

## Analysis of the chemical properties of various liquid organic fertilizers and their effects on soybean plant growth

J Herawati<sup>1</sup>, Indarwati<sup>1, a</sup>, Ernawati<sup>1</sup>, L Tunik<sup>2</sup> and E Noerhartati<sup>3</sup>

<sup>1</sup> Faculty of Agriculture Lecturer – Universitas Wijaya Kusuma Surabaya

<sup>2</sup> FBS Lecturer - Universitas Wijaya Kusuma Surabaya

<sup>3</sup> Agroindustrial Technology Lecturer - Universitas Wijaya Kusuma Surabaya

<sup>a</sup> ir.indarwati110262@gmail.com

**Abstract.** The purpose of this research is to know the chemical nature of liquid organic fertilizer (LOF) based on various organic wastes and their effect on soybean growth. The study was conducted using a randomized block design with 9 treatment of LOF type applications, made from water hyacinth waste and a variety of additional composition of other organic wastes. Each of these treatments was repeated 3 times, requiring 27 experimental plots each with an area of 18 m<sup>2</sup>. The parameters observed were the chemical properties of LOF and the growth of soybean crop (plant height, number of leaves). The data obtained were analysed by analysis of variance when there was real difference, then continued with Least Significant difference (LSD test) 5%. The results showed that LOF contained some essential nutrients needed by plants, it is containing Nutrition Plants: N, P, and K, with C / N ratio: low. In addition also contains various bacteria that can improve the growth of soybean crops. Application of LOF in the field of agriculture can also prevent the occurrence of land degradation, as well as a solution in overcoming the problem of organic waste.

### 1. Introduction

Soybean is still one of the priority food commodities in Indonesia, due to the high price fluctuations that may not disrupt the economy. This can be a study material that the aspect of food security that is based on self-power is a matter that must be encouraged and realized, if not want to depend on other countries [1]. Soybean is annual major crops in the world and important legumes in food security.

With the growing population, soybean demand continues to increase, which has not been followed by increased soybean production. To meet production with the soybean requirement, the Indonesian government imports soybeans from the United States around 1.2 million tons [2].

Food sovereignty is the concept of food fulfillment that can be achieved by conducting sustainable agriculture technology, increasing the use of organic fertilizers and reducing inorganic fertilizers [3].

Modern production-oriented farming makes farmers dependent on the use of chemical fertilizers, their long-term, continuous and uncontrolled impacts will have an adverse effect on soil fertility and the environment. This causes the soil to become hard, difficult to cultivate, thus disrupting plant growth. Proper use of fertilizers should take account of their impact on the environment and the balance of the surrounding ecosystem [4]. Herawati [5] found that the metal content of Cd in several inorganic fertilizers that phosphor (P) was about 0.1-0.7 ppm.

Utilization of organic fertilizers helps improve soil structure, improves soil permeability and reduces land dependence on inorganic fertilizers. Organic fertilizer also serves as a food source for soil



microorganisms and increase the number and activity of soil microorganisms, so the soil becomes loose [6].

Suryaningsih research results [7] the application of organic fertilizer solid waste home bakery industry combined with POC mixture of goat and coconut coir, gives better results compared with without on mustard plants. The results of research Herawati, Indarwati and Achmadi [8] the application of liquid organic fertilizer Mole water hyacinth on soybean plants can increase soybean yield 21.6% compared with no mud water hyacinth waste.

This main study to determine the effect of the application of the development of LOF Eceng Gondok production substituted with various kinds of organic waste to the chemical content in an effort to improve the growth of soybean crops and developed production of LOF water hyacinth in substitution with various organic waste to improve soybean yield in the effort of achievement self-sufficiency of soybeans and the acceleration of achieving food self-sufficiency of Indonesia.

## 2. Methodology

### 2.1. Place and time

The research was conducted in Production Laboratory of Agricultural Faculty of Wijaya University Kusuma Surabaya and Experimental Garden of Mojosari Agricultural Technology Assessment Institute, Mojokerto. Starting from March to July 2018.

### 2.2. Materials and tools

The material is divided into 2, the materials for the production of LOF (organic waste of banana bonggol, fish bones, water hyacinth, egg shell, sugar, coconut water, rice water, well water and starter (LOF) and materials when planted in the field (soybean seed varieties Rings, Urea fertilizer, TSP, KCl, manure, and LOF according to treatment.) Equipment required for the production of LOFs (tubs of LOFs, hoses, stirrers, knives, coppers, bottles, jerry cans, gauges, insulation) and for the field hoe, gembor, cetok, timba, Sprayer, camera).

### 2.3. Research methods

The method used Randomized Block Design method with the treatment of LOF of water hyacinth (BioEcgon) with organic material substitution (B).

B0: Water

B1: POC water hyacinth (BioEcgon)

B2: BioEcgon + banana hump

B3: BioEcgon + fish bone

B4: BioEcgon + chicken egg shell

B5: BioEcgon + banana hump + fish bone

B6: BioEcgon + banana hump + chicken egg shell

B7: BioEcgon + bone fish + chicken egg shell

B8: BioEcgon + banana hump + fish bone + chicken egg shell

Treatment was repeated 3 times, so it takes 27 plots.

### 2.4. Data processing

The data were processed using Multiple Analysis of RBD pattern, to find out whether there is any real difference between treatments. If there is a real difference, then proceed with the test of the Smallest Real (LSD 5%). Data from chemical content analysis result made histogram.

## 3. Results and discussion

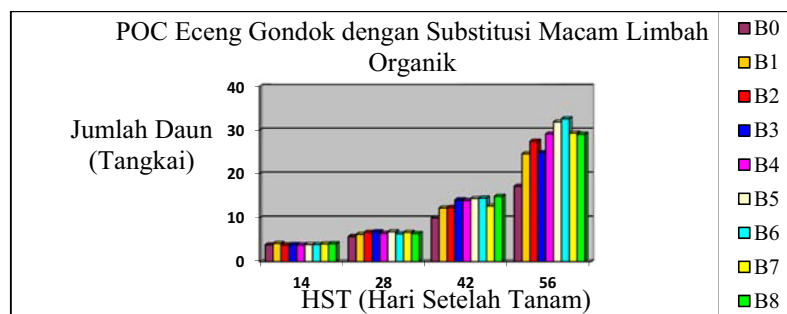
### 3.1. Leaves/plants

**Table 1.** Average leaves and soyben at various age observation.

Treatment	Day After Planting (DAP)			
	POC	14	28	42
B0	3.87	5.77 d	10.07 e	17.33 d
B1	4.20	6.27 dc	12.33 d	24.60 c
B2	3.87	6.73 ab	12.47 cd	27.47 b
B3	3.93	6.87 a	14.20 ab	24.87 c
B4	3.87	6.53 abc	14.07 abc	29.13 b
B5	3.93	6.87 a	14.53 a	31.87 a
B6	3.93	6.40 bc	13.60 a	32.60 a
B7	4.07	6.73 ab	12.80 bcd	29.33 b
B8	4.13	6.47 bc	15.00 a	29.07 b
LSD 5%	NS	0.37	1.64	2.27

Noted: The numbers followed by the same letter in the same column are not significantly different in 5% LSD test

Parameter of leaf number was the real difference between treatment age 28-56 HST. In Table 1 there was a treatment of LOF BioEcgon+banana gobbler+chicken eggshell (B6) had more leaf number than other treatments, although not significantly different with B5 (BioEcgon + banana hump + fish bone).

**Figure 1.** Average leaf chart (stalk)

### 3.2. Plant height

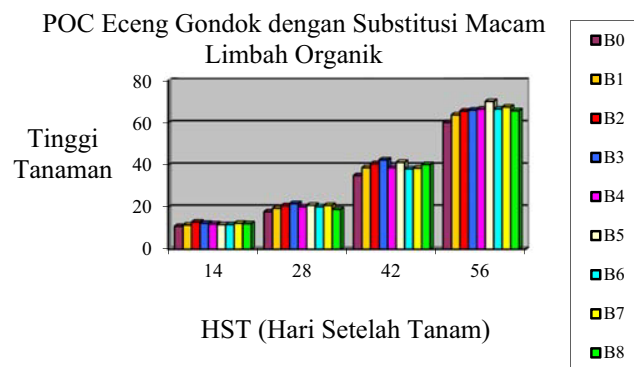
Crop height parameters occurred a marked difference between treatment at 28-56 HST. In table 2 there was a treatment of LOF BioEcgon + fishbone (B3) at age 28 HST had higher average plant height than other treatments, although not significantly different with B5 (BioEcgon+banana cob and fish bone) and B7 BioEcgon +fish bone+chicken egg shell). Age 42 HST, treatment of LOF BioEcgon+fishbone (B3) had higher average plant height than other treatments, although not significantly different with B5 (BioEcgon+banana sponge+fish bone). While at the age of 56 HST the treatment of LOF B5 (BioEcgon + banana cobs + fish bones) had higher average plant height than other treatments, although not significantly different with B7 (BioEcgon + fishbone + chicken egg shell).

**Table 2.** Average plant height (cm) soybean at various age observation.

Treatment	Day After Planting (DAP)			
	POC	14	28	42
B0	10.93	17.87 e	35.07 d	35.07 d
B1	11.57	19.53 cd	38.80 c	63.80 c
B2	12.97	20.73 ab	40.73 b	65.60 bc
B3	12.37	20.73 ab	42.47 a	66.07 bc
B4	12.37	20.73 ab	38.80 c	66.53 bc
B5	11.77	20.93 ab	14.53 a	31.87 a

B6	11.77	20.27 bc	14.60 a	32.60 a
B7	12.37	20.87 ab	12.80 bcd	29.33 b
B8	12.17	19 de	15.00 a	29.07 b
LSD 5%	NS	1.165	1.64	2.27

Noted: The numbers followed by the same letter in the same column are not significantly different in 5% LSD test



**Figure 2.** Average plot die chart of plants (cm) in various age

### 3.3. Total roots/plants

Parameter of total root nodule in table 3 can be seen age 14 DAP no significant difference, but age 28 DAP there was a real difference, where the treatment of LOF BioEcgon + banana hump + chicken eggshell (B6) had an average number of total root nodules which is more than any other treatment.

### 3.4. Content of the nutrient element

Table 5. Treatment of LOF B8 (water hyacinth, banana hump, fish bone and bone) has the lowest C / N ratio. The result of the research of Kesumaningwati [9] the use of banana mole as a decomposer in the compost of empty palm oil bunches is more able to reduce the C / N ratio compared to the use of EM4 as decomposer.

**Table 3.** Results of analysis of nutrient contents of LOF Bioecon and total microbes.

Treatment Type of POC	Bioecon nutrients (%)				
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	C/N ratio	∑ Microbe
B1	0.08	0.09	0.51	15.40	1.2 10 <sup>4</sup>
B2	0.11	0.12	0.62	11.60	2.2 10 <sup>5</sup>
B3	0.13	0.14	0.68	10.10	2.4 10 <sup>5</sup>
B4	0.12	0.13	0.70	10.50	3.1 10 <sup>5</sup>
B5	0.10	0.11	0.72	13.00	3.8 10 <sup>4</sup>
B6	0.11	0.09	0.81	11.40	4.1 10 <sup>5</sup>
B7	0.13	0.11	0.88	11.50	3.2 10 <sup>4</sup>
B8	0.12	0.10	0.85	9.40	1.1 10 <sup>4</sup>

From the results of the study Hasanah [10] that nitrogen is a limited nutrient at dry land. Therefore, in this study added LOF water hyacinth with substitution of various organic wastes containing nitrogen elements, is expected to improve growth so as to increase soybean production

## 4. Conclusions

- There were significant differences in growth parameters of leaf number, plant height, total root nodule, and number of effective root nodules.

- Parameter of leaf amount of treatment giving LOF B6 has average number of leaves more although not significantly different with B5.
- Observation of 56 DAP parameters of plant height of treatment giving B5 has more average leaf number than other treatment, although not significantly different with B7
- Parameters of total root nodules and number of effective root / plant nodules were significantly different between treatments at 28 DAP, in which treatment of LOF B6 had an average number of effective root / plant nodules compared with other treatment

### References

- [1] Adisarwanto 2008 *Budidaya Kedelai Tropika* (Jakarta: Penebar Swadaya)
- [2] Anonymus 2011 *Varietas Unggul: Salah Satu Upaya Tingkatkan Produksi Kedelai* (Tabloid Sinar )
- [3] Kustiono G, Indarwati and Jajuk H 2012 *Kajian Aplikasi Kompos Azolla dan pupuk An-organik untuk Meningkatkan Hasil Padi Sawah (Oryza sativa L.)*. Madura (Indonesia): Prosiding Seminar Nasional Kedaulatan Pangan dan Energi. Fakultas Pertanian Universitas Trunojoyo
- [4] Novizan 2003 *Petunjuk Pemupukan yang Efektif* (Jakarta: PT. AgroMedia Pustaka)
- [5] Herawati J 2003 Pencemaran dan Toksisitas Logam Berat Cadmium di Bidang Pertanian *Jurnal Ilmiah Agro Kusuma* (Surabaya: Fakultas Pertanian Universitas Wijaya Kusuma) ISSN 1412-036 **2(2)**
- [6] Hadisuwito S 2008 *Membuat pupuk Kompos Cair* (Jakarta: PT. AgroMedia Pustaka)
- [7] Suryaningsih D R, Jajuk H and Yohanes M 2010 *Pemanfaatan Lahan Tidur dan Pengelolaan Limbah Industri Rumah Tangga Terhadap Produksi Jenis Tanaman Sawi* Prosiding Simposium Perpupukan Nasional Dewan Pupuk Indonesia ISBN:978-979-25-7694-8.
- [8] Herawati, Indarwati and Achmadi S 2012 *Peningkatan Produksi Kedelai dengan Pemanfaatan Limbah Eceng Gondok*. Bali (Indonesia): Seminar Nasional Peningkatan Mutu Pendidikan MIPA untuk Menunjang Pembangunan Berkelanjutan. Fakultas MIPA Universitas Pendidikan Ganesha (UNDIKSHA). ISBN: 978-602-17993-0-7.
- [9] Kesumaningwati R 2015 Penggunaan Mol Bonggol Pisang (*Musa paradisiaca*) sebagai Dekomposer untuk Pengomposan Tandan Kosong Kelapa Sawit *Jurnal ZIRAA'AH* **40(1)** pp 40-5
- [10] Hasanah Y, Tengku, Hapsoh, and Hamidah 2014 Growth Analysis of Soybean Varieties At Dry Land With Application of Nitrogen Sources *International Journal of Scientific And Technology Research*. ISSN 2277-8616.