

FOOD SAFETY AND USAGE OF PESTICIDES: THE CASE OF IRRIGATED CUCUMBER PRODUCTION AMONG SMALL-SCALE FARMERS IN KADAWA IRRIGATION SITE, KANO STATE, NIGERIA

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ABSTRACT

Food safety is gaining increased importance over the years due to its impact on the health of consumers. This study looks at food safety and usage of pesticides in irrigated cucumber production among small-scale farmers in Kadawa Irrigation Site, Kano State, Nigeria. The data used for analysis were collected by means of random and snowball sampling procedure, from 153 farmers in five villages. The data were analyzed using descriptive statistics. Findings show that majority of the farmers (69.94%) were within the age bracket 18 to 40 years with average age of 39 years. An average of 0.38ha farm size was devoted to Cucumber production which was 28.15% of the total irrigable land available to the average farmer. Findings further revealed a varied number of pesticides being used by farmers and the pesticides were mostly sourced from local agrochemical dealers (82.35%), as sources of information on usage were from fellow farmers (50.33%) and the agrochemical dealers (40.52%). Meanwhile, information about usage handed out to farmers from agrochemical dealers and farmer-to-farmer cannot be trusted. Moreover, deducing the safety of usage of pesticides in irrigated cucumber production vis-à-vis sources of pesticides, sources of information, perception to optimum dosing and how harmful the misuse of pesticides can be to the cucumber consumers; the safety of cucumber consumption cannot be guaranteed. A vigorous safety campaign of pesticides use becomes highly imperative. Further studies to possibly look into the amount of chemical residues in cucumber fruits is also recommended.

Keywords: Food Safety, Usage of Pesticides, Cucumber Production, Small-Scale Farmers, Irrigation, Kano State

INTRODUCTION

Fruits and vegetables are very vital components of a healthy diet. Meager fruit and vegetable consumption are linked to poor health and increased risk of non-communicable diseases. Globally, an estimated 3.9 million deaths were attributable to poor fruit and vegetable intake in 2017 (World Health Organization (WHO), 2019). WHO (2019) further added that fruits and vegetables naturally, are rich sources of vitamins and minerals, dietary fibre and a host of beneficial non-nutrient substances in addition to plant sterols, flavonoids and other antioxidants, and consuming a variety of fruits and vegetables

helps to ensure a sufficient intake of many of these essential nutrients. Consequently, there is an ongoing advocacy for increased consumption of fruits and vegetables.

Cucumber (*Cucumis sativus*) is a widely cultivated plant in the gourd family, Cucurbitaceae. It is a creeping vine that bears cucumiform fruits that are used as vegetables. It is being used traditionally as treatment for a number of ailments and home remedies, for dietary aesthetics and its cultivation can boost significantly, the income opportunities of small-scale farmers. A fresh cucumber provides vitamin C, niacin, iron, calcium, thiamine, fibers and

phosphorus (Khan et al., 2015). Besides, it is one of the very low-calorie vegetables; providing just 15 calories per 100g (Aziza et al., 2018). It is an excellent source of potassium, an important intracellular electrolyte. 100g of cucumber provides 147mg of potassium but only 2mg of sodium. Cucumbers contains unique antioxidants in moderate ratios such as β -carotene and α -carotene, vitamin C, vitamin K, vitamin A, zeaxanthin, and lutein. It helps in checking weight gain and high blood pressure (Aziza et al., 2018). Globally, more than 50% production of cucumber comes from Asia; with China leading, Turkey, Iran, Uzbekistan, Japan and Iraq are other leading cucumber producing countries in Asia (Khan et al., 2015; Aziza et al., 2018; Atlas Big, 2020). Production data for Africa was 1.4million metric tons for the year 2019, a 1.6% share of the total world output (faostat.fao.org, 2020).

Nonetheless, major concerns are being raised regarding safety of fruits and vegetables consumption. Fruits and vegetables are increasingly being recognized as emerging vehicle for foodborne illness in humans. Traditionally, meat, milk and egg products were the 'usual suspects' (Ramees et al., 2017). However, the consumption of fresh produce (fruits and vegetables) is linked, both epidemiologically and microbiologically to infectious intestinal disease (Safe Food, 2007; Ojeleye, 2017). Ramees et al. (2017), added that vegetables consumed raw are increasingly being recognized as important vehicles for the transmission of human pathogens. As fresh vegetables are eaten raw or slightly cooked to preserve the taste and their nutrient contents, this serves as a potential source of various food-borne infections and disease outbreaks (Mir et al., 2018). WHO (2020),

submitted that unsafe food containing harmful bacteria, viruses, parasites or chemical substances, cause more than 200 diseases – ranging from diarrhea to cancers, as an estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food. The report further stated that about 420 000 die every year, resulting in the loss of 33 million healthy life years (Disability-adjusted life years, DALYs).

Meanwhile, fertilizers and pesticides are used in crop production to improve yield and quality due to increased food demand. But, wrongful use of these agrochemicals can be detrimental to health as farmers and consumers are exposed to health hazards due to their toxic residues (Dery, 2017). Dery (2017), further asserted that the indiscriminate use of pesticides, especially during fruiting and pre-harvesting stages, and non-adoption of safe waiting periods have led to pesticide residues accumulating in the produce. These residues in fruits and vegetables are more apparent as they are mostly eaten raw, with dire consequences like; acute effects such as dizziness and diarrhea, chronic health effects like cancer, birth defects, infertility, brain, nervous, immune systems and organ damage. Moreover, certain additives such as mineral oils, colours and some waxes used on fruits and vegetables to give a fresh, attractive appearance can be hazardous (Dery, 2017). Of most concern, chemical pollutants for health are naturally occurring toxins like mycotoxins, persistent organic pollutants (POPs) compounds that accumulate in the environment and human body like dioxins and polychlorinated biphenyls (PCBs), and heavy metals such as lead, cadmium and mercury causing neurological and kidney damage (WHO, 2020). Contamination by heavy metal in food occurs mainly through

pollution of air, water and soil, hence the concerns for food safety.

Nigeria cannot be left behind in the call for food safety particularly fruits and vegetables production as it has been observed that food safety hazards occurs at different stages of the food chain starting right from primary production and extending to secondary and tertiary stages like processing, storage, distribution and packaging (Ojeleye, 2017). Cucumber, being one of the vegetable foods eaten raw deserves attention hence, this study attempts to evaluate the safety of irrigated cucumber production vis-à-vis agrochemical usage practices among the small-scale farmers in Kadawa Irrigation Site.

Materials and Methods

The study area is the Kadawa Irrigation Site in the Kano River Irrigation Project (KRIP) which included the Kano River Project, Phases I and II, with a total area of about 62,000 ha (Simon, 1997). The main source of water for irrigation in the region is the Tiga Dam and Ruwan kanya reservoir. The elevation of the project lies within 440 meters above sea level, with minimum storage level of Tiga Dam at 506.50 meters, which provides a perfect setting for the gravity irrigation (Yakubu, Baba and Mohammed, 2018). The major crops cultivated in the study area include maize, rice, tomato, wheat, melon, cucumber, pepper, onion and garlic throughout the year (Abdulkarim and Balarabe 2003).

A multistage sampling technique was adopted for this study. The first stage involved random selection of villages within the project site namely, Chiromawa, Yantomu, Kupa, Ungwan kudu, Kadawa and Yadakwa. The second stage involved a snowball sampling of cucumber farmers

within the villages as no list of such farmers existed, giving a sample size of 153 respondents. Primary data were collected from the cucumber farmers using structured questionnaires, while descriptive statistic was used in the analysis of data obtained.

Results and Discussion

The socio-economic characteristics of the respondents revealed that about 70% of the cucumber farmers were within the age bracket (18-40) years with a mean age of 39 years. This implies that the majority of the respondents were still economically active and at their productive stages. Meanwhile, the modal class of educational level of the respondents was secondary education (34.64%), followed by Arabic literacy (26.14%). Nwaru et al. (2006), nonetheless observed that farmers would rely more on their farming experience for improved productivity rather than their educational attainment. More so, the average cucumber farming experience as depicted in the result presented in Table 1 indicates an average of 7.1 years between the range 2 to 20 years. Uwagboe et al. (2010) and Enete et al. (2002) showed in their studies that age and years of experience are important positive factors in farm work.

The average irrigable land size is found to be 1.35ha. This average is relatively fair considering that farmers have access to other farmlands not suitable for irrigation. Meanwhile, the average farm size devoted to the cultivation of cucumber is only 0.38ha as shown in the Table 1, which is 28.15% of the total irrigable land available to the average farmer. With the possibility of cultivating other crops like maize, water melon, green pepper, wheat, tomato and other crops, the share of cucumber in the available irrigable land can be said to be substantial.

Table 1: Distribution of socio-economic characteristics of Cucumber farmers in the study area

Characteristics	Mean/Mode	Min.	Max.	St. Dev.	Frequency	Percentage
Age (years)	38.7	18	75	11.9		
<20					11	7.19
21-40	29				96	62.75
41-60					40	26.14
>60					6	3.92
Level of Education						
No formal education					24	15.69
Arabic education					40	26.14
Adult education					7	4.58
Primary education					5	3.27
Secondary educ.					53	34.64
Post-secondary education					24	15.69
Cucumber farming experience (years)						
< 5	7.1	2	20	6.19	52	33.99
6-8	7				34	22.22
9-11					36	23.53
14-17					13	8.50
> 17					18	11.76
Total irrigable land size (Ha)						
< 0.50	1.35	0.1	10.1	1.11	27	17.65
0.51-1.00	1				72	47.06
1.10-1.50					2	1.31
1.51-2.00					32	20.92
2.10-2.50					12	7.84
2.51-3.00					4	2.61
> 3.00					4	2.61
Cucumber farm size (Ha)						
< 0.20	0.38	0.1	1	0.026	76	49.67
0.21-0.40	0.2				45	29.41
0.41-0.60					5	3.27
0.61-0.80					16	10.46
> 0.80					11	7.19
Extension contact						
Yes					49	32.03
No					104	67.97
Total					153	100

Sources of pesticides used in cucumber production

Given the potentialities of pesticides to cause unintended damage, particularly in the food production industry, it becomes necessary to ascertain how farmers sourced them. The majority (82.35%) of the cucumber farmers in the study area patronized the local agrochemical dealers, who are also referred to as input traders.

Analysis further showed that 14.38% bought pesticides from local-open markets while only 1.31% sourced their pesticides from extension agents. This result confirms the findings of Issa (2016) and Mokwunye et al. (2012), that the sources of pesticides used by the farmers include agrochemicals retailers, traders, and Agricultural Development Programmes (ADPs). What this may portray by. The overwhelming sourcing of pesticides from private dealers who sell to earn money may give room for abuse.

Table 2: Distribution of respondents sources of pesticides used in Cucumber production

Sources of pesticides	Frequency	Percentage
Agrochemical dealers	126	82.35
Local markets	22	14.38
Extension agents	2	1.31
Fellow farmers	3	1.96
Total	153	100.00

Survey of types of pesticides used in cucumber production

Typically, pesticides are toxic and may pose significant environmental risks, particularly in the event of accidental spills and misuse. Pollution from pesticides use is a serious threat to environmental safety and exposure to agrochemicals have deleterious health effects such as nervous system damage and cancer. The types of pesticides used by farmers are revealed in Table 3. The most popular pesticides used for irrigated cucumber production is IMI Force as about 75% of the farmers used same. IMI Force's active ingredient is imidacloprid which is rated as "moderately toxic" on an acute oral basis to mammals and low toxicity on a dermal basis by the World Health Organization and the United States Environmental Protection Agency (U.S. EPA) (class II or III, requiring a "Warning"

or "Caution" label). It is rated as an "unlikely" carcinogen and as weakly mutagenic by the U.S. EPA (group E) (U.S. EPA, 1994; Federal Register Notice (2009). Emamectin benzoate in Caterpillar Force is noted to be toxic to fish and mammals, as Awiner (Undated), submitted that if a worker applies Emamectin Formula without resistant gloves, he or she can experience skin irritation. Prolonged exposure has adverse effects on nerve issues as well. Weight gain and loss can also occur accompanied by other impacts on the reproductive and immune system (Awiner, undated).

Profenofos can cause cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills), respiratory paralysis and death

(Eddleston et al., 2009; U.S. EPA, 2000). While Cypermethrin is moderately toxic through skin contact or ingestion. It may cause irritation to the skin and eyes. Symptoms of dermal exposure include

numbness, tingling, itching, burning sensation, loss of bladder control, incoordination, seizures and possible death (Ecobichon, 1993; Baselt, 2008).

Table 3: Type of pesticides used in cucumber production

Pesticides (Brand names)	Frequency	Percentage
IMI Force (Imidacloprid 200G/L SL)	114	74.51
Caterpillar Force (Emamectin benzoate 5 % WDG)	65	42.48
Lava Force	15	9.80
Pro Force	7	4.58
Sharp Shooter (Profenofos: A.I. 40% and Cypermethrin: A.I. 4%)	38	24.84
Termex	9	5.88
Vector (210g/kg of Imidacloprid 30% WP and 90g/kg of Beta cyfluthrin)	16	10.46
DDforce (Profenofos 40% and Cypermethrin 4% EC)	43	28.10
Punch (Abamectin 1.8% EC)	9	5.88
NOPEST (1000gms DDVP per liter)	9	5.88
Optimal 20SP (Acetamiprid 200g/kg: SP)	6	3.92
Frequency of pesticides usage on the average		
Mean	5.9	
St. deviation	3.23	
Min.	3	
Max.	19	

*Multiple choices

Source of information on usage of pesticides

Getting information about usage, type and measure (quantity) of pesticides to use is very important. Information on cautionary measures like not eaten while applying pesticides, how to store, and the use of protective clothing are such that can be passed on to farmers to be properly informed about the handling procedure of various chemicals. Notwithstanding the importance of the source of information, the results as presented in the Table 4 shows

that about half of the respondents sourced information principally from fellow farmers. This, in addition to sourcing information from the agrochemical dealers, add up to an overwhelming 91% of cucumber farmers in the study area, who source information from private agents, while a meagre 5.23% got their information from extension agents. The application of pesticides using information so sourced by the majority are likely to be imprecise, with unintended worker exposures. This finding is supported by Apeh (2018).

Table 4: Information on usage of pesticides in irrigated cucumber production

Source of information	Frequency	Percentage
Fellow farmers	77	50.33
Agrochemical dealers	62	40.52
Extension agents	8	5.23
TV/Radio/newspapers	3	1.96
Brand representatives	3	1.96
Total	153	100.00

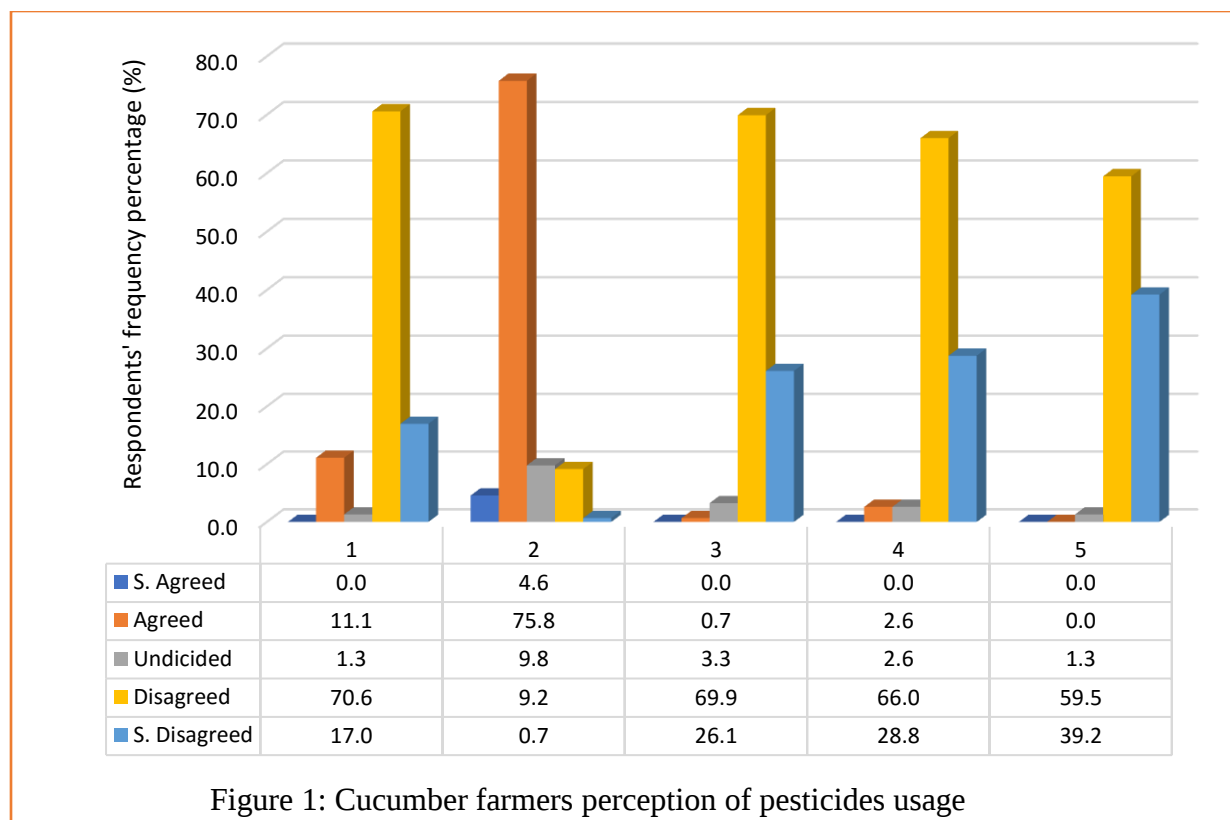
Farmers perception to the use of pesticides

Over the years, pesticides and fertilizers (agrochemicals) have been used to boost agricultural production (Sekhatha, Monyeke, and Sibuyi, 2016), leading to increased food production (Popp, Peto and Nagy, 2013). But factors such as balanced use, optimum dosing, correct application methods and timing, amongst others, help to ensure safety food production with the use of pesticides. In particular, harm could come to the users and consumers of the produce when optimum use and application regulations are not followed. Therefore, views to the following statements were sought from the farmers to know what their perception of pesticides use is like for irrigated cucumber production:

1. Pesticides are not so needed in irrigated cucumber production.
2. Without pesticides, it is not possible to cultivate irrigated cucumber.
3. I am sure of the measurement rate in my application of pesticides to the least detail.
4. Pesticides can be harmful to the consumers of my cucumber if I did not use it correctly.
5. Pesticides can be harmful to me if I did not use it correctly.

Majority (71%) of the famers disagreed to the statement that pesticides are not so needed in irrigated cucumber production. The strength of this assertion is further tested and strengthened as about 76% of the farmers believed that without pesticides, it is not possible to cultivate irrigated cucumber. These statements are pointers to the fact that the use of pesticides in irrigated cucumber production is prevalent in the study area. Meanwhile, as farmers were made to respond to the third statement that reads “I am sure of the measurement rate in my application of pesticides to the least detail”. Emphasis was on precise measurement (optimum dosing) and correct application methods. The farmers’ response was alarmingly in the negative; as about 70% disagree with the statement, and more pathetically, about 26% strongly affirmed their unawareness.

. About 95% of the farmers disagreed that pesticides misuse can be harmful to consumers while 98.7% equally disagreed with the fact that pesticides misuse can be harmful to themselves.



CONCLUSION AND RECOMMENDATIONS

The survey carried out in the Kadawa Irrigation Site, Kano State sought to look at food safety and usage of pesticides for irrigated cucumber production among small-scale farmers. Findings revealed that a varied number of pesticides were used by farmers and the pesticides were mostly sourced from local agrochemical dealers. The sources of information on pesticide usage was mostly from same agro-dealers and fellow farmers. Meanwhile, information from agro-dealer-to-farmer and farmer-to-farmer cannot be trusted. Moreover, by deducing the safety of usage of pesticides in irrigated cucumber production vis-à-vis sources of pesticides, sources of information on usage, knowledge of optimum dosing and the perception of farmers to how much harm the misuse of pesticides can do to

the cucumber fruit consumers, the safety of Cucumber for consumption cannot be guaranteed. A vigorous safety campaign of pesticides use becomes highly imperative. A key component to this campaign could be the integrated pest management techniques in the control of insect pests in irrigated cucumber production. Further studies to identify the number of chemical residues in cucumber fruits is also recommended.

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