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Farmer's Behavior and Attitude in Using Chemical Fertilizers and Pesticide in Rural Areas and its Effects on the Environment

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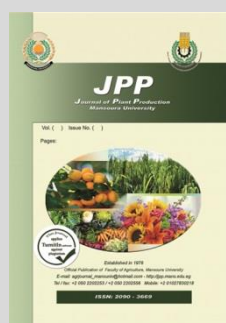


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ABSTRACT

Human activities especially farmers can have impacts on the environment via using chemical substances, these effects can be directly on human or indirectly through food, wildlife, climate, crops, or livestock. Chemical substances which are introduced into delicately balanced ecosystems, they could have led to damage in motion that reverberates via the food for years. Nevertheless, it wreaks havoc, biodiversity and the natural system that human survival depends on. The aim of this study is to evaluate farmer's behavior in using pesticides and fertilizers to prevent the environment pollution and the harm to the human beings. Primary data was used to achieve the objective which using a semi-structure questionnaire, that administered in a random sampling technique, face to face administration. The total number of farmers in the sample was 200 farmers in 31 villages. The analysis is conducted with SPSS and Excel Spreadsheets. The results illustrated that great number of farmers in rural area of Sulaimani uses chemical pesticides and fertilizers in huge amounts, they still with the adage, "if little is good, a lot more will be better". In addition, the great number of farmers don't follow the product's labels, or believe that these chemical substances impact on the environment, or adopt new techniques in applying chemical substances. So, farmers require knowledge and informations to understand the negative influences of these chemical substances on the biotic and abiotic components of the environment to use organic fertilizers and pesticides instead of toxic chemicals with the recommended standard levels.

Keywords: Pesticides, Fertilizers, Environment, Farmers, Rural Area



INTRODUCTION

Increasing in human population has led to a considerable rise in demanding for food, chemical pesticides and fertilizers can have impacts on environment and health. The danger of the chemical fertilizers and pesticide might be it toxic in huge amounts, non-essential biologically, with age it can accumulated in tissue, environmentally persistent and mobile in the biogeochemical cycles, it could more effect specific genotypes than the target organisms (Goodman, 1974). Hence, farmers usually use toxic pesticides, fertilizers, hormones and antibiotics to increase productivity; however, the overuse of these chemical substances led to poisoning and contamination of land; in other words, according to Mishra, *et al.* (2016) they affect the quality of soil. Gimeno-García *et al.* (1996) indicated that applying these inorganic fertilizers and pesticides to rice farming, the toxic heavy metals were found in the soils. Additionally, Atafar, *et al.* (2010) shown that the concentration of heavy metals, especially (Cd, Pb, and As) increase in the soil. Nevertheless, the uses of pesticide and chemical fertilizer have several problems include increasing the cost of production (Sabur and Molla, 2001 and Razzaq *et al.*, 2004). In addition, it is a large source of water, air and soil pollution, which can have a negative influence on living organisms in the environment (Mhammedi *et al.*, 2017; Mishra *et al.*, 2016; Maitah *et al.*, 2015 and Saravanan *et al.*, 2005). Moreover, Saravanan *et al.* (2005) mentioned that destruction of useful earthworms occurs from accumulation of toxic elements in the land. Besides, it is dangerous to human health, especially to the farmer directly involved in the

handling of pesticides and other chemical substances (Jallow *et al.*, 2017). Therefore, soil test assists farmers in efficient decision about using the appropriate type of chemical fertilizers (Mckenzie, 2008). In addition, Organic production has a vital role in reducing using chemical product, it can be defined as "an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity" (Winter and Davis, 2006). Organic farming utilizes different methods to maintain or improve the fertility of the soil, such as cover crops, crop rotation, tillage and cultivation practices, and natural fertilizers, and pesticides (Winter and Davis, 2006). According to Woese *et al.* (1997) who revealed that there are differences in quality of food that produced from conventional and organic farming. That it is probable that the foods produced organically are lower in pesticide residues (Bourn and Prescott, 2002). Furthermore, it has an effect on food quality; for instance, as Mitchell *et al.* (2007) discovered that the levels of flavonoids in tomato rose with the passage of time in samples from organic treatments, while the rate of flavonoids did not considerably change in conventional treatments. In the research of Chibuike, and Obiora (2014) shown that plants growing on polluted land show a decrease in performance, growth, and yield. Because of that in the soil there are great numbers of micro-organisms that are useful for soil, which are responsible for decomposing the organic matter and recycle it. These micro-organisms are suffering from soil pollution. This pollution occurs via using pesticides, Common chemical pesticides that used to kill specific organisms are Boric Acid, Sodium Fluoride, Basic Copper Sulfate, Methyl-chloroform, Silica Gel, Fenthion, and

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Carbon Disulfide. However, pesticides can kill more than just their target organisms (Mishra *et al.* 2016). Additionally, farmers in the United State use 750 million pounds of twenty thousand different agricultural chemicals each year. Although these approved by the U.S. Environmental Protection Agency (EPA) contain ingredients that are known carcinogens, while others led to birth defects, severe allergies, and different health problems (Reuben, 2010). Using pesticides even the dosages that recommended for the field application has effect on the honey bees via using contaminated water and available food for bees which is led to poison stomach's bees (Anderson and Atkins, 1958). Pesticides have negative effects on biodiversity, which could change in the function of ecosystem, moreover; it has impact on bees' learning and foraging behaviors (Boff *et al.*, 2020). Bees are important for the pollination of plants; they assist in maintaining biodiversity and ensure food security (Raine and Gill, 2015). Herein study concentrate on farmers' behaviors on using chemical substances in the rural area in Sulaimani and the impacts of these chemicals on environment and human health.

MATERIALS AND METHOD

The Research was conducted at the Collage of Agricultural Engineering Sciences, University of Sulaimani in 2018- 2019. The research community consists of farmers in town Bakrajo in Sulaimani. Primary data was used for this research; using a semi-structure which is a combination of open and closed questions. The questionnaire is administered in a random sampling technique. Face to face administration of questionnaires was conducted to gather information about farmers' behaviors and attitudes in using chemical substances. The total number of farmers in the sample was 200 farmers in the 31 villages. The questionnaire consists of two parts: The first part; included personal questions (age, gender, education level, production). The second part; of the questionnaire categorized to: socio-economic and farm characteristics, using chemical fertilizers and pesticides, current fertilizer and pesticides application behaviors, decision-making in fertilizer application, attitudes towards adopting better fertilizer application technologies, and environmental consciousness. Furthermore, the analysis is conducted with utilize of statistical software known as the Statistical Package for the Social Sciences (SPSS) version 22 and Excel.

RESULTS AND DISCUSSION

This table illustrates that the greatest number of responds was male, with aged 34-48, that have primary education, and about 18-34 years' experiences. Additionally, most of the lands are irrigating land.

This table shows that the majority of farmers do not test the soil, as they believe it does not need. While, a soil test is essential to assist farmers in their efficient decision about using the appropriate type of chemical fertilizers (Mckenzie, 2008). Additionally, non-judicious of utilizing fertilizers led to lower yields but applying fertilizers depend on testing soil is the mantra for agricultural sustainable that result to increase the products (Bhatt, 2013).

This pie chart shows that 68.5% of farmers follow crop rotation, while 31.5% they do not.

Even though the majority of farmers follow crop rotation, they do not release the main rule of crop rotation. Because, as it's clear from figure (2), they generally grow up only wheat and barley, which are required the same nutrients, as these plants from one family, which is Gramineae and subfamily Triticeae (McKevith, 2004). However, "rotations can be defined as temporal arrangements of crops and can be classified systematically according to their internal variability and cyclical pattern" (Castellazzi *et al.*, 2008). Moreover, crop rotation increases profit and yield and permits in sustained production, as well as, can improve soil organic matter and soil physical properties (Bullock, 1992). Another benefit is it can disrupt the life cycle of plant- specific pests (IEPA, 1996).

Table 1. Personal questions

Questions	Variable	Frequency	Percentage (%)	
Gender	Female	30	15	
	Male	170	85	
Age (Year)	19-33	30	15	
	34-48	78	39	
	49-63	62	31	
	64-78	28	14	
	79-93	2	1	
Education Level	No formal education	53	26.5	
	Less than primary school	39	19.5	
	Primary school	67	33.5	
	Central school	25	12.5	
	Secondary school	7	3.5	
	Academy	3	1.5	
How many years agricultural doing (Year)	Bachelors degree	6	3	
	1-17	64	32	
	18-34	70	35	
	35-52	61	30.5	
Lands by Dunam	53-70	5	2.5	
	Irrigation land	1-40	197	98.5
		41-82	2	1
		83-123	0	0
		124-164	0	0
Rain fit	165-205	1	0.5	
Lands by Dunam	1-50	179	89.5	
	51-102	0	0	
	103-154	20	10	
	155-257	0	0	
	258-308	1	0.5	

Table 2. Testing soil

Soil Test	Frequency	Percent
Yes	18	9
No	182	91
Total	200	100.0

Source: Author's field survey (2019) and SPSS Result

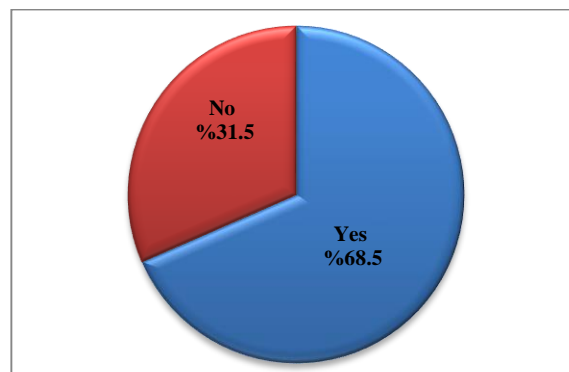


Figure 1. Crop Rotation

This table demonstrates that (134) of farmers follow the crop rotation for improving the soil fertility, representing 67%, 53 have no idea representing 26.5%, 3 depending on the market representing 1.5%, while 1 of farmers change their crop for profit, and comforting land representing 0.5%.

However, 8 farmers do not respond. Although, high percentage follows crop rotation, they do not release the main rule of crop rotation. Because they grow up the crops that need almost the same nutrients as it is clear in figure (2). Even the reason for the great number of farmers that follow crop rotation is to improve the soil fertility, the second greatest number of responding they did not have an idea about crop rotation, while they follow it. This could be a reason to apply it in non-appropriate way.

Table 3. Reasons for following crop rotation

Reasons for following crop rotation	Frequency	Percent
Soil Fertility	134	67
Depending on the market	3	1.5
Profit	1	0.5
Comforting land	1	0.5
No idea	53	26.5
No response	8	4
Total	200	100

Source: Author's field survey (2019) and SPSS Result

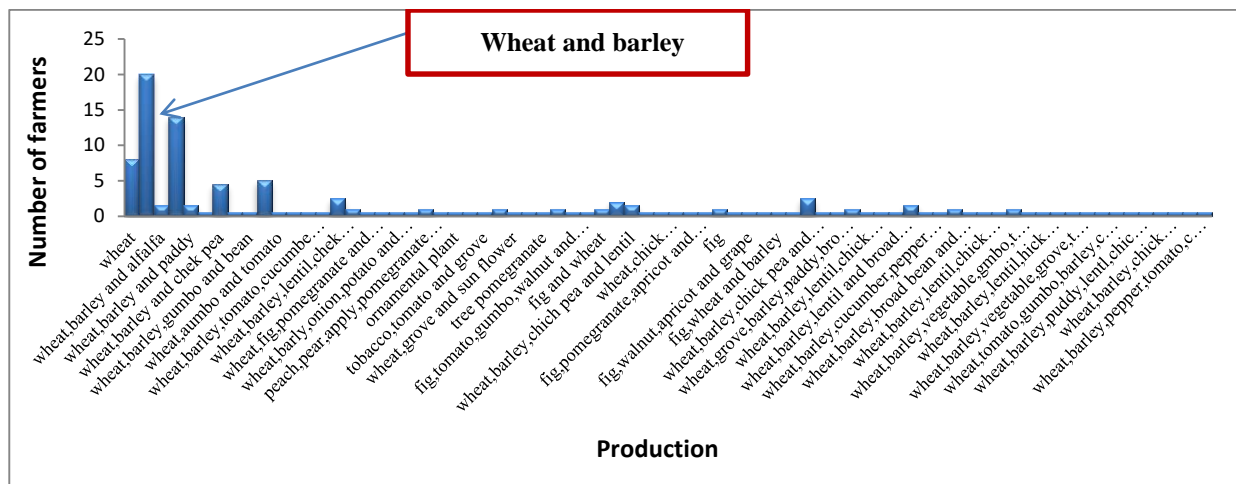


Figure 2. The crops that grown up by farmers

The bar chart demonstrates that the wheat and barley are the most crops grow by farmers. Repeating these crops makes specific pests to increase which is required apply specific pesticide numerously. While according to Gill and Garg (2014) applying pesticides a lot from frequency and quantity make the pest adapt to the new environment via several mechanisms for instance mutation of gene, increase in number of generations, and change in population growth. This is resulted to resist these pests to pesticides.

Table 4. Number of farmers using Chemical Fertilizers and pesticides

Using chemical Fertilizers and pesticides	Respondents	Frequency	Percent
Using chemical Fertilizers	Yes	198	99
	No	2	1
Using Pesticides	Yes	186	93
	No	14	7

This table illustrates the number of farmers who are utilizing the chemical fertilizers and pesticides. As it is clear %99 and %93 of farmers applying chemical fertilizers and pesticides respectively to their lands. While, IEPA (1996) and Ngowi (1995) recommended, instead of using chemical pesticides can be used several mechanisms to manage pests such as, cultural control, mechanical control, and biological control. However, if chemical substances must be used, should be followed the label direction carefully. As mentioned by Ngowi (1995) if inorganic agrochemical used in inappropriate technique can led to environmental pollution, soil degradation and health risks.

This figure shows that the highest rate of agriculturalists is consuming both organic and chemical fertilizers and pesticides, representing 55%. Unfortunately, the minimum numbers using organic fertilizers and pesticides which is 6.5% and 1% was used nothing to lands. Furthermore, the most common kind of fertilizers and pesticides which are used by farmers is inorganic one, represent 37.5%. In developing countries, the quantity of synthetic agrochemical has been rising;

while, in the developed countries have been attempting to reduce the pesticides application (Ngowi, 1995). According to Aktar *et al.*, 2009 and IEPA, 1996 the chronic diseases and death around the world owing to poisoning because of pesticides around one million dwellers/year. Chemical substances can have impacts on the environment; for instance, pesticides could pollute water, soil, and vegetation. Moreover, it can kill weeds and insects, and toxicity beneficial insects, birds, fish, and non-target organisms. Additionally, overuse of pesticides can lead to decrease in the beneficial soil microorganism populations, which in term cause lose soil fertility (Aktar *et al.*, 2009). Organic fertilizers release their nutrients slowly which assist plants to absorb these nutrients; in contrast, the chemical fertilizers release their nutrients rapidly that plants cannot take off all these nutrients; moreover, this is cause to leach below the root of plants and carry out with surface water.

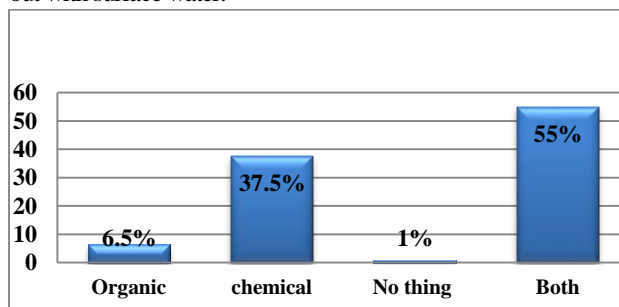


Figure 3. Types of fertilizers

This table clarifies that the quality of the fertilizers and pesticides are bad, due to the majority of the farmers responded by bad and very bad 43% and 35% respectively for fertilizers substance. While, just 1.5% and 0.5% responded by very good and good respectively. Additionally, 20% of agriculturalists retorted by rather which is not good newscast also. Conversely, 33%, 29.5% and 23.5% were replied the quality of pesticides substance is rather, bad and good respectively. As Chakrabarty *et al.* (2014) mentioned that these chemical substances are non-

biodegradable which accumulate in the environment and pollute the soil, air, and water; thus enter into human food chain; hence, this is hazard human and animal health. Despite that, the qualities of these chemical substances which are used bad.

Table 5. Illustrate the quality of chemical fertilizers and pesticides

Category	Respond	Fertilizers		Pesticides	
		Frequency	Percentage	Frequency	Percentage
The quality of the fertilizers and pesticide that you use	Very good	3	1.5	15	7.5
	Good	1	0.5	47	23.5
	Rather	40	20	66	33
	Bad	85	43	58	29.5
	Very bad	68	35	0	0

Table 6. Adopting new technique for using chemical substances and environmental consideration and following products label

Category	Respondents	Frequency	Percentages
Adopting new technique for applying chemical substance	Yes	36	18
	No	164	82
Environmental Consideration	Yes	24	12
	No	176	88
Do you think chemical fertilizers and pesticides have negative effects?	Yes	89	44.5
	NO	111	55.5
Do you read, understand and follow chemical fertilizers and pesticides label?	Yes	72	36
	NO	128	64

Table (6) demonstrates that the majority of respond do not adopt new techniques in applying chemical substance, because they do it as they used to. However, according to Randall *et al.*, (1985) changing in application techniques required to meet the economic and agronomic needs in the future. Besides, modern application methods of fertilizer can enhance its efficiency (Randall *et al.*, 1985). Moreover, according to Jian *et al.*, (2004) adopting new system which called new chemical substance notification can prevent and control the pollution to the environment, and its negative impacts to human beings; furthermore, this method can assist to exchange the information among producers/importers and users to prevent the pollution and negative effects to human by these chemical substances. In case of environmental consciousness, the large number of farmers does not believe these chemical substances have influence on the environment. This result shows that the farmers require knowledge and information through courses to understand the negative impacts of these chemical substances on the biotic and abiotic components of the environment, nevertheless, and on their health. The same result with the study that done by (Damalas *et al.*, 2006) who established that the greatest number of farmers do not read, understand, and follow the information that displayed on the pesticides product labels because it is hard to understand, while; a tiny proportion of the farmers stated that because they know this information. Furthermore, another research reported that the farmers do not read the labels because the label's direction so long and the font size are very small. Hence, the incapability to understand the information that written in the label lead to increase risks to human health and environmental pollution (Waichman *et al.*, 2007). On the other hand, it is necessary to read the label on the pesticide container due to that according to Ngowi (1995)

using under-dosing and overdosing can damage the crops by either the pest or pesticides.

Table 7. Weather consideration

Weather Consideration	Respondents	Frequency	Percentage
Consideration of weather when using Chemical fertilizers	Yes	168	87.5
	No	24	12.5
Consideration of weather when using pesticides	Yes	170	91.4
	No	16	8.6

This table clarify that most of the farmers consider the weather when they use chemical substances. Furthermore, Weather and climate variability have positive effect on application of pesticides. As the type of crops and the chemical classes of pesticides restrict the pesticides dosage. Despite that requiring of fruits and vegetables for pesticide increase by the variability of temperature and precipitation, beans and cereals remain desires the greatest amount of pesticides. However, variability of climate decreases the dosage of chemical pesticides for some chemical classes (Koleva *et al.*, 2009). Nonetheless, IEPA (1996) advice the farmers must not apply pesticides during the rain forecast, unless it is recommended in the label; in addition, wear protective clothe, mask, and gloves while applying the chemical substances as instructed in the label.

CONCLUSION

Chemical Pesticides and fertilizers can have impacts on environment and health. In addition, it is dangerous to human health, especially to the farmers who are directly involved in the handling of pesticides and other chemical substances. However, the results of this study show that farmers use great amount of chemical pesticides and fertilizers, and believe that these are not adequate in quality. In addition, the great percentage of responds does not read, understand, or follow the product label. Furthermore, they do not believe these chemical substances have environmental problems which indicate a serious issue. The recommendations of this research are use organic fertilizers and pesticides instead of toxic chemical, as chemical substances have negative influence on human health, and the environment. Appropriate utilizes of fertilizer, including the suitable amount of nutrient for greater growth of crops. Moreover, adopt crop rotation that allows the land replenish its nutrients. Overuse of chemical pesticides and fertilizers should avoid.

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سلوك المزارعين وموقفهم من استخدام الاسمدة الكيميائية والمبيدات في المناطق الريفية وتأثيرهم على البيئة

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يمكن ان يكون للنشاط البشري و خاصه المزارعين تأثيرات على البيئة من خلال استخدام المواد الكيميائية. ويمكن ان يكون لها تأثير على الانسان بصورة مباشرة او غير مباشرة من خلال الغذاء او الحياة البريه او المناخ او المحاصيل او الثروة الحيوانيه. يتم ادخال المواد الكيميائيه التي تم صنعها لقتل الافات في النظام البيئي الذي يبقى بدوره في الشبكة الغذائية لسنوات. و الذي يدمر البيئة و له مخاطر على التنوع البيولوجي و يضعف النظام الطبيعي الذي يعتمد عليه بقاء الانسان. تهدف هذه الدراسة لتقييم سلوك المزارعين في استخدام المبيدات و الاسمدة الكيميائيه. ومنع تلوث البيئة و الأضرار بالانسان. تم جمع البيانات عن طريق الاستبيان. تم اجراؤه بطريقه اخذ العينات العشوائيه و جها لوجه. بلغ العدد الاجمالي للمزارعين في عينه 200 مزارع في 31 قرية. تم إجراء التحليل باستخدام (SPSS version 22 و Excel). توضح نتائج البحث أن عددًا كبيرًا من المزارعين في المناطق الريفية في محافظه السلیمانيه يستخدمون مبيدات حشرية و أسمدة كيميائية، و يستخدمونها بكميات كبيرة، و لا يزالون مع القول المأثور، "إذا كان القليل جيدًا، فسيكون الكثير أفضل". بالإضافة إلى ذلك، فإن عددًا كبيرًا من المزارعين لا يقرؤون أو يفهمون أو يتبعون ملصق المنتجات. نسبة كبيرة من المستجيبين لا يعتقدون أن هذه المواد الكيميائية لها تأثيرات على البيئة. يتضح من النتائج أن المزارعين يحتاجون إلى المزيد من المعرفة و المعلومات لفهم التأثيرات السلبية لهذه المواد الكيميائية على المكونات الحيويه و غير الحيويه للبيئة. علاوة على ذلك، فإن غالبية المزارعين لا يعتمدون تقنيات جديدة في تطبيق المواد الكيميائية. تظهر نتيجة أخرى أنه على الرغم من أن النسبة الكبيرة من الردود تتبع تناوب المحاصيل، إلا أنها لا تطبق القاعدة الرئيسية لها. توصيات الدراسة هي استخدام المبيدات و الأسمدة العضوية بدلا من الكيماويات السامة بالمعدلات القياسية الموصى بها.