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The Reality of Using the Mineral Fertilizers by Farmers in Janowski County of Poland

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

The research aims to identify the social, personal, economic and communicative characteristics of farmers in Janowski County, as well as to identify the level of use of mineral fertilizers among farmers, identify the level of use of mineral fertilizers among farmers in each item of study, and to find a correlation between the level of use of mineral fertilizers and independent variables.
A questionnaire was designed to collect data from farmers for this research, it consist of two parts: The first part: Includes information related to farmers. The second part includes thirty (30) statement (item) related to the use of mineral fertilizers. The results showed that the level of use of mineral fertilizers to farmers is medium. The results also showed that there is a positive correlation between the use of fertilizers and variables (gender, educational level). While there is no correlation between the use of fertilizers and variables (age, size of farm, sources of information on the use of mineral fertilizers).

Keywords: Mineral fertilizer; farmers; extension.

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1. INTRODUCTION

Fertilizer is defined as any material, organic or mineral, natural or synthetic, that supplies plants with the necessary nutrients for plant growth and optimum yield [1].

Fertilizers have important role in increased crop production, and will continue to be a cornerstone of the science-based agriculture required to feed the expanding world population. Fertilizers replenish the nutrients removed from soils by harvested crops, encourage adoption of high-yielding varieties, and increase biomass in the nutrient-poor soils of the tropics [2,3]. Fertilizers are classified as two major type: organic and mineral fertilizers. Mineral fertilizers are mined from mineral (e.g. lime, potash, or phosphate rock) or by manmade through chemical processes (e.g. urea). Mineral fertilizers vary in appearance depending on the process of manufacture. Mineral fertilizers divided into (simple fertilizers and compound fertilizers).

- Simple fertilizers which contains one of nutritious element. The most fertilizers simple and the most common are: Nitrogen fertilizer which contain nitrogen as an essential element, also it contain phosphate fertilizers which contain phosphorus as an essential element, and it contain potassium fertilizer which containing potassium as an essential element.
- Compound fertilizers, which contains two or more nutrients usually combined in a homogeneous mixture by chemical interaction, such as the three major elements (NPK), and it may contain some other necessary elements [1,4]. Artificial fertilizers are tend to be easier to use and may be stored longer without deteriorating. These fertilizers include three kinds:

Mineral fertilizers can be applied by hand or with application equipment. When hand applied, it is essential to distribute the fertilizers uniformly and at the recommended rates to avoid over-or under-fertilization. Application equipment needs proper adjustment to ensure uniform spreading. Broadcast fertilizers should be incorporated after application to enhance effectiveness or to avoid evaporation losses of N. With banding or spot application, take care that no fertilizers is placed too close to either the seed or the germinating plant, to avoid damage to the seedling or roots [5,6]. In this case, the agricultural extension plays an active role in this field, through the transfer of all information about the use of mineral fertilizers to farmers as well as the development of information and the capacity of farmers in the fields of the use of mineral fertilizers, and the educate farmers on modern and scientific methods on how to mix mineral fertilizers, how to spray-on plants that lead to improved agricultural production, as well as agricultural extension has big role on the transfer of the problems and the needs of farmers to the scientific research centers in order to find solutions to their problems [7].

The research objectives:

- Identify the social, personal, economic and communicative characteristics of farmers in Janowski County.
- Identify the level of use of mineral fertilizers among farmers in Janowski region.
- Estimate the level of use of mineral fertilizers in each item of use of mineral fertilizers.
- Identify the correlation between the level of use of mineral fertilizers among farmers and independent variables.

2. METHODOLOGY

The research community consists of farmers in Janowski County. These areas cultivate various kinds of agricultural crops. The study adopted a simple random sampling technique to select 50 farmer while a questionnaire was designed to collect data from the farmers. Questionnaire was designed as tool to collect data required in order to achieve the research objective. Questionnaire consists of two parts:

The first part: Included personal variables that related with farmers which connected with the use of mineral fertilizers.

The second part: Included the scale for the use of mineral fertilizers. This scale consist of 30 item of research which related to the use of mineral fertilizers (Table 7). Also, the half split method was used to find the reliability coefficient of scale, the value of reliability is (82). The author used (Pearson correlation coefficient, Equation of Spearman-Brown) to find a correlation between the level of use mineral fertilizers and independent variables in the research.

2.1 Measuring of Variables in Research

2.1.1 Measurement of independent variables

- **Age:** was measured through the age of farmer during the time of collecting the research data.
- **Gender:** was measured through (2 levels) (Male - Female): (male =1) and (female = 2).
- **Education level:** was measured according to the following levels: (Primary School - secondary school - High school). It has been given the following degrees: (Primary school = 1), (Secondary school = 2) and (High school = 3).
- **Size of farm:** It has been measured by (ha.).
- **Sources of information on the use of mineral fertilizers:** This variable was measured through the four sources (agricultural extension, Press and agricultural magazines, other farmers, Radio and TV programs in the media). It has been given degree for answer ranging from (1-10) degrees for each source. Through the collected the answers of farmers about the sources of information, the author in the end will get the final degree for farmer answer (from 40 degree) about this variable. Thus, the range of answer for this variable (sources of information) between (1-40) numeric values.

2.1.2 Measurement of dependent variable

The variable (use of mineral fertilizers) it was measured by scale. This scale consists of 30 item, relating to use of mineral fertilizers, was put in front of each item (4 alternatives/options), it has been given the following degrees, namely:

- I apply it a large degree, it was given 4 degrees.
- I apply it a moderate degree, it was given 3 degrees.
- I apply it a low degree, it was given 2 degrees.
- I don't apply, it was given 1 degree.

Through the collection the answers of each farmer about item of mineral fertilizers, the author will get the final degree about the use of mineral fertilizers. The author used (Pearson correlation coefficient, Equation of Spearman-Brown) was used to find if there is a correlation between the level of use of mineral fertilizers among the farmers and independent variables in the research. It was used the method (Range and category length) to divide the independent variables to the (3 categories), these variables (age, size of farm, Sources of information on the use of mineral fertilizers) and to divide the categories of dependent variable also, as following:

Range = $Y_{max} - Y_{min}$ (max value – min value)

$$\text{Category Length} = \frac{\text{Range}}{\text{Number of categories}}$$

3. RESULTS AND DISCUSSION

3.1 Identify the Social, Personal, Economic and Communicative Characteristics of Farmers in Janowski County

3.1.1 The age

Result shows that the highest age of farmers in the research sample is 67 year, and the lowest age is 35 years, farmers were distributed to three categories according to this variable, as described in the Table 1.

Table 1. Distribution of farmers to categories according to the age

Categories (year)	Frequency	Percentage
(35-45) Low	9	18
(46-56) Medium	37	74
(57- 67) High	4	8
Sum	50	100%

Mean 48 year, standard deviation 6.23

The Table 1 showed that the proportion 74% of farmers fall in the medium category, while the proportion of low category is 18%, and the proportion of high category is 8%. Showing that the medium category, constitute the highest percentage of farmers.

3.1.2 Gender

Farmers were distributed to two categories according to this variable, as described in the Table 2.

Table 2. Distribution of farmers to categories according to the gender

Categories	Frequency	Percentage
Male	43	86
Female	7	14
Sum	50	100%

The Table 2 showed that the proportion 86% of the research sample from males, and the 14% of sample from females. Showing that the male's category constitutes the highest percentage of farmers.

3.1.3 Educational level

Farmers were distributed to three categories according to this variable, as described in the Table 3.

Table 3. Distribution of farmers to categories according to the education level

Categories	Frequency	Percentage
Primary school	14	28
Secondary school	31	62
High school	5	10
Sum	50	100%

The Table 3 showed that the proportion 62% of farmers fall in the category of (secondary school). While the proportion of category of (Primary school) is 28%, and the proportion of the category of (high school) is 10 %. Showing that the category of (Secondary school) constitute the highest percentage of farmers.

3.1.4 Size of farm

Result shows that the highest size of farm of farmers in the research sample is (60 ha.), and the lowest size of farm (1 ha.) Farmers were distributed to three categories according to this variable, as described in the Table 4.

Table 4. Distribution of farmers to categories according to the size of farm

Categories (ha.)	Frequency	Percentage
(1-20) Low	38	76
(21-40) Medium	7	14
(41-60) High	5	10
Sum	50	100%

Mean 45 ha. Standard deviation 11.33

The Table 4 showed that the proportion 76% of farmers fall in the low category. While the proportion of medium category is 14%. The proportion of high category is 10%. Showing that the low category, constitute the highest percentage of farmers.

3.1.5 Sources of information on the use of mineral fertilizers

Results showed that the highest of numeric value which represents the (sources of information on the use of mineral fertilizers) for farmers in the research sample is 20 and the lowest value is 3. Farmers were distributed to three categories according to this variable, as described in the Table 5.

Table 5. Distribution of farmers to categories according to the sources of information on the use of mineral fertilizers

Categories (numeric values)	Frequency	Percentage %
(3-8) Low	4	8
(9-14) Medium	44	88
(15-20) High	2	4
Sum	50	100%

Mean12.54, standard deviation 2. 95

The Table 5 showed that the proportion 88% of farmers fall in the medium category. While the proportion of low category is 88%, and the proportion of highest category is 4%. Showing that the medium category constitutes the highest percentage of farmers.

3.2 Identify the Level of Use of Mineral Fertilizers among Farmers in Janowski County

The result shows that the highest of numeric value that obtained by farmers is 121, and lowest value is 29. The total mean of use of mineral fertilizers is 75. It is the values that accounted for the application level of farmers in use of mineral fertilizers. Farmers were distributed into three categories according to the application level of farmers in use of mineral fertilizers, as described in the Table 6.

Table 6 showed that the highest proportion of farmers were in the medium category, which accounted for 70%, and the proportion of farmers in the high category, accounted 24%. While the proportion of farmers were in the low category, which accounted 6%. This indicates that the level of use of mineral fertilizers for farmers is medium and tends to high degree. This means that the

most farmers in the Janowski region, they have information and knowledge on the use of mineral fertilizers in agriculture and other uses, especially information related to the use of lime fertilizers on the soil.

Table 6. Distribution of farmers to categories according to the use of farmers of mineral fertilizers

Categories (numeric values)	Frequency	Percentage %
(29-59) Low	3	6
(60-90) Medium	35	70
(91-121) High	12	24
Sum	50	100%

Mean 75, standard deviation 3.97

3.3 Estimate the Level of Use of Mineral Fertilizers in Each Item of Use of Mineral Fertilizers

The result shows that the items which took the first rank in use the mineral fertilizers according to the centennial weight of items, are (I use of lime fertilizers on the ground surface with lime spreader and then incorporated into the soil) in the centennial weight (97.75%). This shows that the farmers have more information and knowledge about use of lime fertilizers into the soil. The item which took the last rank in use the mineral fertilizers according to the centennial weight of items, are (I use the foliar fertilization together with the application of pesticides) in the centennial weight 57 %. This shows that farmers have low information and they don't have enough knowledge about how using the foliar fertilization together with the application of pesticides. As show in Table 7.

3.4 Identify the Correlation between the Level of Use of Mineral Fertilizers among Farmers and Independent Variables: (Table 8)

3.4.1 The correlation between the use of mineral fertilizers and age

The result shows, the value of Pearson correlation coefficient equal to 0.2520 and it is not significant (p-value 0.1401). (Table 8 explain that). It means there is no correlation between the level of use of mineral fertilizers among the farmers and the age. This means that the level of use of mineral fertilizers does not depend on age of farmer, and that the elderly farmers and young farmers they use the fertilizers in same level. (Table 8). This result agrees with the results of study [8,9].

3.4.2 The correlation between the use of mineral fertilizers and gender

The result shows, the Spearman correlation coefficient is equal to 0.3500 and it is significant (p-value 0.0084**). (Table 8 explain that). It means there is positive correlation between the level of use of mineral fertilizers among the farmers and the gender. This means that the level of use of mineral fertilizers depend on gender of farmer. Perhaps, the (males, females) have a different information level of use of mineral fertilizers and their resorting to the different sources for scientific recommendations in use of mineral fertilizers. (Table 8). This result agrees with the results of study [10,9].

3.4.3 The correlation between the use of mineral fertilizers and education level

The result shows, the Spearman correlation coefficient is equal to 0.3210 and it is significant (p-value 0.0058**). (Table 8 explain that). It means there is positive correlation between the level of use of mineral fertilizers among the farmers and the educational level. This may be due because the farmers who have a higher education, they have the higher information and knowledge about use of mineral fertilizers, which they obtained through stages of education that associated with use of mineral fertilizers, especially information related to the lime and NPK fertilizers and how to use it in the soil and how to sprinkle on the soil (Table 8). This result agrees with the result of study [11,12].

3.4.4 The correlation between the use of mineral fertilizers and size of farm

The result shows, the value of Pearson correlation coefficient equal to 0.3410 and it is not significant (p-value 0.1094) (Table 8 explain that). It means there is no correlation between the level of use of mineral fertilizers among farmers and the size of farm. This may be due to the farmers who have a large and small farms, they have same information of using mineral fertilizers in different size of farm. This result agrees with the results of study [13,14].

3.4.5 The correlation between the use of mineral fertilizers and sources of information on the use of mineral fertilizers

The result shows, the value of Pearson correlation coefficient equal to 0.5200 and it is not significant (p-value 0.1532). (Table 8 explain that). It means there is no correlation between the level of use of mineral fertilizers among the farmers and the sources of information on the use of fertilizers. This may be due to the farmers who have many contacts and low contact with the sources of information about mineral fertilizers, the have the same information about the use of mineral fertilizer sources (Table 8).This result agrees with the result of study [15].

Table 7. Ranking the items of the mineral fertilizers according to the centennial weight of item

No.	Items	Maximum score for item	Mean of item	The centennial weight of item
1	I use of lime fertilizers on the ground surface with lime spreader and then incorporated into the soil.	4	3.91	97.75
2	I use of lime to reduce soil acidification.	4	3.87	96.75
3	I use the nitrogen fertilizers before seeds sowing, on the ground surface with spreader and then they are incorporated into the.	4	3.76	94
4	I use nitrogen fertilization because it helps to increase the sugars in plants.	4	3.75	93.75
5	I use the mineral fertilizers to increase crop yields.	4	3.73	93.25
6	I use the doses of nitrogen fertilizers depending on nutritional requirements of crops.	4	3.68	92
7	I use the doses of lime depending on the pH and the texture of the soil.	4	3.65	91.25
8	I use the doses of lime depending on the sensitivity of plants to soil acidification.	4	3.62	90.50
9	I use the nitrogen fertilizers depending on the nutritional requirements of the crops.	4	3.54	88.50
10	I use the phosphorous and potassium fertilizers before plowing and sowing.	4	3.38	84.50
11	I use always the doses of nitrogen fertilizers accordance to the EU nitrates directive to avoid the risk.	4	3.34	83.50
12	I use the lime fertilizers after harvesting crop, before sowing and plowing.	4	3.32	83
13	I use the doses of nitrogen fertilizers depending on the method of utilization of the crop.	4	3.16	79
14	I use the approximately half 4the dose of nitrogen fertilizers are applied before sowing of crops.	4	3.12	78
15	I use the doses of nitrogen fertilizers depending on the expected yield.	4	3.08	77
16	Nitrogen fertilizers are used to increase the protein content in plants.	4	2.86	71.5
17	I use the lime fertilizers every 3-4 years	4	2.86	71.5
18	I use the microelement fertilizers only in the case of their low abundance.	4	2.79	69.75
19	I use the phosphate fertilizers depending on the abundance of the soil in this nutrient.	4	2.76	69
20	I use the foliar nutrition of plants with urea is used together with magnesium and microelements in the period of intensive vegetative growth of crops.	4	2.76	69
21	I use the foliar fertilization an amount of about 300-400 liters of solution per hectare.	4	2.74	68.30

No.	Items	Maximum score for item	Mean of item	The centennial weight of item
22	I use the potassium fertilizers depending on the abundance of the soil in this nutrient.	4	2.71	67.75
23	I use the approximately 1/2 dose of nitrogen fertilizer as top dressing in the form of solid fertilizers.	4	2.71	67.75
24	I use the mineral fertilizers to increase soil fertility.	4	2.67	66.75
25	I use the doses of phosphate and potassium fertilizers depending on the abundance of the soil in available forms of these elements.	4	2.67	66.75
26	I use the foliar fertilization with nitrogen in a dose of up to 20% of N requirements of crop.	4	2.59	64.75
27	I use potassium fertilization because it gives the plant's immunity against diseases:	4	2.50	62.50
28	I use the sulfur, magnesium and microelements fertilizers depending on abundance of the soil in that nutrients.	4	2.49	62.25
29	I avoid excessive use of nitrogen fertilizers because it lead to increase dispersion of the nitrogen in the environment.	4	2.30	57.50
30	I use the foliar fertilization together with the application of pesticides.	4	2.28	57

Table 8. The correlation between the level of use of mineral fertilizers among the farmers and independent variables

No.	Independent variables	Person correlation	Spearman correlation
1	X1 The age	0.1401	
2	X2 Gender		0.0084**
3	X3 Educational level		0.0058**
4	X4 Size of farm	0.1094	
5	X5 Sources of information	0.1532	

(**) Significant at the level (0.01)

4. CONCLUSIONS

Author concludes from this research: that farmers in Janowski region have medium information and knowledge in the use of mineral fertilizers in agriculture, especially in subjects (use of lime fertilizers on the ground surface with lime spreader and then incorporated into the soil and use of lime to reduce soil acidification). Also, the variables (gender, educational level) have an effecting role on the use of mineral fertilizers by farmers, and that the research variables (age, size of farm, and sources of information on the use of mineral fertilizers) have no effect on the use of mineral fertilizers by farmers in the Janowski region.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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