Analysis of C-organic and total Phosphor (P$_2$O$_5$) contents of soil around egg-laying chicken farm

A B Abdullahi$^1$, A R Siregar$^2$, W Pakiding$^2$ and Mahyuddin$^3$

$^1$Doctoral Candidate in Agricultural Sciences, Postgraduate School of Universitas Hasanuddin
$^2$Faculty of Animal Science, Universitas Hasanuddin
$^3$Faculty of Agriculture, Universitas Hasanuddin

E-mail: alimababdullahi@pasca.unhas.ac.id

Abstract. Sustainable animal husbandry development should be environmentally friendly, meaning it doesn’t cause pollution and degradation of environmental quality, i.e. technically efficient, economically fit for use, socially acceptable and ecologically still ensuring the balance of other ecosystems. One of the resources which should be noted is the soil condition around the farm which is suspected to have degraded quality due to pollutions caused by farming activities. Based on that, the environmental test was performed by analyzing the C-Organic and Total Phosphor (P$_2$O$_5$) contents of soil around the egg-laying chicken farm. The present study was aimed to (1) know the C-Organic and P$_2$O$_5$ contents of soil around the egg-laying chicken farm; (2) compare the C-Organic and P$_2$O$_5$ contents of soil around the egg-laying chicken farm with the set assessment criteria for soil chemical properties (C-Organic and P$_2$O$_5$) for farmland. The present study was performed on October-December 2018, soil samples were obtained from locations around egg-laying chicken farms in Sidenreng Rappang Regency, South Sulawesi, Indonesia. The method used in testing the C-Organic and P$_2$O$_5$ contents of soil was spectrophotometric. The working procedure in the present study: (1) testing the C-Organic and P$_2$O$_5$ contents of soil in the location and around egg-laying chicken farm; (2) comparing the C-Organic and P$_2$O$_5$ contents of soil from the research result with the set assessment criteria of soil chemical properties (C-Organic and P$_2$O$_5$) for farmland. The research result showed that the average C-Organic content of the soil around the egg-laying chicken farm was 0.699% and the average P$_2$O$_5$ content of the soil around the egg-laying chicken farm was 159.2 mg/100 g. Based on the results, it’s concluded that the content of C-Organic soil around the egg-laying chicken farm is very low because < 1.0 % but P$_2$O$_5$ very high because of > 60 mg/100 g.

1. Introduction
Livestock development must be carried out with a pattern of sustainable development which is defined as an effort to manage and conserve livestock resources (land, water, and genetic resources) through the orientation of technological and institutional changes in such a way as to ensure the achievement of the required needs on an ongoing basis over time. Sustainable livestock development that takes into account aspects of conservation of natural resources, water and genetic resources of plants and animals must be environmentally sound, meaning that it does not cause pollution and degradation in the quality of the environment, that is technically appropriate, economically feasible, socially acceptable, ecologically it still guarantees the balance of other ecosystems. The implications of the development
of environmentally friendly livestock are: (1) Maintaining natural resource production capacity, (2) Reducing the impact of pollution and environmental degradation, (3) It can produce quality and hygienic high quality primary and secondary products, and (4) It can provide adequate employment and income for breeder [1].

Various obstacles are often found in the livestock sector, both related to capital, adequate knowledge, technology, and the area of land owned by the population. To overcome these problems, integrated efforts need to be made between the government, livestock breeders, and institutions related to the livestock sector. Especially for laying hens, in line with the growth of laying hens agribusiness, laying hens are often blamed as businesses that contribute to polluting the environment. Environmental pollution caused by chicken livestock, which triggers the problem actually due to the growing settlement. At the beginning of development, chicken livestock were established far from residential areas but over time the area surrounding the livestock became settlements. For that we need an improvement in the land use system in accordance with its designation. In this case the government has made a policy of using an area or livestock business area (KUNAK) so as not to interfere with each other between livestock and settlements [2].

One of the resources that needs to be considered is the condition of the land around the livestock which is suspected to have decreased quality due to contamination caused by human daily activities or caused by the existence of livestock business. Government Regulation No. 150 of 2000 stated that “Damage to the soil for biomass production is changing the nature of the soil that exceeds the standard criteria for soil damage” [3]. The balance between Carbon input and output is important for changes in C-Organic soils. Inputs include above-ground and below-ground plant residues, manure, compost, and so on, while the output is loss through water and wind erosion, gas flux associated with microbial and plant respiration, and deep washing. How quickly the residue breaks down follows the exponential decay function which is known to depend on the quality of the residue, management (residue, soil, and water), soil type, and climate [4].

When a dangerous or poisonous substance has contaminated the surface of the soil, then it can evaporate, be swept away by rain water and/or enter the ground. Pollution that enters the soil is then deposited as toxic chemicals in the soil. Toxic substances in the soil can have a direct impact on living things. Therefore, to determine soil damage due to pollution, it is necessary to analyze the soil. Soil analysis is carried out to evaluate soil fertility and to determine the condition and characteristics of the soil, such as nutrients, contamination, composition, acidity, mineral content and so on [5]. Based on this, a research was carried out to determine the nutrient content of the soil in this case limiting only seeing the content of C-Organic and Total Phosphor (P₂O₅) of soils around egg-laying chicken farm.

The purpose of this study was to determine the C-Organic and P₂O₅ content of the soil around the laying hens and to compare the C-Organic and P₂O₅ content of the soil around the laying hens with criteria to assess the chemical properties of the soil (C-Organic and P₂O₅) for predetermined agricultural land.

2. Methodology
This research was conducted in October-December 2018. Soil samples were obtained from locations around egg-laying chicken farm in Sidenreng Rappang Regency, South Sulawesi, Indonesia. This location is very interesting to study the quality of the soil because the area is quite developed and the population density is quite large and is the largest population of egg-laying chicken in South Sulawesi (South Sulawesi is the 5th province with the largest population of egg-laying chicken throughout Indonesia, while Sidenreng Rappang 60% of total population of egg-laying chicken in South Sulawesi).

The C-Organic and P₂O₅ soil content tests around egg-laying chicken were conducted at the Central Laboratory and Public Health of the Ministry of Health of the Republic of Indonesia in Makassar, South Sulawesi. The method used is UV-Vis (ultraviolet-visible) spectrophotometry. This spectrophotometry is a combination of UV and Visible spectrophotometry that is using two different
light sources, UV light sources and visible light sources. Although for more sophisticated devices already using only one source of light as a source of UV and Vis, namely photodiode equipped with a monochromator.

The working procedures in this research are: (1) testing the content of C-Orga and P_O_5 of soils found in and around egg-laying chicken farm; (2) comparing the content of C-Orga and P_O_5 of soils obtained from the results of research with the criteria for assessing the chemical properties of soils (C-Orga and P_O_5) for predetermined agricultural soils.

3. Result and Discussion
Healthy and fertile soils determine the success of farming business to obtain high productivity [6] with relatively low farm business input. The important role of soil as a factor of production is as a growth media for roots and nutrients for plants. In addition to functioning as a factor of production, soil also plays an important role in improving and maintaining environmental quality both locally and globally through the ability of the soil to filter pollutants so that water sources are not polluted, controlling the release of water to water bodies such as rivers or lakes and storing carbon to reduce greenhouse gas emissions [7]. With its complex and multi-dimensional functions, various forms of soil damage as a result of unwise management will have an impact on deteriorating soil quality and loss of most of these functions.

Soil fertility is related to the content of all nutrients in the soil that are needed by plants, so that plants can grow and develop properly. Soil is said to have a high/low level of fertility if the soil is able to provide all the nutrients needed by plants, while the soil is said to be less fertile if the soil is not able to provide all the nutrients needed by plants [5].

Plant growth is influenced by the properties of soil fertility, namely physical properties, chemical properties, and biological properties. The physical properties of soil are related to the physical state of the soil such as effective depth, texture, structure, humidity and soil air system. Soil chemical properties include soil reaction (soil pH), cation exchange capacity (CEC) Saturation of Bases (KB), organic matter, abundance of nutrients, nutrient reserves and availability of plant growth. Whereas soil biology includes the microbial activity of overhauling organic matter in the process of humification and binding of air nitrogen [8].

3.1. C-Orga content analysis
C-Orga states the number of organic compounds as a source of carbon elements present in the soil, including litter, fraction of light organic matter, microorganisms biomass, dissolved organic matter in water, and stable organic matter or humus [9].

In organic farming systems, increased C-organic soil can help the sustainability of soil fertility, protect soil and water quality related to nutrient, water and biology cycles, in addition to being a key indicator of soil quality and sustainability of agricultural system because it has an important role in influencing physical quality and soil productivity [10, 11]. Deposits of C-organic soil (soil organic carbon storage) can be a measure of C sequestration in soil [12]. In addition to weight (volume and content) of C-organic soil, soil depth also determines the amount of sequestration or stored C-organic soil [13].

The content of C-Organic soil around egg-laying chicken farm in Sidenreng Rappang Regency, South Sulawesi, Indonesia shown in table 1.

| Table 1. Tests results of C-organic soil content around egg-laying chicken farm. |
|-----------------|-----------------|-----------------|
| Location | Test Result (%) | Criteria for assessment of C-organic soil properties (%) |
|-----------|-----------------|----------------|
| 1         | 1.45            | <1.0 very low   |
| 2         | 0.53            |                 |
Based on table 1 above, it can be seen that the content of C-Organic soil around egg-laying chicken farm from 10 sampling points obtained C-Organic test results on average of 0.699%. Based on the criteria for assessing the chemical properties of the soil that have been determined, the soil around egg-laying chicken farm in Sidenreng Rappang Regency, South Sulawesi, Indonesia has a very low C-Organic content because <1.0%. This is caused by the texture of the soil, and possibly due to the impact of contamination caused by livestock business (improper waste management). Sipatuhar et al. [15] C-Organic content tends to decrease with increasing soil depth because organic matter is only applied or falls on the ground so that the organic material accumulates in the top soil layer and some of it is washed into the deeper layer (sub soil).

Low C-organic indirectly implies low production of organic matter in the research soil, because soil organic matter is one of the parameters that determines soil fertility. The value of C-organic in the research soil is low due to the very lack of vegetation in the research soil due to frequent cultivation for planting and transporting the remains of the harvest out of the planting area [16]. Furthermore, Nurmegawati et al. [17] stated that the content of organic material and C-Organic is influenced by the processing factor and the slope of the land.

3.2. Total phosphor content (P$_2$O$_5$)

Phosphor (P) is a type of nutrient needed by plants in relatively large quantities and is also included in macro nutrients, but the amount of P in the plant is known to be smaller than the Nitrogen and Potassium, but the role of P is very important for plants because the key to the life of these plants. Element P in the soil is obtained from various sources both from organic materials, artificial fertilizers, such as compost and soil minerals.

Total phosphor is an essential macro nutrient that plays an important role in various processes, such as photosynthesis, assimilation, and respiration. Phosphor is needed by plants for cell formation in the growing root and shoot tissues and to strengthen the stem so that it does not easily collapse in natural ecosystems [18].

The P$_2$O$_5$ content of the soil around laying chicken livestock in Sidenreng Rappang Regency, South Sulawesi, Indonesia shown table 2.
Table 2 it can be seen that the P$_2$O$_5$ content of soil around egg-laying chicken farm from 10 sampling points obtained an average P$_2$O$_5$ test results of 159.2 mg/100 g. Based on the assessment criteria for chemical properties of soil that have been determined, the soil around egg-laying chicken farm in Sidenreng Rappang Regency, South Sulawesi, Indonesia has a very high P$_2$O$_5$ content because >60 mg/100 g as Suseno [19] has reported. The results of measurements of P$_2$O$_5$ content of soil from each sampling location varied from moderate to very high with an average value ranging from the highest of 136 mg/100 g of soil to the lowest of 7 mg/100 g of soil. The P$_2$O$_5$ element content is low at 7 mg/100 g because the soil around the location is Latosol which is rich in Fe and Al elements can bind the P element in the soil and also C-Organic content which tends to be low. At the sample point with a high content of P$_2$O$_5$, that is, 136 mg/100 g is influenced by the addition of a large amount of P fertilizer into the soil during crop cultivation/farming activities by the surrounding community [19].

Furthermore, Arifin et al. [20] states that overall it can be concluded that this soil has relatively low fertility for C-organic and N-total content, whereas for K$_2$O and P$_2$O$_5$ it is very high, and its pH is Sour. For this reason, efforts need to be made to overcome the problem of soil fertility, and the need for handling inputs in the form of fertilizers in order to increase soil fertility [20].

4. Conclusion
It was concluded that the C-Organic content of the soil around chicken eggs laying an average of 0.699% and very low because of <1.0%. P$_2$O$_5$ content of the soil an average of 159.2 mg/100 g and very high because > 60 mg/100 g.

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