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Effect of changes in some beneficial elements and dangerous heavy metals in cow and sheep manure on human and animal health and the environment

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Abstract--Cow and sheep manure contains beneficial nutrients nitrogen (N) carbohydrates (CHO) and Organic matter (OM), and is therefore used as an organic fertilizer. However, the excessive use of manure can cause environmental problems and negatively affect human and animal health because these materials also contain large amounts of heavy metals, especially selenium (Se), nickel(Ni), cobalt(Co), tin(Sn), lead(Pb), and cadmium(Cd) To assess the potential risks due to increased concentrations of heavy metals in sheep and cow manure. The compost was collected from three different regions in Kirkuk, Diyala and Sulaymaniyah governorates in Iraq and Kurdistan Region where the results showed The content of cow and sheep manure of organic matter (OM), carbohydrates (CHO) and nitrogen (N) levels were normal, which are beneficial nutrients for soil and plants and used as organic fertilizer. The level of selenium, nickel and cobalt was higher in cow manure compared to sheep manure in all governorates. The level of lead and cadmium was higher in sheep manure in Diyala governorates compared to cow manure. We conclude from this study that cow and sheep manure is useful and nutritious

for soil and plants and reduces environmental pollution as it is useful for recycling waste and reduces the risk to human health.

Keywords---Sheep Manure, Cow Manure, Heavy Metals, Environment.

Introduction

Traditionally known as cattle manure as a rich fertilizer until the beginning of the twentieth century, the use of manure was the only way to enrich the soil in farms. The use of manure to provide nutrients to agricultural crops is the best way to reduce the use of mineral fertilizers (Sommer et al., 2013)(Petersen et al.,2007). The intensification of livestock farming has raised concerns about soil fertilization associated with livestock manure management [Nicholson et al 1999; Leclerc and Laurent, 2017). Pollution of the environment and nutrients leads to the accumulation of some metal elements in the human and animal bodies, which leads to the inhibition of chemical reactions and enzymes in the cells, and this leads to an imbalance in the organs and tissues of the body as it has a toxic effect. The evaluation of the levels of minerals in the environment and food in order to assess their harmful effect on human and animal health (Oymak et al., 2017). Environmental pollution is one of the issues that threaten human and animal health across the globe. Recently, pollution has increased due to rapid population growth and unscientific indiscriminate exploitation of natural materials (Yabe et al., 2011). Heavy metal poisoning is a major health and environmental problem and is dangerous due to bioaccumulation (Ayciek et al., 2008). This causes serious effects on human and animal wealth and this is due to the level of available components and the absorption of them by the plant (Aschner et al., 2002). Recent studies have shown that pollution of the environment and nutrients with toxic metals has reached unprecedented levels during the past decade and that human exposure to toxic metals has become a health hazard in the world (Yabe et al., 2010). High levels of heavy metals in soil may lead to increased uptake by plants, which may be consumed by animals (He et al., 2005)(Wang et al., 2017). Sheep manure can be used as fertilizer for plants as nutrients and does not negatively affect the environment (Palani et al., 2019), The use of organic fertilizers is not only a means to effectively reuse agricultural waste resources, but also an agricultural waste management method. To better understand the effect of these factors on the accumulation of heavy metals in the Cow and sheep manure, three different areas were selected and cows and sheep grazing on pastures to study the levels of some minerals in terms of benefits and harms. The main objective of the study was to determine the effect of Cow and sheep manure on the compositions of some heavy metal elements selenium (Se), nickel(Ni), cobalt (Co), tin (Sn), lead (Pb), and cadmium (Cd) and on beneficial nutrients such as nitrogen (N), carbohydrates (CHO), and organic matter (OM), Another objective was to determine the input-output balance of these components for a pasture in a livestock-intensive environment. And use the results to assess soil concentrations of heavy metals and beneficial elements in the study areas.

Materials and Methods

The current study was conducted during the summer season, 8 sheep and 8 cows were used for each of the different regions of Diyala, Kirkuk and Sulaymaniyah governorates in Iraq. Samples of Cow and sheep manure were collected after attaching the bags to the animals and collected in the early morning before being taken out to grazing and placed in special plastic bags for a week., then The Cow and sheep manure was dried in a semi-open building, mixing the manure of each animal taken daily for a week. In addition, Cow and sheep manure of each animal put in pasteurized (sterilizer) closed container and saved in the refrigerator (frozen) until the chemical analysis is carried out. Where 200 mg was taken after dilution with 1-4 sulfuric acid (H₂SO₄), and HClO₄ perchloric acid for 16 hours, and added to 50 ml of distilled water. Chemical analyzes of nitrogen, carbohydrates and organic matter were performed by A.O.A.C (2005). Where the ICPE-9000 device from Japanese Shimadzu was used to assess the mineral level in Cow and sheep manure, the experimental design was a complete factorial random design (CRD). The data were analyzed using the ready-made statistical program XLstat (2017) according to the following mathematical model: $Y_{ijk} = \mu + A_i + B_j + AB_{ij} + e_{ijk}$ where: Y_{ijk} : the observational value of the experimental unit, μ , the general average, A_i : the effect of the additive factor, and B_j : the effect of the period factor. And AB_{ij} : the effect of the interaction between the two factors and e_{ijk} : the value of the random experimental error for that experimental unit and it is distributed normal and independent, then compare the significant differences using Duncan's polynomial (Duncan, (1955) within the program.

Table (1)
The level of some chemical properties in sheep and cow manure

Impact Place	Comparison	N%	CHO%	OM%
Kirkuk	cow	3.1 a ± 0.2	7.5 a ± 0.4	75.9 a ± 0.3
	Sheep	2.5 b ± 0.1	6.2 b ± 0.2	73.1 b ± 1.1
Diyala	cow	2.7 a ± 0.1	7.7 a ± 0.3	74.2 a ± 0.9
	Sheep	2.9 a ± 0.2	6.0 b ± 0.2	74.8 a ± 0.9
Sulaimaniyah	cow	3.3 a ± 0.2	7.1 a ± 0.3	73.3 a ± 0.7
	Sheep	2.4 b ± 0.1	6.6 a ± 0.4	75.6 a ± 0.9

Results and Discussion

This table (1) shows that there were no statistically significant differences between the regions for cow manure in organic matter (OM), carbohydrates (CHO) and nitrogen (N) and their levels were normal. Where the level of nitrogen (N) and

organic matter (OM) of sheep manure was higher in Diyala governorate, while the level of carbohydrates (CHO) was higher in Sulaymaniyah governorate.

Means with different letters within each column differ significantly ($P \leq 0.05$) according to Duncan's test. Animal fertilizers are an important source of nutrients for land and crops, are convenient to use, and can reduce environmental and human health impacts and maximize agricultural value, reuse can enhance productive use of manures and prevent environmental problems (Shober and Maguire, 2014). In addition, the use of animal manure as fertilizer for plants can replace commercial chemical fertilizers, raising the value of crops by meeting the nutrient needs of crops and reducing the risk of water contamination (Sutton, 1994). Moreover, the nutrients from animal manure have an economical and nutritious profit (Brown, 2013). Because these nutrients are necessary for the plant, nitrogen is considered one of the essential nutrients for plant growth and is absorbed by the plant from the soil. Also, a typical plant contains 1.5% of the dry weight; (Mahler, 2004). In addition, according to (Moreno -Caselles et al. 2002) Fertilizer use is beneficial in arid and semi-arid environments because the organic matter acts as a reservoir, preventing leaching and bioaccumulation. It also acts as a source of nutrients and organic matter in dry and semi-arid soils (Moral, 2008; and Moreno-Caselles, et al 2002). In the research of (Angers and N'dayegamiye 1991) it was proved that carbohydrates of microbial and plant origin are improved when manure is applied to the soil.

Table (2)

Selenium (Se), nickel (Ni) and cobalt (Co) concentrations for Kirkuk, Diyala and Sulaymaniyah regions in sheep and cow manure

Impact	Comparison	Se/ppb	Ni/ppb	Co/ppb
Kirkuk	cow	159.9 a \pm 6.7	23.1 a \pm 1.0	0.3 a \pm 0.0
	Sheep	149.5 a \pm 6.0	14.9 b \pm 1.2	0.1 b \pm 0.0
Diyala	cow	172.3 a \pm 3.6	21.6 a \pm 1.4	0.2 a \pm 0.0
	Sheep	137.0 b \pm 4.1	16.4 b \pm 1.5	0.2 a \pm 0.0
Sulaimaniyah	cow	154.9 a \pm 8.1	20.6 a \pm 1.4	0.2 a \pm 0.0
	Sheep	154.5 a \pm 4.4	17.5 b \pm 1.8	0.2 a \pm 0.0

Means with different letters within each column differ significantly ($P \leq 0.05$) according to Duncan's test. The results in (Table 2) showed that the level of selenium, nickel and cobalt, there were no significant differences between regions in cow manure, while the level of nickel was higher in Kirkuk governorate compared to Diyala and Sulaymaniyah governorates. While significant differences were shown in sheep manure, where the level of selenium was higher in Sulaymaniyah governorate compared to Diyala and Kirkuk governorates. While there were no significant differences in the level of nickel, and there were significant differences in the level of cobalt, which was less in Kirkuk governorate compared to Diyala and Sulaymaniyah governorates. The level of selenium, nickel and cobalt was higher in cow manure compared to sheep manure in all governorates.

Table (3)
Tin (Sn), lead (Pb) and cadmium(Cd) concentrations for Kirkuk, Diyala and Sulaymaniyah regions in sheep and cow manure

Impact	Comparison	Sn/ppb	Pb/ppb	Cd/ppb
Kirkuk	cow	12.6 a ± 1.8	8.4 a ± 0.8	1.3 a ± 0.1
	Sheep	10.7 a ± 2.1	8.6 a ± 0.7	1.2 a ± 0.1
Diyala	cow	17.7 a ± 0.9	6.5 b ± 0.4	1.0 b ± 0.1
	Sheep	5.5 b ± 0.6	10.4 a ± 0.6	1.6 a ± 0.1
Sulaimaniyah	cow	12.7 a ± 2.0	7.4 b ± 0.6	1.2 a ± 0.1
	Sheep	10.6 a ± 1.9	9.5 a ± 0.9	1.4 a ± 0.1

Means with different letters within each column differ significantly ($P \leq 0.05$) according to Duncan's test. The results in (Table 3) showed that the level of tin there were no significant differences between regions in cow manure, while the level of tin was higher in Diyala province compared to Kirkuk and Sulaymaniyah provinces. While it showed significant differences in cow manure, where the level of lead was higher in Kirkuk governorate compared to Diyala and Sulaymaniyah governorates. While there were significant differences in the level of cadmium as it was lower in a higher governorate in Kirkuk and Sulaymaniyah governorates compared to Diyala governorate in cow manure. Significant differences appeared for the level of tin, and they were higher in sheep manure in Diyala governorate compared to Kirkuk and Sulaymaniyah governorates. Where the level of tin was higher in cow manure compared to sheep manure in Kirkuk and Sulaymaniyah governorates, and the highest level of cow manure was in Diyala governorate. The level of lead was higher in sheep in Diyala and Sulaymaniyah governorates compared to cow manure. The level of cadmium was higher in sheep manure in Diyala governorate compared to cow manure, and there were no significant differences between sheep manure and cows in Kirkuk and Sulaymaniyah governorates.

That the low level of selenium in Kurdi sheep is due to its low level in plants, and to its low concentration in the soil of Sulaimani governorate which is in Iraq Kurdistan Region (Palani., 2019). that dung is an important source of heavy metals in the environment and mentioned (Mahler .,2004), the micronutrients are essential for plant growth; However, an increase in the amount of the metal will lead to toxicity that leads to multiple direct and indirect effects in related plants, especially all physiological functions (Barcelo and Poschenrieder, 1990). Farm animals also rely heavily on their nutritional status (micronutrients) for their performance, and detoxification (Smith and Akinbamijo, 2000). In addition, (Soetan et al., 2010) levels of toxic elements in this study were below the toxic level and were also below levels recommended by Food, Environment and Health sources and organizations (Institute of Medicine, 2003). The long-term application of organic fertilizer containing trace metals can cause soil pollution. The long-

term application of organic fertilizer containing trace metals can cause soil pollution. In order to estimate the time scale (in years) during which the trace metal content of farmland soil would increase from background level to the maximum permissible limit as a result of using organic fertilizer according to Soil Environmental Quality Standard of Iraq and Kurdistan Region. This might be due to the fact that the study only considered the effects of manure on human health but not the risk of human health in the food chain. More research on other exposure pathways in the study area is needed in the future.

Conclusions

Reducing the impact of mineral inputs on agricultural soils is an important strategy to protect agricultural land and ensure food safety. Estimating the effect of adding compost on soils there is an urgent need for human health to develop sound management practices and policies, which requires information on the trace minerals present in organic fertilizers. In this study, This is considered as an adequate for use it as fertilizer for plants and which has no harmful effects on the environment and their levels within the limits allowed from Institute of Medicine (US) Considering that the introduction of heavy metals into the soil and food chain can have a potentially negative impact on environmental quality and on animal and human health, especially lead and tin, should be carefully considered.

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