

PESTICIDE USE, MANAGEMENT PRACTICES AND PERCEIVED EFFECTS ON THE HEALTH OF COCOA FARMERS IN CROSS RIVER STATE, NIGERIA

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ABSTRACT

Pesticide poisoning is a leading occupational and public health concern among farmers in Nigeria. Nevertheless, with the country's rising population coupled with fluctuations in climatic conditions that favor frequent pest and disease outbreaks, the demand for pesticides has been on the increase to enhance food production and quality, thereby ensuring food security. Cross River State is the second largest cocoa producing state in the country with many small scale farmers involved in cocoa production. In spite of researches carried out on agrochemical use in Nigeria, little is known about pesticide use in Cross River State. This study was, therefore, aimed at documenting pesticide use, management practices and perceived effects on cocoa farmers' health in Cross River State, Nigeria. A multistage sampling technique was used to survey 150 cocoa farmers in the State. A set of structured questionnaires was used to elicit information from farmers. The instrument focused on farmers' socio-economic characteristics, major pesticides used, pesticide management practices, and perceived pesticide effects on health. Data were analyzed using descriptive statistics. Results showed that the majority (71.3%) of farmers was male with most (60.7%) having farming experience of ten years and above, implying that cocoa production is dominated by men. Pesticides used in the study area were: herbicides such as clear weed (58%), insecticides such as Actara 25WG (98%) and Dursban 48EC (96%), inferring that more insecticides than herbicides were used by farmers. Pesticide management practices such as "use of personal protective equipment (PPE) and reading manufacturers' instructions before pesticide application" were practiced by 26% and 38% of respondents, respectively. Cough (MS=4.03), shortness of breath (MS=3.96), skin itching (MS=3.87), dizziness (MS=3.78) and sneezing (MS=3.78) were the severely perceived pesticide related sicknesses reported by farmers. The study recommended that agricultural extension advisory services should lay more emphasis on pesticide risk awareness and attitudinal change among farmers.

Key words: Pesticide use, Pesticide management practices, Farmers' Health, Perceived pesticide effects



INTRODUCTION

Globally, pesticide poisoning has become a leading occupational and public health concern as it accounts for close to 300,000 mortalities yearly with developing countries being the hardest hit [1]. In these countries, the brunt of pesticide effects is particularly felt by small-scale farmers and those working in the agricultural sector which is the second largest employer of labor in the world [2]. According to the World Health Organization (WHO), more than three million farmers in developing countries are poisoned by agrochemicals on a yearly basis, even though these countries account for about 20% of the world's pesticide use [3, 4]. A pesticide is any substance or mixture of substances aimed at controlling, destroying, or preventing any pest, including vectors of animal or human diseases, weeds, undesirable species of animals that cause harm during the production, processing, storage, transportation or marketing of agricultural produce, animal feedstuffs or wood products [5]. It is anticipated that by the year 2050, the world's population will increase to 9 billion, necessitating increased use of pesticides to reduce yield losses emanating from pest attacks [6]. On the other hand, more use of pesticides in agriculture will ensure food security by enhancing food production, productivity and quality [7].

Nigeria is rated one of the world's leading producers of cocoa among countries like Cote d'Ivoire, Cameroon, Indonesia and Ghana [8]. Currently, the country produces approximately 248,000 metric tonnes of the crop out of a production capacity of 300,000 metric tonnes annually [9]. Thus, cocoa is undoubtedly one of the main cash crops that have played a central role in the country's economic development, providing employment opportunities for more than one million of the population [10]. Notwithstanding, cocoa production in Nigeria is plagued by disease and pest attacks resulting in poor yields, low farm income, low foreign exchange earnings, hence reduced government revenue [11]. With the country's rising population coupled with recent fluctuations in climatic conditions that favor frequent pest and disease outbreaks, the demand for pesticides has been on the increase [12]. Increased use of pesticides has exposed farmers to more startling health and environmental challenges with effects that could be short- and long-term [13]. Boateng *et al.* [4] noted that irresponsible handling of pesticides by farmers not only affects the environment directly but indirectly, as it can also target unintended useful organisms such as pollinators like moths, butterflies, bees, and so on, hence poor crop yields. An epidemiological study on respiratory symptoms and farmers' exposure to agricultural pesticides by Mamane *et al.* [14] identified some of these effects as dyspnea, chest tightness or breathlessness and chronic cough. Others include skin and eye irritations, sneezing, nausea, vomiting,



headaches, dizziness, convulsion, birth defects, low sperm quality and count in men leading to sterility, endocrine disruptions, cancer, end stage renal disease, reproductive and immune system malfunctions/abnormalities, developmental disorders, and behavioral changes [13, 15, 16]. Pesticides can enter the human body through the following routes: inhalation (through the lungs), contact (skin) and ingestion (mouth). Inhalation occurs when very fine pesticide particles are inhaled in the body in vapor form [17]. Absorption through the skin occurs due to spills and splashes when disposing, mixing, or loading the chemicals, while ingestion happens when eating and drinking is done without proper washing of hands after pesticide use or by accidental ingestion due to poor storage (e.g., storage of pesticides in food and water drinking containers) [18,19].

Various researches have been conducted on agrochemical use, management practices and effects on the health of arable crop farmers in the south-western, south-eastern and north-western regions of Nigeria [18, 20-24]. For instance, Oludoye *et al.* [25] observed that only few cocoa farmers demonstrated safe pesticide use behavior in Nigeria. Specifically, it was noted that farmers overused certain pesticides and administered some that were not approved by the official regulating body. In Ogun and Osun states, Nigeria, Oyekale [26] found that the level of awareness of agrochemical safety precautions among cocoa farmers was very high. The study also established that the number of farmers who owned PPE was very small and that there was an association between farmers' perceived health status and agrochemical safety compliance. Farmers who perceived their health status as good had higher safety compliance indicators. In another study by Agbongiarhuoyi and Fawole [27] in south-western Nigeria, it was revealed that there was a decline in compliance with standard pesticide safety practices among older cocoa farmers as well as among those that had access to approved pesticides. However, the reverse was true among those who had access to information and income. In spite of these researches, little or no study has been conducted on pesticide use, management practices and perceived effects on the health of cocoa farmers in the south-south region where Cross River State is situated despite that the state is the second cocoa producing region in the country with a significant number of farmers involved in the activity. It is, therefore, based on this that the study sought to document pesticide use, management practices and perceived effects on the health of cocoa farmers in Cross River State, Nigeria. Specifically, it described farmers' socio-economic characteristics, identified the major pesticides used, the pesticide management practices employed, and the perceived effects of pesticides on farmers' health.



MATERIALS AND METHODS

Study area

The study was conducted in Cross River State, Nigeria sited in the south-south geopolitical region. The state falls within the tropical rainforest of Nigeria and is host to a large portion of the country's virgin forest. Its population stands at 3.7million with a land mass of 20,156 square kilometers and population density of 190 inhabitants per square kilometer [28].

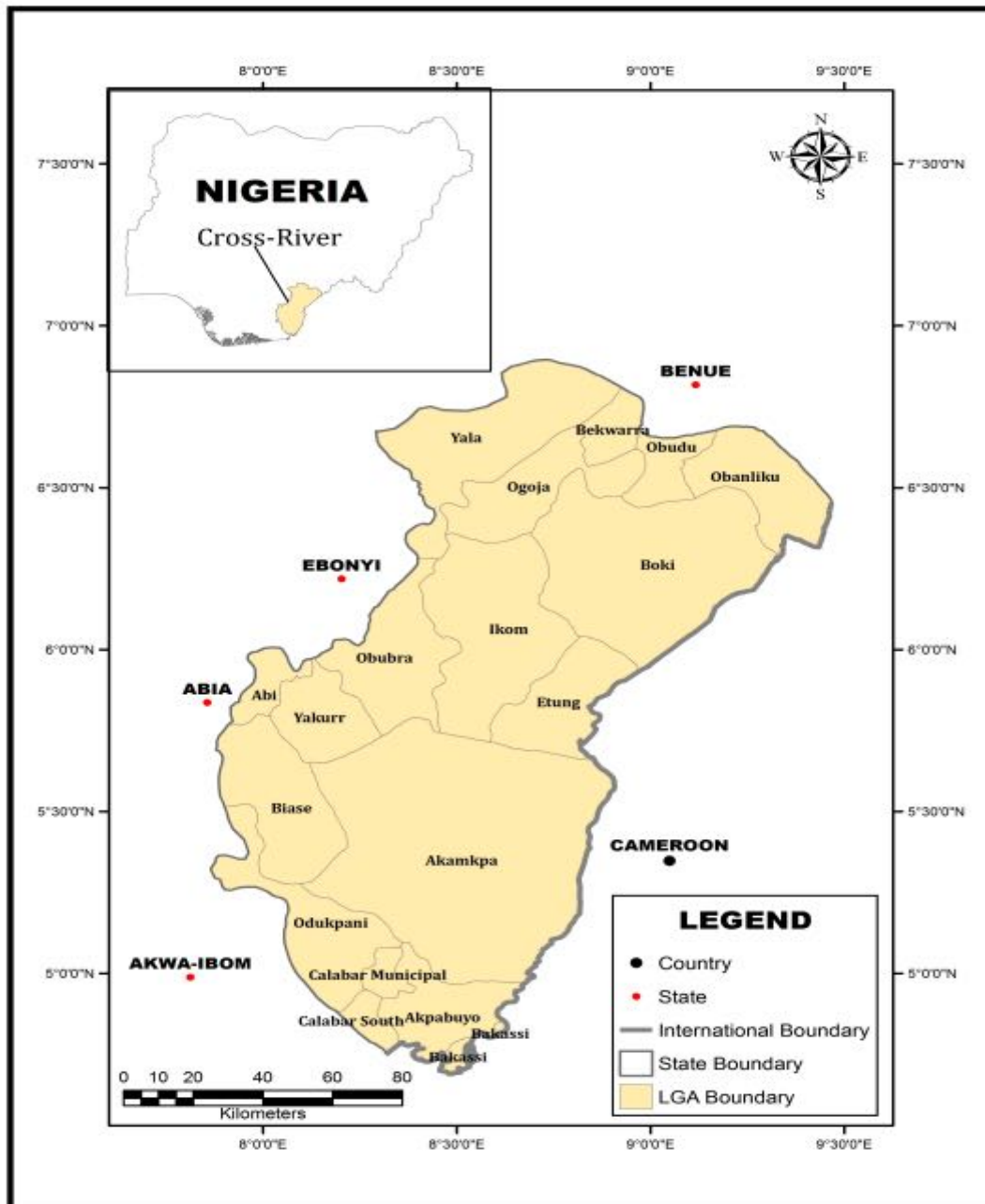


Figure 1: Map of the study area (Cross River State)

Source: [29]

Sampling and data collection

A multistage sampling technique was adopted to select respondents for the study. In the first stage purposive sampling was used to select three out of nine cocoa producing Local Government Areas (LGAs) in the state. Etung, Ikom and Boki were selected because they are the highest cocoa producing LGAs. In the second stage, simple random sampling was used to choose six cocoa producing communities (that is two communities per LGA) from the selected LGAs. A list of cocoa producing communities in the LGAs was obtained from Cross River Agricultural Development Programme (CRADP) and used for this purpose. The communities selected were Bendeghe-Ekim, Etomi, Akparabong, Ikom Town, Orimekpa and Ochor. In the third stage, simple random sampling was used to select 25 cocoa farming household heads per selected community, giving rise to a sample size of 150. The number used was motivated by limited funds for the research. Information from cocoa farmers was elicited with the help of a set of structured questionnaire in line with the objectives of the research. Content validity of the instrument was assured by some staff of the Department of Agricultural Extension and Rural Sociology, University of Calabar, Nigeria, while the Departmental research quality assurance team ensured that the ethics of research was maintained. The questionnaire clearly solicited the consent of potential respondents and specified that it was purely for academic purposes and that all information supplied was to be treated with absolute confidence. Hence, respondents were free to refuse to participate without any repercussion. The instrument was divided into four subsections as follows: socio-economic characteristics of farmers; major pesticides used; pesticide management practices employed; and perceived effects of pesticides on farmers' health. Data were analyzed using descriptive statistics such as means and percentages. In order to identify the major pesticides used by cocoa farmers, a list of pesticides approved for use by cocoa farmers in Nigeria was obtained from literature and presented to respondents to indicate the ones used. Scores of one and zero were assigned to yes and no answers respectively. To ascertain the pesticide management practices employed, a list of good pesticide management practices sanctioned for the cocoa value chain by the Standards Organization of Nigeria (SON) was obtained from literature and presented to respondents to indicate those practiced. Scores of zero and one were assigned to yes and no responses respectively. Lastly, perceived effects of pesticides on farmers' health were ascertained using a five point likert scale with response categories of: Strongly Agreed (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD) and with the score values five, four, three, two and one respectively. These values were added and divided by five to have the mean score (MS) (that is three). Factors with mean scores



greater than/equal to three were considered severe health effects while those with mean scores less than three were considered less severe.

RESULTS AND DISCUSSION

Socio-economic Characteristics: Table 1 shows farmers' socio-economic characteristics. It can be observed that the majority (71.3%) is made of males, most (66%) fall within the age range of 30 to 49 years, with most (60.7%) having farming experience of ten years and above, and few (37.3%) were degree holders. The implication is that cocoa is a male dominated crop, confirming the report of a study in south western Nigeria [30]. It is possible that more women are not involved in the activity due to the enormous labor required for its operations. Furthermore, the findings infer that cocoa farmers in the region are relatively young. This contradicts the observations made in Oyo, Kwara, Ogun and Osun states, Nigeria [20, 31]. It is probable that with the prevalence of unemployment among youths in the country, those in Cross River State are turning to agriculture to earn a living. In addition, the involvement of few degree holders in cocoa production may likely support the view that in Nigeria graduates perceive agriculture as laborious, dirty, unfulfilling and inferior to other professions [32-33]. Farmers with lower educational levels may not fully comprehend the implication of pesticide use on their health; hence they may not take all necessary measures to protect themselves against the dangers of pesticide use.

Types of Pesticides: Results on Table 2 show the types of pesticides used by cocoa farmers. The main herbicide used is clear weed (58%). Farmers reported that this chemical is used principally when cocoa plants are young and that subsequently it is replaced by mechanical weeding. With respect to the use of insecticides, the study found out that the majority (98%) of respondents used Actara 25WG, while 96% used Dursban 48EC. The dominant fungicide used was Kocide 2000 (98%). Some farmers reported that in addition to the use of fungicides, cultural control measures such as rapid removal and destruction of diseased plants outside farming areas were also practiced. Concerning fumigants, Phostoxin was used by only 16% of farmers and for storage purposes. From these findings, it can be inferred that farmers make use of herbicides, insecticides and fungicides. This corroborates results of a study conducted in Ghana which noted that small scale cocoa farmers are progressively using pesticides instead of indigenous methods to boost cocoa yields [34]. In the Akyemansa district of the eastern region of Ghana, some cocoa farmers did not use herbicides because their cocoa plants had already formed a canopy which helped to suppress weed growth [35]. These results also show that cocoa farmers tended to use assorted types of



insecticides. This is consistent with the finding of a study in Ethiopia and Hungary by Tessema *et al.* [1] where it was reported that farmers used various insecticides than herbicides and fungicides. The use of varied insecticides infers that insect pest attacks remain a valid challenge in cocoa production requiring that more chemicals be used to keep them in check. However, frequent use of insecticides may result to insecticide resistance necessitating the application of higher dosages before they can be eradicated [36]. The fact that more farmers use fungicides contradicts the finding made in Ghana that farmers prefer the cultural method of fungi control to fungicide use [35]. No farmer reported using any pesticide outside that recommended by the Standards Organization of Nigeria (SON). This also contrasts with the observation in Ghana where farmers in addition to using pesticides recommended by the Ghana cocoa board, used other banned chemicals because of their availability and affordability [35].

Pesticide Management Practices: Pesticide management practices employed by cocoa farmers are summarized on Table 3. The results show that the majority (98%) did not spray their farms when it was raining to prevent chemicals running into water bodies. Similarly, a large proportion (92%) never used their mouths to clean the nozzle of sprayers when blocked. These results revealed further that only 26% used full personal protective equipment -PPE (that is rubber boots, gloves, goggles, face mask, overall and hat or cap) to cover the entire body before mixing the chemicals. Some farmers reported that the only time they covered their faces was when they were mixing or loading the chemicals while leaving heads, necks, arms and legs bare. In addition, only 38% reported reading and following manufacturers' instructions before pesticide application. Some said that they got information on the mode of application from farm input marketers or extension agents; hence, they did not bother reading the instructions. The adoption of practices such as not spraying cocoa fields while it is raining might also be to prevent pesticide wastage, considering the high cost of pesticides. The results of a study conducted in Ogun state, Nigeria by Idris *et al.* [11] showed that there is a strong relationship between cost of pesticides and pesticide use; thus, the higher the cost of pesticides, the less their use. On the other hand, only a small proportion of respondents checked the wind direction when spraying to prevent pesticides drifting off target. This finding corroborates that of a study in south-western Nigeria [37]. The implication is that neighboring farmers may also be exposed to pesticides, thereby exhibiting health challenges similar to those of cocoa farmers who use them. Furthermore, considering that only a small proportion of farmers used full personal protective equipment (that rubber boots, gloves, goggles, face mask, overall and hat or cap) it might be a reflection of the high cost of personal protective equipment, poor knowledge on the routes through which pesticides can

gain entrance into the body, adverse weather conditions that may discourage their use, and poor knowledge on the gravity of adverse effects of pesticides on human health. Not putting on full personal protective equipment gives farmers a false impression that they have been protected, thus preventing them from being extra careful. This confirms findings of studies in rural Tanzania, Ghana and other developing countries [13, 35, 38]. In Ghana in particular, it was reported that hot and humid weather conditions made it uncomfortable for cocoa farmers to wear full personal protective equipment [13]. Again, given that few farmers read and followed manufacturers' instructions before pesticide application may be an indication of low educational level among farmers in the area. Results of a study in Northern Nigeria reported a significant relationship between farmers' pesticide handling and their educational attainment where those with high educational levels tended to read manufacturers' instructions before pesticide use [18]. Overall, Oludoye *et al.* [25] noted that up to 42.7% of cocoa farmers across Nigeria exhibit unsafe pesticide behaviors with only 8.2% of them demonstrating safe pesticide use behaviors.

Perceived Effects of Pesticides on Health of Cocoa Farmers: The summary of results on perceived effects of pesticides on the health of cocoa farmers is found on Table 4. The results indicate that cough (MS=4.03), shortness of breath (MS=3.96), skin itching (MS=3.87), dizziness (MS=3.78) and sneezing (MS=3.78) were the most severely perceived effects experienced by cocoa farmers after exposure to pesticides. Farmers reported that effects such as cough, breathlessness, sneezing and skin itching were severely felt from the time of mixing the chemicals to a few days after spraying. Also, a farmer mentioned that one of his colleagues lost a child due to accidental ingestion of the chemical. These results agree with those of a similar study conducted by Apeh [21] in south-eastern Nigeria and by Demi and Sicchia [34] in Ghana. The results of a study in Ogun and Osun states, Nigeria established an association between perceived health status of cocoa farmers and compliance with agrochemical safety indicators [26]. The researcher observed that farmers who perceived their health status to be poor or fair were more willing to comply with agrochemical safety compliance indicators than those who perceived their health status to be otherwise. The implication of these results is that when farmers fall sick, they are unable to carry on with agricultural activities. This may subsequently lead to low yields, low income, poverty and even death.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

This study investigated pesticide use, management practices and perceived effects on the health of cocoa farmers in Cross River State, Nigeria. From the findings, it can be concluded that pesticides use is prevalent among cocoa farmers in Cross River State. Also, there exists poor pesticide management practices such as limited use of personal protective equipment before pesticide application, and that farmers are exposed to pesticide related sicknesses and poisoning. It is, therefore, recommended that agricultural extension advisory services should focus on pesticides risk awareness and attitudinal change that will lead to adoption of good pesticide management practices by farmers. Also, more village extension officers should be employed and trained together with pesticide suppliers/marketers to enable them give sound advice to farmers on pesticide use.

GRANT SUPPORT DETAILS

The present research did not receive any financial support.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

LIFE SCIENCE REPORTING

No life science threat was practiced in this research.



Table 1: Socio-economic characteristics of cocoa farmers

Characteristics	Percentage (Frequency) (n=150)
Sex:	
Male	71.3 (107)
Female	28.7 (43)
Age (Years):	
<20	03.3(05)
20 – 29	13.3(20)
30 – 39	38(57)
40 – 49	28(42)
50 – 59	14.7(22)
≥60	02.7(04)
Marital Status:	
Married	45.3(68)
Separated	16.7(25)
Divorced	15.3(23)
Widow	8(12)
Single	14.7(22)
Household size:	
<5	29.3(44)
5 – 10	30(45)
11 – 15	28(42)
≥16	12.7(19)
Educational level:	
No formal education	17.3(26)
FSLC	22.7(34)
SSCE	22(33)
OND/NCE	21.3(32)
BSc/HND	12(18)
MSc/PhD	04.7(7)
Cocoa farming experience (Years):	
<5	9.3(14)
5 – 9	30(45)
10 – 14	38(57)
>14	22.7(34)
Farm Size (Hectares):	
<1	17.3(26)
1 – 3	37.3(56)
3.01 – 6	28.7(43)
6.01 – 9	16.7(25)
Contact with Extension Agents:	
Not at all	35.3(53)
Monthly	6(9)
Quarterly	26.7(40)
Yearly	32(48)

Table 2: Types of pesticides used by farmers

	Trade name	Active ingredient	Percentage (Frequency) n=150
Herbicides	Clear weed	Glyphosate	58(87)
	Touch down	Glyphosate	6(9)
	Round up	Glyphosate	26(39)
Insecticides	Actara 25WG	Thiamethoxam	98(147)
	Esiom 150 SL	Acetamiprid	
		Cypermethrin	10(15)
	Dursban48EC	Chlorpyrifos	96(144)
	Proteus 170 O-TEQ	Deltamethrin 20g/l + Thiacloprid 150g/l	4(6)
	Parastar	Imidacloprid	76(114)
Fungicides	Plantima 30SC	Lambda-cyhalothrine	68 (102)
	Funguran-OH	Copper hydroxide	86(129)
	Champ DP	Copper hydroxide	0.7(1)
	Ridomil Gold 66WP	Cuprous Oxide + Metalaxyl-M	88(132)
	Copper Nordox 75WP	Cuprous Oxide	92(138)
	Cacaobre	Cuprous Oxide	78(117)
	Ultimax plus	Metalaxyl + Copper hydroxide	4.7(7)
	Kocide 101	Cuprous Oxide	62(93)
	Kocide 2000	Cuprous hydroxide	98(147)
	Fumigants	Phostoxin	Aluminum Phosphide

Table 3: Pesticide management practices by cocoa farmers

Management practices	Percentage (Frequency) n=150
Manufacturers' instructions are read and followed before application	38(57)
I wear full personal protective equipment (i.e. rubber boots, gloves, goggles, face mask, overall and hat or cap) before mixing the pesticide	26(39)
Wind direction is checked when spraying to prevent the pesticide from drifting off target	16(24)
Pesticides are not sprayed when it is raining to prevent washing into water bodies	98(147)
Smoking, eating or drinking is never done while spraying	68(102)
The sprayer is cleaned immediately after use	66(99)
I bath immediately after spraying	48(72)
I never dispose the water used for bathing in the river, stream or near children or animals	56(84)
I use full personal protective equipment (i.e. rubber boots, gloves, goggles, face mask, overall and hat or cap) to cover my entire body before spraying	44(66)
Clothing worn during spraying are washed separately	78(117)
I never use my mouth to clean the nozzle of the sprayer when it is blocked	92(138)
Pesticide containers are always disposed of according to instructions	54(81)
I never use pesticide containers for storage of water or foodstuff.	60(90)

Table 4: Perceived effects on farmers' health

Perceived effects	Mean score (MS)	S.D	Rank
Cough	4.03*	0.10	1 st
Dizziness	3.78*	0.10	4 th
Eye reddening/shedding of tears	3.58*	0.10	9 th
Sneezing	3.78*	0.09	4 th
Skin itching	3.87*	0.10	3 rd
Headache	3.58*	0.09	9 th
Body pain	2.62	0.09	14 th
Vomiting	3.31*	0.09	12 th
Throat irritation	3.67*	0.08	7 th
Excessive sweating	3.31*	0.09	12 th
Muscle weakness	3.58*	0.09	9 th
Shortness of breath	3.96*	0.10	2 nd
Cancer	3.67*	0.08	7 th
Renal diseases	2.35	0.10	15 th
Death of farmer	3.7*	0.09	6 th

* : Severe effects

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