which it shares 60km common boundary. The estimated size of the district is 689.91 sq km.

2.2. Data collection and analysis techniques

Data for the study was obtained by means of interviewer administered structured questionnaires survey of rice farmers from 8 communities within the district (Kadjebi, Asato, Dzamlome, Papase, Dodo Amanfrom, Ahamansu, Kosamba/Odiewu, and Dzindziso). The survey communities and respondents were purposively selected on the basis of rice cultivation. The data collected included the demographic information, and farm practices on pesticide preparation and use. The survey was conducted in February 2012. The instruments were pre-tested on farmers at Avalavi in the Ketu North district. In all, 200 farmers were interviewed; and after sorting and data cleaning, 195 questionnaires were deemed fit for analysis. The data was analysed with the SPSS version 16 software involving mainly descriptive statistics. See figure 1 below for distribution of respondents.

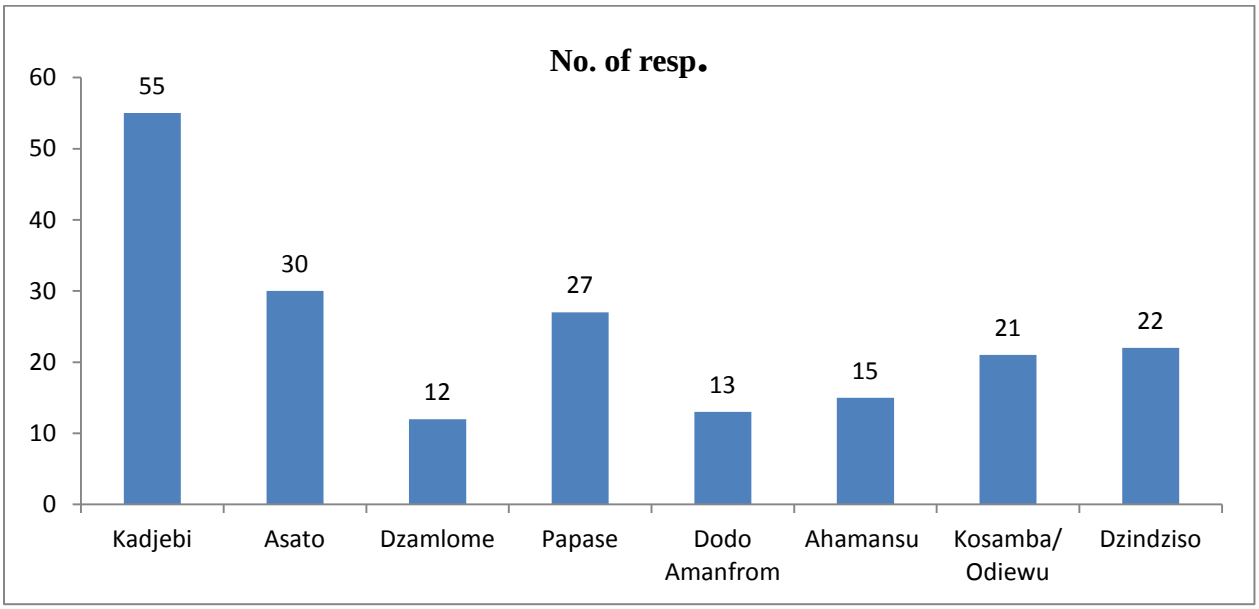

Figure 1: distribution of sampled respondents among the communities in the study area (source: author from survey data).

3. RESULTS AND DISCUSSION

3.1. Results

General information on respondents

The general information on the respondents is presented in Table 1 below. Out of the 195 respondents, 142 (72.8%) were males. In literacy, 99 (50.8%) of respondents were literate, 10 (5.1%) as partially literate and the remaining being illiterate. Three rice varieties were cultivated among the farmers, named as: brown rice, perfume (aromatic rice), and "akpese" (a locally non-improved variety). The perfume (aromatic) variety was the most cultivated variety among the farmers (cultivated by 85.6% of respondents). Some farmers cultivated more than one variety. The farm sizes ranged from 0.04ha to 1.6ha with a mean of about 0.4ha. The respondents' ages is normally distributed but slightly skewed to the left, with 35.8% above 50 years, 52.3% between 31 and 50 years, and 11.8% below 31 years.

Table 1: General information on respondents

Variable			Responses (Freq.)	Cases (%)
Gender (male=1, female=0)			142	72.8%
Literacy				
literate			99	50.8%
partial			10	5.1%
illiterate			86	44.1%
Age of respondents				
<21			3	1.5%
21-30			20	10.3%
31-40			48	24.6%
41-50			54	27.7%
51-60			35	17.9%
> 60			35	17.9%
Rice variety cultivated				
Brown rice			64	32.8%
Perfumed/aromatic rice			167	85.6%
"Akpese" (local-non improved variety)			44	22.6%
Farm size (ha)	**N**	**Minimum**	**Maximum**	**Mean**
	195	.04ha	1.60ha	.3945ha

(Source: author from survey data).

Pesticides used by the farmers

All the farmers agreed to using pesticides. They all use solely herbicides for two main activities: weed control as part of land preparation before planting and controlling weeds within crops. Among the farmers, 13 different commercial pesticide (herbicide) products were used; including: Sarosate, Kum nwura, Condemn, Roundup, Adwumawura, Sharp, Kalash, Glyphogan, Glyphader, Glyfos, Atrazine, Calliherb, and Select – all of which fall into the herbicide class of pesticides. Glyphader was the most used herbicide – used by 79% of respondents – followed by Sarosate and Glyphogan which were both used by 78.5% of respondents. Select was the least used – used by only 8.7% of respondents. Analysis of the active ingredients shows that 10 of the herbicides (Sarosate, Kum nwura, Condemn, Roundup, Adwumawura, Sharp, Kalash, Glyphogan, Glyphader, Glyfos) were all glyphosate based herbicide; and 2 of the remaining (Calliherb and Select) were amine salt based, and the last one (Atrazine) is Atrazine based. And on the bases of the type and concentration of active ingredient, Sarosate, Condemn, Roundup, Glyphogan, Glyphader, Glyfos, and Kum nwura all contain Glyphosate (360g/L) hence are the same. The amount of glyphosate in Adwuma wura (75.7g/Kg), Sharp (480g/L) and Kallash (510g/L) were different from the others. Also Calliherb and Select contain the same amount of 2,4-D Amine salt (720g/L), hence could be classified as similar (see table 2)

Table 2 Pesticide use by farmers

Pesticide use by farmers			Responses	Cases (%)
Pesticide usage confirmation			195	100.0%
Purpose of pesticide use				
Weed control in Land prep.c			195	100.0%
Weed control within crops			195	100.0%
Product name	**Active ingredient**	**Pesticide cat.**		
Sarosate 360 SL	Glyphosate (360g/L)	Herbicide	153	78.50%
Condemn 360SL	ll	ll	55	28.20%
Roundup 360	ll	ll	153	78.50%
Glyphogan 360 SL	ll	ll	111	56.90%
Glyphader	ll	ll	154	79.00%
Glyfos 360	ll	ll	54	27.70%
Kum nwura	ll	ll	71	36.40%
Adwumawura	Glyphosate 75.7 g/Kg	Herbicide	80	41.00%
Sharp 480 SL	Glyphosate (480g/L)	ll	66	33.80%
Kalash 510 SL	Glyphosate (510g/L)	ll	59	30.30%
Atrazine 500 SC	Sun – Atrazine (500 g/L)	ll	106	54.40%
Calliherb 720 SL	2,4-D Amine (720g/L)	Herbicide	21	10.80%
Select 720 SL	ll	ll	17	8.70%

a. Dichotomy group tabulated at value 1. (responses and cases)

(Source: author from survey data).

Pesticide mixture use among farmers and the pesticides mixed

Table 3 Pesticide mixture confirmation

Gender of respondents * use pesticide-pesticide mixture Cross tabulation					
			Use pesticide-pesticide mixture		
			No	Yes	Total
Gender	Female	Count	12	41	53
		% of Total	6.2%	21.0%	27.2%
	Male	Count	39	103	142
		% of Total	20.0%	52.8%	72.8%
Total		Count	51	144	195
		% of Total	26.2%	73.8%	100.0%

(Source: author from survey data).

Table 3 shows results on the analysis on the question of whether pesticides were mixed for application; of which 144 (73.8%) of the respondents admitted to the act of mixing pesticides (herbicides) in pesticide-pesticide mixture. The number included 41 (21.0%) females and 103 (52.8%) males. Table 4 presents counts of cases of pesticide mixtures as confirmed by the farmers. The total cells show total number of cases of mixture of particular pesticide (herbicide) with other pesticides; whiles the inner cells show specific cases of mixture between specific pesticides used by the farmers. Atrazine had the highest total number of cases of mixture with other pesticides (504) followed by Sarosate (123), Glyphader (117) and Roundup (105). Condemn had the least total number of cases of mixing with other pesticides (35), behind Glyfos (41) and Kallash (43). On specific cases of mixtures, 91 cases of Atrazine/Glyphader mixture was the highest, followed by 90 cases Atrazine/Sarosate mixture, and 75 cases of Atrazine/Roundup mixture. The lowest specific mixture cases were the 1 case of Select/Condemn mixture, ahead of 4 cases of Calliherb/Glyfos mixture.

Table 4 cases of pesticide "cocktail" mixture Pesticide used x pesticide added Cross tabulation

			Pesticide added[a]			Total
			Atrazine	Calliherb	Select	
Pesticide used	Sarosate	Count	90	17	16	123
	Kumwura	Count	33	8	7	48
	Condemn	Count	28	6	1	35
	Roundup	Count	75	16	14	105
	Adwumawura	Count	38	11	5	54
	Sharp	Count	33	5	8	46
	Kallash	Count	32	6	5	43
	Glyphogan	Count	56	15	9	80
	Glyphader	Count	91	11	15	117
	Glyfos	Count	28	4	9	41
Total		Count	504	99	89	692

Percentages and totals are based on responses.

a. Dichotomy group tabulated at value 1

(Source: author from survey data).

3.2. Discussion of results

The study observed pesticide-pesticide mixture use among rice farmers in the Kadjebi district in the Volta region. The farmers cultivated three types of rice: a local brown rice, a local white long grain variety called "Akpetse" and aromatic rice generally called "perfume" rice by the farmers. Within the aromatic/perfume rice are "Lome" (a variety from neighbouring Togo), AgraRice distributed with the assistance of Alliance for Green Revolution in Africa (AGRA), and a NERICA variety. The farmers most often are unable to distinguish between the aromatic cultivars hence refer to all as "perfume" rice.

All the farmers responded to using pesticides. Herbicides are the only type of pesticide used by the farmers mainly for weed control as part of land preparation and within crops. For land preparation, often the field is sprayed with the herbicide to kill the weeds before working the land. The results suggest a wide variety of commercial pesticides (herbicide) availability and usage among the farmers with some being more popular than others. From the total of thirteen (13) commercial herbicide brands used among the farmers, Glyphader, Sarosate, and Roundup were the most popular ones, whiles Select, Calliherb, and Glyfos were the least popular in that order.

It was realised that mixture pesticides into "cocktail" for application was a common feature practice among the farmers with about two thirds of the farmers confirming to partaking to the act. The pesticide mixtures entailed Glyphosate based pesticide on one part and Amine Salt or Atrazine based pesticide on the other part. It is therefore concluded from this study that majority of rice farmers in the Kadjebi district of Ghana apply "cocktails" of synthetic insecticides is hereby confirmed among the rice farmers in Kadjebi district and that majority of the farmers are involved.

REFERENCES

Alexander, J. et al., 2008. *Combined toxic effects of multiple chemical exposures*, Oslo: Norwegian Scientific Committee for Food Safety.

Asante, K. A. & Ntow, W. J., 2009. Status of Environmental Contamination in Ghana, the Perspective of a Research Scientist. *Interdisciplinary Studies on Environmental Chemistry — Environmental Research in Asia*, p. 253–260.

Clarke, E. E. K., Levy, L., Spurgeon, A. & Calvert, I., 1997. The problems associated with pesticide use by irrigation workers in Ghana. , *Occup. Mod. Copyright O 1997*, 47(5), pp. 301-308.
Cloyd, R. A., 2011. Pesticide Mixtures. In: P. M. Stoytcheva, ed. *Pesticides - Formulations, Effects, Fate*. s.l.:InTech.

Horna, D. et al., 2008. *Insecticide Use on Vegetables in Ghana: Would GM Seed Benefit Farmers?; Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27-29, 2008.*. Orlando,FL, s.n.

Kepner, J., , 2004. Synergy: The Big Unknowns of Pesticide Exposure; Daily combinations of pesticides and pharmaceuticals untested. 23(4).

Kepner, J., 2004. Synergy: The Big Unknowns of Pesticide Exposure;Daily combinations of pesticides and pharmaceuticals untested. *Pesticides and You; Beyond Pesticides/National Coalition Against the Misuse of Pesticides*, 23(4).

Ntow, W., 2008. *The use and fate of pesticides in vegetable-based agroecosystems in Ghana*, s.l.: Taylor & Francis/Balkema.

PAN, 2007. *Why Risk Assessment is necessary for substance mixtures*, Hamburg : PAN Germany.

Plianbangchang, P., Jetiyanon, K. & Wittaya-areekul, S., 2009. Pesticide use patterns among small-scale Farmers: a case study from Phitsanulok,Thailand. *Southeast Asian J Trop Med Public Health*, March.40(2).

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