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Improving the Quality of Agricultural Land Due to the Implementation of Organic Ecological Agriculture in the Subak of High, Medium and Low Flats

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Abstract **– The application of modern agricultural technology based on chemicals, such as the use of inorganic fertilizers, chemical pesticides and growth regulating substances, turned out to have a negative impact on agricultural resources. This will certainly have implications for the decline in agricultural production per unit area, in addition to other implications, namely the contamination of agricultural products with hazardous chemicals such as pesticide residues. In connection with this, some *subak* in Bali who are at different altitudes (high, medium and low altitude) have made efforts to ensure that agricultural resources can be sustained and well maintained, and strive to improve food quality, by applying organic ecological agriculture. This research was conducted to answer the problem of how is the quality of agricultural land both in terms of physical properties (water content of field capacity), chemical properties (soil pH, C-organic, N-total, P-Available, and K-dd) and soil biology, due to the application of ecological agriculture organic in high, medium and lowland *subak* to support food independence? The data collected in this study were sourced from laboratory analysis data, field data, and document studies. Data analysis was carried out with qualitative and interpretive descriptive, through three stages of process namely data reduction, data presentation and conclusion drawing. Based on the results of the study it can be concluded that the application of organic ecological agriculture in the three *subak*, both the highland *subak* (*Subak* Wangaya Betan), the medium plains (*Subak* Babakan) and the lowlands (*Subak* Bongan), has significant implications for the improvement of the quality of agricultural land both physically (water content of field capacity), chemical properties (soil pH, organic C, N-total, P-Available, and K-dd) and soil biology.**

Keywords **– Quality, Land, Organic Agricultural and Altitude.**

I. Introduction

The application of modern agricultural technology based on chemicals, such as the use of inorganic fertilizers, chemical pesticides and growth regulating substances, turned out to have a negative impact on agricultural resources. This will certainly have implications for the decline in agricultural production per unit area. In connection with this, some *subak* in Bali who are at different altitudes (high, medium and low altitude) have made efforts to ensure that agricultural resources can be sustained and well maintained.

In connection with this, one of the *subak* in Tabanan Regency, Bali Province, namely Gunung Sari *Subak* as a traditional irrigation institution in Bali, has strived to ensure that the sustainability of agricultural resources and the environment can be sustained and well maintained, by re-implementing the ecological environment farming system (organic). The application of organic farming can increase grain production by almost 50%, this at least indicates that there has been an improvement in the quality of agricultural resources. The strategy adopted by Gunungsari *Subak* members to maintain the sustainability of their agricultural resources is by applying two primary organic ecological agriculture, namely organic farming without using pesticides (non-pesticides), using 80% organic fertilizer and 20% chemical fertilizers (Yuliana, et al., 2014). Organic farming according to Yuliana (2010), is agriculture which, in addition to being able to return most of what has been produced by nature in the form of organic fertilizer, also organic farming does not burden nature with harmful chemicals that endanger the ecosystem as a whole.

Furthermore, Yuliana and Sitepu (2016) in their study of the effect of organic farming on pesticide residues on rice produced found that there had been an improvement in food quality due to the application of two prime organic farming in *subak* Wangaya Betan. Brown rice and brown rice produced in *subak* Wangaya Betan do not contain harmful chemicals. In other words, hazardous chemicals (pesticide residues) in organic rice produced in the Wangaya Betan *subak*, were not detected and were below the lowest testing limit.

But until now there has been no clear implication of the implications of organic ecological agriculture applied in the two *subak* both in the Gunungsari *subak* and in the Wangaya Betan *subak*, both of which are *subak* in the highlands, to the improvement of agricultural resources themselves in terms of the quality of their agricultural land and irrigation water. Furthermore, it is not yet known how the implications of the application of organic ecological agriculture will be applied at different altitudes, in this case the highlands, temperate plains, and lowlands, to the quantity and quality of rice produced, and its implications for the quality of agricultural resources (agricultural land and irrigation water). It is suspected that the more downstream organic ecological agriculture is applied, the more polluted by non-organic wastes that flow together with the irrigation water flow, so that the implications will be different from the application of organic farming upstream. This is a very important and interesting issue to be studied further in order to do a mapping / cluster of organic ecological agriculture that is applied to different altitudes. On the other hand, it is not known how the implications of the application of organic ecological agriculture are applied at different altitudes (high, medium and low) to the quality of agricultural resources (soil and irrigation water) in terms of physical, chemical and biological properties, in order to support food independence. Starting from the above problems, a study was carried out that examined "Improving the Quality of Agricultural Land Due to the Implementation of Organic Ecological Agriculture in the *Subak* of High, Medium and Low Flats". In this context the problem to be studied is summarized in questions how is the quality of agricultural land both in terms of physical properties (water content of field capacity), chemical properties (soil pH, C-organic, N-total, P-Available, and K-dd) and soil biology, due to the application of ecological agriculture organic in high, medium and low *subak*, to support food independence?

II. Research Methods

The approach used in this study is a quantitative approach combined with a qualitative approach. The study was conducted on three *subak* who carried out organic ecological agriculture, each *subak* Wangaya Betan, Mengesta Village, Penebel Subdistrict, Tabanan Regency representing the *subak* in the highlands. *Subak* Babakan, Wanasari Village, Penebel Subdistrict, Tabanan Regency in the mediumlands. *Subak* Bongan, Bongan Village, Tabanan District, Tabanan Regency in the lowlands. The type of data collected in this study is quantitative data supported by qualitative data as supporting data. Data collection was done through techniques (1) laboratory analysis, (2) observation, (3) in-depth interviews, (4) document study. Samples soil are taken composite from a collection of populations (to three *subak*). Laboratory analysis of physical and chemical properties of soil was carried out in the laboratory of Seameo Biotrof Bogor and UPT of the Bali Provincial Health Laboratory. Data analysis was carried out in descriptive qualitative and interpretive ways. The results of data analysis are presented informally in the form of descriptive analysis with descriptions/ narratives, words, expressions, sentences that are good in accordance with scientific language that is easily understood and understood. Besides the data presented informally, the data is also presented formally such as the inclusion of maps, tables, photos and charts.

III. Result and Discussion

The results of the research on the quality of agricultural land in paddy fields in *Subak* Wangaya Betan (*Subak* Highlands) which most of the soil has textured soil to clay clay, before the implementation of organic ecological agriculture, shows that in general it is less fertile. This is because the soil pH is relatively acidic with soil pH below 7, macro nutrients, especially organic carbon (C-organic) are low, N-total is relatively low, P-available is very low, Electrical Conductivity (DHL) is low, Dry Water Content (KA) is classified as very low, Field Capacity Water Content is not good. There is also a description of the quality of the land in the *Subak Subak* Highlands (*Subak* Wangaya Betan), in more detail presented in table the following (Yuliana, 2011).

Table 3.1. Physical and Chemical Properties of Soil in *Subak* Plateau (*Subak* Wangaya Betan) before Implementing Organic Ecological Agriculture

Description	pH Soil	DHL (mm hos/cm)	C-Organic (%)	N- Total (%)	P available (ppm)	Dry air mois-ture (%)	Field Capacity Water Content (%)
Maximum	6.94 (AM)	0.54 (SR)	4.24 (T)	0.24 (R)	16.59 (S)	12.94 (SR)	39.60 (KB)
Minimum	5.67 (AN)	0.09 (SR)	0.43 (SR)	0.08 (SR)	5.41 (SR)	7.31 (SR)	26.91 (KB)
Avarage	6.21 (AM)	0.20 (SR)	1.61 (S)	0.18 (R)	8.06 (SR)	9.56 (SR)	32.83 (KB)

Source: Results of Research Data Analysis.
Information :

AM : Agak Masam.
T : Tinggi.
S : Sedang.
R : Rendah.
SR : Sangat Rendah.
KB : Kurang Baik.

Soil sampling for analysis is carried out on paddy fields in the highland *subak* (*subak* Wangaya Betan) seen in Figure 3.1, the moderate terrain *subak* (Babakan *subak*) seen in Figure 3.2 and the lowland *subak* (Bongan *subak*) seen in Figure 3.3. Soil sampling was carried out in a composite manner from 9 retrieval points in each *subak* location (3 upstream points, 3 points in the middle, and 3 points in the downstream *subak*). After collecting the soil samples in a composite, the analysis of soil samples both analysis of physical properties and soil chemical properties were carried out in the Laboratory of Seameo Biotrof Bogor.

Fig. 3.1. Rice Fields in *Subak* Highlands (Photo Documentation of Euis Dewi Yuliana, May 2018).

Fig. 3.2. Soil Sampling in One Point on the Medium *Subak Subak* (Photo Documentation of Euis Dewi Yuliana, May 2018).

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Fig. 3.3. Paddy Fields in *Subak* Lowland (Photo Documentation Euis Dewi Yuliana, May 2018).

While the results of soil analysis both physical properties and soil chemical properties carried out on paddy fields found in the highland, medium and lowland *subak* are presented in Table 3.2.

Table 3.2. Physical and Chemical Properties of Soil in *Subak* Plateau (*Subak* Wangaya Betan), *Subak* Medium Plains (*Subak* Babakan), and *Subak* Lowlands (*Subak* Bongan) After Implementing Organic Ecological Agriculture

Description	pH Soil	Ratio C/N	C-Organic (%)	N- Total (%)	P available (ppm)	K Can Be Exchange cmol/kg	Field Capacity Water Content (%)
Plateu	6.30 (A M)	8.00 (S)	1.87 (S)	0.24 (S)	41.5 (T)	2.36 (ST)	41.31 (B)
Medium Plains	6.60 (N)	6.00 (S)	2.03 (S)	0.33 (S)	126.4 (ST)	3.13 (ST)	43.20 (B)
Lowland	6.60 (N)	6.00 (S)	2.09 (S)	0.34 (S)	104.9 (ST)	3.80 (ST)	46.87 (B)

Source: Results of Research Data Analysis.

Information :
AM : Agak Masam
ST : Sangat Tinggi
T : Tinggi
N : Netral
S : Sedang
R : Rendah
B : Baik

3.1 *Acidity (pH) of Soil*

Soil (pH) Soil. Biological processes and chemical processes in the soil are strongly influenced by the level of acidity (pH) of the soil. In addition, the process of decomposition of soil minerals and absorption of nutrients and soil minerals as nutrients for plants are strongly influenced by the level of acidity (pH) of the soil. In addition, the absorption of various heavy metals by plants, influenced by pH conditions on the soil, which are less likely to benefit the health of consumers of agricultural products.

The level of absorption of nutrients by plants will decrease at acidic soil pH, but it actually increases the absorption of various types of heavy metals by plants, so that the tendency of plants that grow on pH of acid soils will contain higher heavy metal residues compared to plants that grow on the soil. With neutral pH. Therefore, to obtain optimal land productivity and agricultural products that are not contaminated with heavy metals, the pH of the soil in the paddy fields in the high, medium and lowlands must be in normal conditions, ie between 6.5-7.5. Whereas the soil pH in *Subak* Wangaya Betan before being carried out by organic ecological agriculture is on average slightly sour that is 6.21 (Table 3.1), the soil pH conditions must be increased so that soil productivity can be optimal, thus treatment must be given to *subak* land so that changes occur to increase pH land towards better.

The agricultural system implemented in the *subak* Wangaya Betan which is located in the highlands in the past decade has continuously applied organic ecological agriculture to the wetland farming system. Organic farming according to Yuliana (2010) is a cropping system where one of the criteria is to avoid (without) the use of chemicals (inorganic fertilizers and chemical pesticides) which are toxic to agricultural and environmental products. Organic ecological agriculture carried out in *Subak* Wangaya Betan is Prima organic farming 2 (two). According to Yuliana, et al (2014) what is meant by prime organic farming is organic farming without using pesticides (non pesticides), using 80% organic fertilizer and 20% chemical fertilizer. In *Subak* Wangaya Betan, the use of chemical fertilizers as much as 20% of recommended doses is still applied, on the grounds that farmers do not want to experience crop failure. The use of chemical fertilizers as much as 20% of recommended doses is intended as a catalyst/ trigger for plant growth. Farmers assume that the availability of organic fertilizer at the beginning of growth is slow, so that the availability of nutrients at the beginning of rice growth is insufficient, so the plant growth rate is also disrupted.

Furthermore, what is meant by organic ecological agriculture based on the criteria of the Internal Control System (ICS) is agriculture that fulfills several requirements, namely (1) pesticide free, (2) can still use chicken feces, (3) is allowed to use inorganic fertilizer up to 30% maximum recommended needs and (4) there is still a policy to use irrigation waist water garden. What is meant by watering waist water garden is by using the *subak* system watering, if the water contained pesticide elements carried by water from other places, then the irrigation water is channeled to the land with organic farming, so that the pesticides contained in it are absorbed by plants that are cultivated, the plants are still categorized as organic plants (Yuliana., et al, 2014).

Based on what has been described above, *subak* Wangaya Betan which is located in the highlands has implemented Prima Dua organic ecological farming and is based on the Internal Control System (ICS), it can be said that in *Subak* Wangaya Betan located in the highlands has implemented agriculture namely organic ecological agriculture. The application of organic ecological agriculture in *subak* in the highlands (*subak* Wanggaya Betan) turned out to have been able to improve the quality of agricultural land, this is based on the results of soil analysis conducted showed an increase in soil pH as shown in Table 3.2 above. The same thing is to apply organic ecological agriculture has also been carried out in the other two *subak* namely Babakan *subak* which is located in the medium plains, and Bongan *subak* located in the lowlands, so that from the results of soil analysis shows the level of acidity (pH) of the soil is in neutral condition (Table 3.2). The increase in soil pH from the average rather acidic (6.21) before conducting organic ecological agriculture to pH 6.3 (somewhat sour) in the highland *subak*, pH 6.6 (neutral) in the temperate plains *subak*, and pH 6.6 (neutral) in the lowland *subak* indicate there has been an improvement in soil acidity conditions due to applying organic ecological agriculture.

When viewed from Table 3.2 above, there is no firm difference in the level of soil acidity (soil pH) between the three plains both in the high, medium and low plains. Good soil pH in the highlands of 6.3 is not much different from the pH of the soil in the medium plains of 6.6 and in the lowlands of 6.6, so does the pH of the soil in the temperate plains *subak* with the lowland *subak* is the same, which is 6.6, due to the application of organic ecological agriculture in all three *subak* on different plains. The addition of organic fertilizer was able to increase the pH of the soil so that the soil was in a neutral condition.

3.2 *Organic Carbon (C-Organic)*

Organic Carbon (C-Organic). One important factor that determines determining soil fertility is the content of organic carbon contained in the soil. The presence of carbon that is too high or low without being balanced by organic N, is also not good because the balance between C and N in the soil is very important to determine soil fertility. C-Organic content in paddy fields in *Subak* Wangaya Betan (highland) before being carried out by organic ecological agriculture is classified as a medium average of 1.61% (Table 3.1). However, after the implementation of organic ecological agriculture there was an increase in the C-organic content in the soil as shown in Table 3.2, namely 1.87% in the medium category. Whereas the C-organic content in paddy fields in the medium plains is 2.03% (medium category) and in the lowland *subak* is 2.06% (medium category). Although the status of C-organic availability is in the good category in the high, medium and low *subak*, but there has been an increase in the C-organic content after the implementation of organic ecological agriculture. From Table 3.2 it is also seen that there is no strong difference between the good C-organic content found in the highland, medium and *subak* lowland *subak*.

The increase in the C-organic content in the highland *subak* (*subak* Wangaya Betan), temperate plains *subak* (Babakan *subak*), and lowland *subak* (Bongan *subak*) cannot be separated from the implementation of organic ecological agriculture in the three *subak*. Organic fertilizers added to the soil are a major contributor to the availability of C-organic in the soil. Soil organic fertilizers play an important role in improving soil quality, especially organic C. Land with enough organic fertilizer will provide nutrients for all living things in the soil. Aside from being a C-organic supplier, organic fertilizers are also very instrumental in providing nutrient input and maintaining the balance of micro ecosystems in the soil, which play a role in the process of soil grazing, such as w--orms and other micro fauna on the soil.

3.3 *Total Nitrogen (N)*

Total Nitrogen (N). One of the important (main) macro nutrients needed by plants to grow and produce optimally is Nitrogen. From Table 3.1 it can be seen that the N-Total nutrient content in the soil in the Wangaya Betan *subak* which is a *subak* in the highlands on average is still relatively low at 0.18%, and this condition needs to be improved so that the N-Total content can be increased. Therefore the supply of N derived from organic fertilizer needs to be added by applying organic ecological agriculture. After carrying out organic ecological agriculture, there was an increase in N-Total content in the soil as shown in Table 3.2, which is 0.24% in the medium category. Whereas the N-Total content in the paddy fields in the medium plains (Babakan *subak*) is 0.33% (medium category) and in the lowland *subak* (Bongan *subak*) is 0.34% (medium category). Here there is an increase in the status of N-Total availability from the low category to the medium after the implementation of organic ecological agriculture. This will indicate that the soil will provide better support for the growth process of plant development. However, there is no clear difference between Nitrogen nutrient content in both *subak* in the high, medium and low areas, which are in the medium category.

3.4 *Phospor (P) Available*

Phospor (P) Available. Like N, Phospor (P) is also one of the main elements that are needed by rice plants, to be able to grow and produce optimally. With the Nitrogen element as an exception, no other element is as critical as P for plant growth. P deficiency is very serious because it can cause plants to be unable to absorb other elements. Therefore an absolute P must be available in the soil that will be used to grow rice. The elemental P content in paddy fields in *Subak* Wangaya Betan (highland *subak*) is classified as very low on average, namely 8.06 ppm (Table 3.1) before the implementation of organic ecological agriculture.

Increasing the P content in the soil can be taken in several ways, one of which is by adding organic fertilizer to the soil by carrying out organic ecological agriculture. The implementation of organic ecological agriculture that is applied to *subak* in high, medium and low land can increase the P content in the soil. This as shown in Table 3.2 has increased the P content in the soil from very low conditions to high in the highland *subak* (*subak* Wangaya Betan) which is 41.5 ppm (high category), in the moderate *subak* (Babakan *subak*) of 126.4 ppm (very high category) and in the lowland *subak* (Bongan *subak*) 104.9 ppm (very high category). When viewed from Table 3.2 above, there is a difference in the availability of P in the highland *subak* (high category) and in the medium plains *subak* (very high category) and with the lowland *subak* (very high category), according to Wiguna et al. (2006), increasing P content in the soil, in addition to adding organic fertilizer, decomposition bacteria can also be added such as Bio-Fos. The addition of Bio-Fos will be very effective if in the soil there is still a non-available P element, because the Bio - Fos is only mine P in the soil, which is not yet available for plants.

3.5 *Potassium-dd (can be exchanged)*

Potassium-dd (can be exchanged). Potassium is one of the important elements needed by plants other than N and P. potassium is the only monovalent cation that is essential for plants. The main role of Kalim for plants is various enzyme activators. The availability of sufficient potassium in the soil guarantees plant rigidity, then makes the plant more resistant to various diseases and stimulates root growth. Given the importance of the role of Potassium for the growth and development of plants, the availability is absolutely necessary. From the results of soil analysis on the three *subak* at different altitudes, the K-dd content was found in the highland *subak* 2.36 cmol / kg soil, the moderate *subak* 3.13 cmol / kg soil, and in the lowland *subak* 3.80 cmol / kg soil, all are in very high category status (Table 3.2). From the results of the analysis it turns out that the presence of potassium in the soil is sufficient to support the growth and development of plants in *subak* of different heights. Potassium in *subak* with different altitudes has different contents, the lower the altitude, the increase in potassium content, but still in very high availability status. The high status of availability of potassium in the soil is inseparable from the addition of organic fertilizer, which is suspected to be high in potassium in organic fertilizers, given the process of making organic fertilizer added rice husk ash which is a contributing element of potassium.

3.6 *C/N Ratio*

Carbon-Nitrogen Ratio. From the results of soil analysis carried out in the high, medium, and lowland sub-regions that carry out organic ecological agriculture, the results obtained are shown in Table 3.2, namely in the highland *subak* (*subak* wangaya Betan) is 8 (medium category), moderate *subak subak* (Babakan *subak*) is 6 (medium category), and lowland *subak* is 6 (medium category). There is no firm difference between C / N Ratio in *subak* with different place heights, because all are in the medium category, the soil condition with the C / N ratio category that is indicating a nitrogen and carbon nutrient balance is in balance. The carbon-nitrogen ratio (C / N ratio) has a very important meaning for the soil, among which the competition will occur if the organic material has a high carbon and nitrogen ratio included in the soil.

3.7 *Water Capacity Field Content*

Water Content (KA) Field Capacity. Another factor that is another important indicator for rice cultivation is the water capacity (KA) field. Water content of field capacity is the ability of the soil to hold water in the field conditions is an important thing that must be known by farmers in order to be able to regulate water irrigation properly. In limited water conditions, the higher the field capacity, the better the ability of the soil to retain water, the land with high field capacity trains will still be able to provide water for plants. Rice fields in *Subak* Wangaya Betan (highland *subak*) before being carried out by organic ecological farming, have an average field capacity of 32.83% (Table 3.1) which means that they have poor water retention capability. This land condition needs to be watched out because the chances of drought are very large for plants, if there is a lack of irrigation water.

One effort that can be used to improve the ability of the soil to bind water is by adding soil organic matter through fertilization with organic fertilizer. Based on the results of soil analysis in the three *subak* both in the highlands (*subak* Wangaya Betan), temperate plains *subak* (Babakan *subak*), and *subak* in the lowlands (Bongan *subak*) obtained successive field capacity trains 41.31% (in the highland *subak*), 43.20% (in medium-lying *subak*), 46.87% (in low-lying *subak*). In the three *subak* conditions, the field capacity train is in good condition, meaning that there is no difference in the conditions of the field capacity trains both in the high, medium and low, all are in good condition criteria. With the implementation of organic ecological agriculture there is an improvement in the field capacity of the train from poor to good. The increase in soil organic matter with the addition of organic fertilizer, causes an increase in the ability of the soil to retain water, so that the resulting drought will result in less favorable impacts. This is in line with the opinion of Soetanto (2002: 49) that the productivity of land in producing something per hectare of land is largely determined by the condition and fertility of the land (both physical, chemical and biological soil), the availability of water in sufficient quantities, capital covering varieties, appropriate fertilizer use, farming techniques, technology and management, innovative ideas, and reliable workforce.

3.8 *Land Biota*

Soil biota is one component of the land/ soil ecosystem that acts to improve soil structure through weight reduction, increase pore space, aeration, draenase, water storage capacity, decomposition of organic matter, mixing of soil particles, microbial dispersal and soil aggregate repair. Although the effect is indirect, but soil biota can be seen as a regulator of physical, chemical and biochemical processes in the soil. Land biota is a collection of living bodies that make the body of the land as a living space to carry out part or all of its ecological activities. In connection with this, based on observations made there are several soil biota in the three *subak*, both those in the highlands (*subak* Wangaya Betan), *subak* in the lowlands (Babakan *subak*), and *subak* in the lowlands (Bongan *subak*) as presented in Table 3.3.

Table 3.3 Soil Biota in the Three *Subak* (Plateau, Medium Plains and Low Lands).

No	Local Name	Scientific name	Total population
1	Eel	*Monopterus albus*	Many
2	Earthworms	*Haplotaxida*	Many
3	Conch	*Pila ampullacea*	Many
4	Water Beetle	*Coleopetra*	Many
5	Frog	*Anura*	Many
6	Snail	*Mollusca*	Many
7	Ant	*Formicidae*	a little
8	Snake	*Serpentes*	a little
9	Kokokan Bird	*Aves pelecaniformes*	Many
10	Duck	*Anas platyrhynchos domesticus*	Many

Source: Observation results in the Field

The existence of soil biota as seen in Table 3.3 indicates that the ecological life in the soil is going well. Soil gives life media to soil biota (Figure 3.4), because in the soil there are no elements that endanger the life of biota such as toxic elements which are limiting factors for growth of the soil biota itself such as pesticides and other synthetic chemicals. On the other hand the life of biota in the soil can improve the physical and chemical properties of the soil, which makes the body of the soil as a living space to carry out part or all of its ecological activities. This means that mutualism symbiosis takes place between the land as a media of life from biota with the soil biota itself.

According to Soepardi (1983: 12) the soil is said to be fertile if the three factors both physical, chemical, and biological soil are in balance, if one of the three factors above is in an imbalance, then this factor will be a limiting factor for plant growth and development.

Moving on from Soepardi's statement above, the three factors both physical, chemical, and biological of the soil must be in a balanced state, one factor that will influence the existence of other factors. If one factor is in an imbalance, such as nutrient levels (chemical factors) its presence is too extreme in the soil (can be high or very low), then this will cause soil biological factors, both macro and soil microorganisms (both eels, frogs snakes, worms, bacteria and other biota) growth will be disrupted. Even though the life of the soil biota will affect the physical factors of the soil such as the formation of soil pores, soil elasticity, deep soil solubility, and so on. In the end all of them will have implications for soil fertility, and further implications also for the rice field ecosystem.

Fig. 3.4. Life of Land Biota in *Subak* (Photo Documentation of Research Results, June 2018).

IV. Conclusions and Suggestions

4.1 *Conclusion*

The application of organic ecological agriculture in the three *subak*, both the highland *subak* (*Subak* Wangaya Betan), the medium plains (*Subak* Babakan) and the lowlands (*Subak* Bongan), has significant implications for the improvement of the quality of agricultural land both physically (water content of field capacity) , chemical properties (soil pH, organic C, N-total, P-Available, and K-dd) and soil biology. The water content of the field capacity for all *subak* is in the good category, the soil pH for the medium and low *subak* is in a neutral atmosphere except in the rather acidic highland *subak*, the C-organic in the three *subak* is in the medium category, N-Total in the three *subak* in in the medium category, P-is available in the middle and lowland *subak* in the very high category except in the highland *subak* in the high category and K-can be exchanged for all *subak* in the very high category. As for the biology of the soil of life, biota is in balance.

4.2 *Suggestion*

The suggestions from this study are as follows.

1. Considering that the longer the quality of agricultural land is decreasing, then the application of environme--ntal ecological agriculture must be implemented to improve the quality of agricultural land in the cultivation of rice fields.
2. Further research is needed on the production and quality of rice produced
3. Environmental ecological agriculture needs to be implemented in other *subak subak* in Bali, in addition to the three *subak* where the research was conducted, in different watersheds.

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