



POLLUTION OF AGRICULTURAL LANDS BY FERTILIZERS AND PESTICIDES ON EL-GUBBA AND EL-ABRAQ AREA IN LIBYA

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ABSTRACT

Around 151 farms were studied at EL-Gubba and Alabraq area, one of the important agricultural zones of EL-Jabal EL-Akhdar (the green mountain) located north of Libya at an altitude ranging between 600 - 800 meters above sea level. The area is characterized by a semi-humid climate with an annual average temperature of 18 degrees Celsius and average annual rainfall of about 382 mm/year. The main crop products of the area are: Cereals, Vegetables and Fruits. Chemical analysis showed that soil is alkaline (pH 8.4 - 9.2) and the electrical conductivity ranging between 0.96 - 2.09 dS/m. High proportion of heavy metals was recorded, Cadmium concentrations ranged between (0.02-0.15 mg/kg). Lead concentrations ranged between (0.1 - 0.63 mg/kg). Mercury concentrations ranged between (0.03 - 0.06 mg/kg) and Copper concentrations between (0.68 - 2.11 mg/kg) all exceeding the respective permitted limits, these results clarify a high soil pollution by Fertilizers and Pesticides. The study showed also that most farmers do not apply crop rotation and they lack the information and knowledge needed for the application of pesticides and fertilizers (1.3 % only have the knowledge) and the adequate management of farms (53 % are illiterate), (76.8 %) of them are applying chemical control against pests instead of mechanical or biological control, and only (0.7 %) are accurate in the use of Fertilizers and Pesticides. Other human activities are covered in this study.

KEYWORDS: Agricultural lands, pollution, fertilizer, pesticides, El-Gubba, Alabraq, Libya.

1. INTRODUCTION

Agriculture is one of the main pillars of economy, and one of the most important productive sectors, and the main land use activity in many countries. But it causes a variety of miscellaneous hazards in the properties of soil in agricultural areas, which in turn it depends on a variety of complex and interrelated factors, like chemical and physical properties of soil, climate, nature of biological process in the soil, systems used in agriculture (whether primitive or modern applications), intense machinery uses, type of applications whether irrigated or dry farming, degree of use of fertilizers and pesticides, and cultural and social level (Ahaway, 1968). These intensive agricultural activities also caused a high degree of pollution of agricultural lands due to the application of pesticides and fertilizers in order to increase productivity. But this intensive application reached in many instances the underground and surface water as well (Camerlynch and Velghe, 1979). More over the pollution of surface water or underground water by Nitrite increased due to the continuous adding amount of nitrogenous fertilizer (Hallberg, 1987). The continued addition of fertilizer to the soil resulted in increased content of heavy metals in form of impurities mixed with fertilizer, although the amount of pollution may be little, but this may contribute to the accumulative effects in plants, including the alteration of water content (Swaine, 1962). Since EL-Jabal AL-Akhdar particularly EL-Gubba and EL-Abraq areas constitutes a significant portion of the cereal production of eastern Libya, Vegetables and Fruits are also included, so it is necessary to put an end to the excess surplus in dealing with these

chemical fertilizers and pesticides to protect this important agricultural areas from pollution and to protect the people themselves who consume the contaminated agricultural products from the risk of these chemical compounds. This study aimed to investigate, the degree of contamination in this agricultural area by heavy metals because of the concomitant intensification of the use of fertilizers and pesticides, also aims to identify how farmers deal with these chemicals and to assess the adherence to proper methods of use and their knowledge about the environmental damage caused by the bad use.

2. STUDY AREA

The study area is located at the north-east part of Libya at an important locality of AL-Jabal EL-Akhdar mountain, at an elevation between 600 and 800 meters above the sea level, and extends along the coastal road link between EL-Baida and Derna cities, the length of the region is around 44 km and its width varies between 3 to 10 kilometers. Coordinates 19 - 20:10 east and 32:50 - 33 north, there are about 167 Farms in the region, each has an area not less than 25 hectares. The soil belongs to the order Mollisols which is widespread in dry and sub-humid regions and it is classified under Rendolls class, which is rich in Calcium carbonate and is immature and does not have a deep profile on the prospects for (Ben Mahmoud, 1995). The farms are distributed through wide area of rocky lands. Average annual temperature in the study area is about 18 degrees Celsius. December, January and February are the rainy and coldest months of the year, with temperatures that sometimes reach zero on cold nights during winter, the temperature rise gradually during spring to reach its highest degrees during summer. July, August and September are the warmest months of the year, the temperature sometimes exceed 35 degrees Celsius on hot days during summer. The prevailing wind is North and North-West especially in summer. In winter, the wind blow from several directions, the average annual wind speed fluctuates between 4 to 6 meters/second. The rain is considered the most important phenomenon in the region, while Frost, Snow are rare. Rainfall decreases gradually to reach the minimum rate during summer months, the average annual rainfall for the region is 382 mm/year. Percentage of relative humidity is about 78% during winter, in summer it have the minimum percentage which reach approximately 55%, due to the effect of hot waves associated with the south warm dry winds (EL-Ghibli) and the lack of rainfall during this season.

3. MATERIALS AND METHODS

This study included a survey of about 151 Farms in EL-Guba and Al-Abraq area, which produces several types of vegetables, fruits and Cereals. The sources of data for this research were as follow:

3.1. QUESTIONNAIRE

151 Questionnaires were distributed to 151 Farmers in the study area, to identify the types of agricultural crops, sources of irrigated water, pests that afflict Farmers, control methods used, techniques of improving soil fertility and the important pesticides and fertilizers applied and to understand the extent of knowledge of Farmers concerning pesticide pollution, the degree of concern of Farmers about risks of environmental pollution.

3.2. FIELD STUDY

Intensive field survey was conducted, including all farms, personal interviews, and visits and meetings of the Secretariat of Agriculture and Livestock in the region (the responsible authorities).

3.3. CHEMICAL ANALYSIS

30 soil samples were collect from the study area at a depth of 0-30 cm indiscriminately to represent most of the study area, they have been kept in nylon bags and Coded, then they transported to the laboratory, air dried and chemically analyzed, as stated in Black et al., (1965). The obtained data was tabulated and statistically analyzed using statistical package (SPSS).

4. RESULTS AND DISCUSSION

Through the chemical analysis it was found that the soil pH trend to be alkaline, it ranged between 8.4 - 9.2, which is due to the nature of the composition of the soil formed from parent rock that has high calcareous composition. The value of electrical conductivity ranged between 0.96 2.09 dS/m, which indicates little increase in the proportion of soil salinity, this may be due to faulty irrigation in agricultural land, and high evaporation rates. As shown by chemical analysis, presence of significant proportions of heavy metals (Cadmium, Lead, Copper and Mercury) because of the intensive use of chemical fertilizers and pesticides over long period of time. Its well known that fertilizers always are contaminated by heavy metals, so it is always cause pollution of soil with heavy metals, The high proportion of these heavy metals in soil may affect the cultivated plants, as indicated

by Cottenie *et al.*, (1982) that the plants may absorb the elements and minerals not needed, but due to availability and high concentrations in the soil, so they are absorbed by plants, such as Zn, Fe, Ni, Cd, Mo, Pb, which is highly absorbed in plant tissues. The chemical analysis of cadmium percentage in the soil on the study area exceeds the limits of 0,005 mg/kg with an overall average of 0,073 mg/kg, the least value was 0.02 mg/kg, while the highest value was 0.15 mg/kg. That may be due to high addition rate of phosphate fertilizer, most farmers are using ammonium di-phosphate fertilizer in order to increase soil fertility. According to Hann (1987) and Adriano, (1986) the increase rate of nitrous or phosphate fertilizer emancipate soil cadmium. The amount of emancipation amount depends on the properties of soil and rate of biological activity. Boo (1990) also found that phosphate fertilizers are always the source of soil pollution by many heavy metals such as Cadmium. Lead in soil on the study area exceeds the limits of 0.04 mg/kg with an overall average of 0,387 mg/kg, the least value was 0.10 mg/kg, while the highest value was 0.63 mg/kg (refer to Figure 1), these high values are a result of excessive use of pesticides and fertilizers by farmers, this went in line with Mortvedt and Giordano (1977), they clarified that Cadmium, Lead and Zinc come up to the environment from a number of ways including the use of fertilizers or pesticides of phosphorous content. As the proportion of Mercury in the soil of the study area exceeds the limits of 0.03 mg/kg, with an overall average of 0.04 mg/kg, the least value was 0.03 mg/kg while the highest value of 0.06 mg/kg, the high concentration of this metal is due to the use of a large amount of pesticides particularly Superkil, applied in all farms as the sole insecticide against many pests. The times interval of the application of this pesticide by Farmers varies between 1 to 10 times a year. The proportion of Copper in the soil also exceeds the limits of 0.10 mg/kg with an overall average of 1.29 mg/kg, the least value was 0.68 mg/kg, while the highest value was 2.11 mg/kg, this high level is due to the excessive use of Copper content pesticides against fungal infections, as well as phosphate fertilizers, this agree with the findings of Mortvedt *et al.*, (1981) that the addition of Ammonia di-phosphate fertilizer in North Carolina led to an increase in the ratio of a number of heavy metals, including Copper.

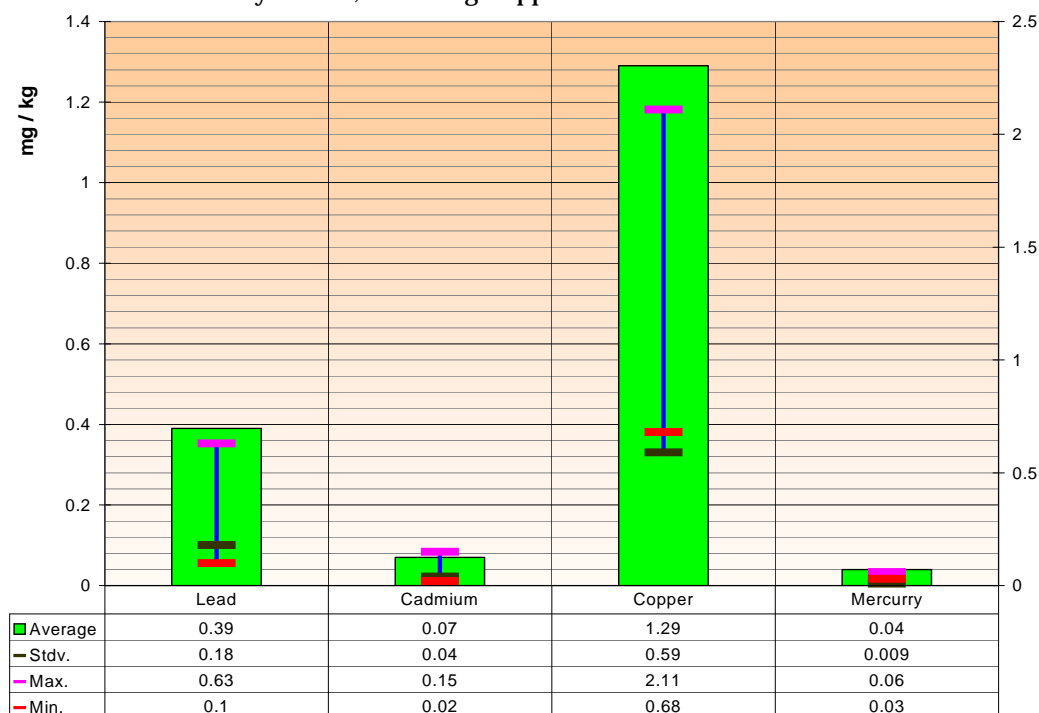


Figure 1. Heavy metals measurements

The trend of farmers towards the irrigated agriculture which has necessitated the increased use of fertilizers to improve soil fertility, and increasing the use of chemical pesticides for pest control which has spread due to the expansion of irrigated agriculture, and the planting of new kinds of crops in this region. It was clear that about 50% of the farms turned to the irrigated agriculture and so to the use of chemical fertilizers to increase the fertility of soil and used chemical pesticides to control many kinds of pests. The proportion of Farmers who have been added fertilizer to the soil was about 94% (Figure 2), while that who used pesticides was 77% (Figure 3). This refers to the spread of the pests in this region. The study shows that educational qualifications of Farmers is very low, where rate of low illiteracy was about 53%, while rate of moderate level of education was about 14.1%, which resulted in

lack of expertise and knowledge of pesticides and fertilizers and the proper ways to deal with. It was revealed that about 2 % of farmers have good knowledge about pesticides and fertilizers, 66.9% have moderate knowledge, while 31.1% were without any knowledge at all (See Figure 4). 2% of the Farmer's knowledge source of pesticides and fertilizers was through study, 2% through self-education and about 96% through exchange of experience between farmers or just through rely solely on the label on pesticides and fertilizers containers without any scientific or cultural knowledge. Also the study clarified that about 6.1% of the Farmers are aware about environmental pollution and its risks, while 93.9% are not familiar with this subject at all. The striking thing is only 0.65% of the Farmers control the application of pesticides and fertilizers accurately, while 55.55% have moderate accuracy, where about 43.8% are not accurate, however, the addition of fertilizers and pesticides and the treatment with these chemical in this area is haphazard (Figure 5).

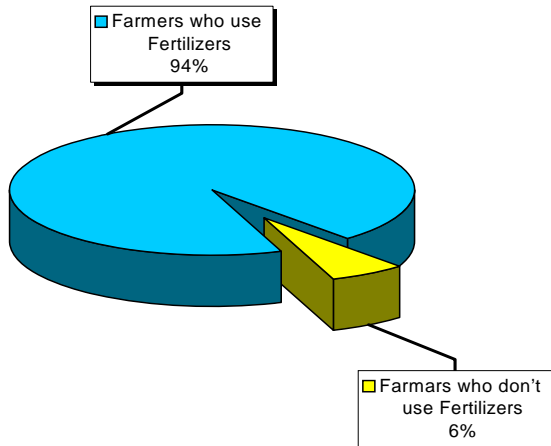


Figure 2. Using the fertilizers by Farmers

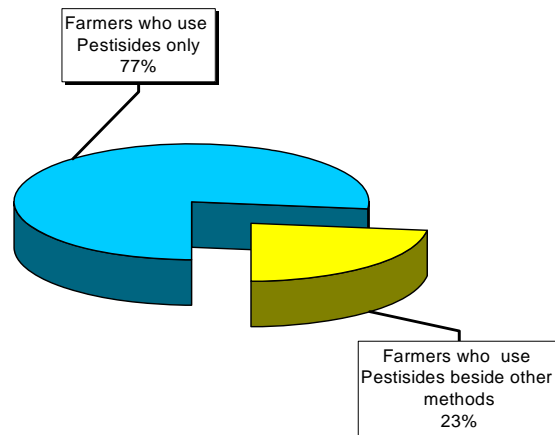


Figure 3. Using the pesticides by Farmers

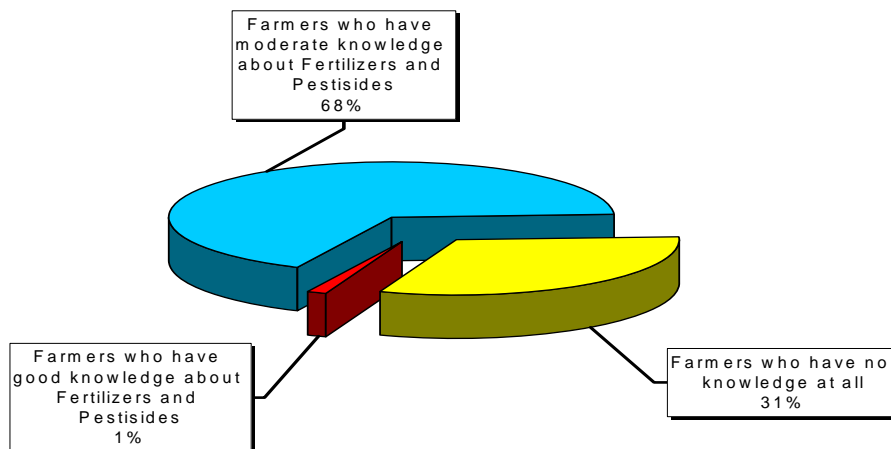


Figure 4. Using the fertilizers by Farmers

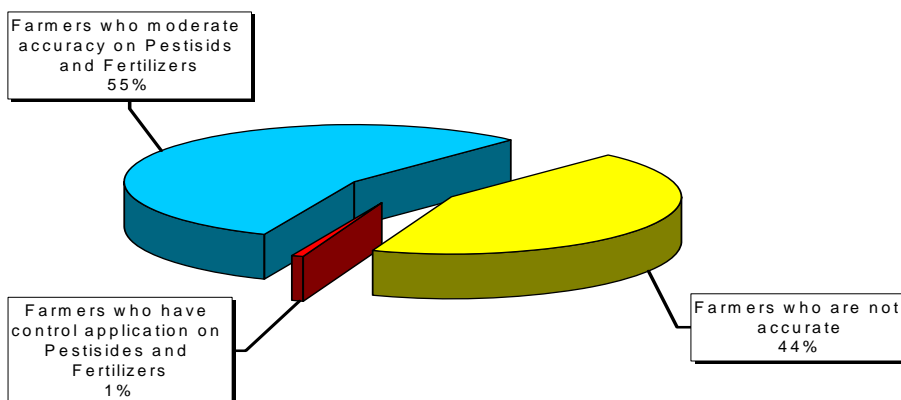


Figure 5. Using the fertilizers by Farmers

The percentage of Farmers who are equipped and able to measure and control the application of fertilizers and pesticides is only 0.65% and those who are not able and don't have the capabilities constituted 99.35%, this mean that the application of these chemicals compounds is not controlled. It was also found that 1.3% of the Farmers claim from insects only, while 98.7% of the Farmers claim from diseases, insects and weeds together. Also 77% of the farmers use the chemical control against the pests, besides limited mechanical control against weeds as Ploughing (both deep and surface), burning, pulling out or harvesting. It is clear that the region's farmers do not use other methods to control pests such as the use of crops rotations to overcome the spread of pests, or use of biological treatment, or planting specific kinds of crops that have high resistance against pests, which spread in this region. The main type of fertilizers used by Farmers is Urea at the rate of 0.2 to 0.4 tons/ha, and Ammonia di-phosphate at a rate between 0.2 to 0.6 tons/ha, as well as the use of organic fertilizers with non determined quantities. It has been observed during this study that the Farmers in this area did not follow crop rotations, due to the lack of awareness, and there were lack of any official role control, which also mentioned by (Brullo, 1979).

5. CONCLUSION

A general conclusion can be drawn from this study as following:

- ✚ The heterogeneity of farms in the study area led to a lack of accuracy in the organization and the existence of differences in production and problems in dealing with agricultural pest control operations and programming.
- ✚ The limited knowledge and education of farmers, and the absence and the lack of standards, both to control the production, pest control or regulate the rest of agricultural activities.
- ✚ The Farmer's turning towards irrigated agriculture and drilling of more and more wells and the avoidance of rainwater harvesting.
- ✚ Increasing rates of application of pesticides and chemical fertilizers which assures the aggravation of soil pollution in the coming future.
- ✚ This area can be regarded as a region of heavy metals pollution resulting from the heavy usage of pesticides and fertilizers without knowledge and without the proper application.

6. RECOMMENDATIONS

- ✚ Sever control of the import, distribution and application of pesticides.
- ✚ Activating the role of oversight and follow-up and increase the penalties for violators.
- ✚ There is a big need to establish a specialized laboratory for the analysis of pollutants in the region.
- ✚ Raise awareness of damage and risks of Fertilizers and Pesticides, and the proper methods of use among the Farmers, and citizens as consumers and also include officials at all facilities and sectors.
- ✚ Management information and education campaigns via TV, Radio programs, Lectures, seminars, newspaper articles, magazines and posters to spread awareness and to clarify the risks of environmental pollution on the surrounding environment and on the humans.

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