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The Effect of Provision of Chicken Manure and Local Micro-Organisms of Bamboo Shoots on the Growth and Yield of Chickpeas (*Phaseolus vulgaris* L.) in Red Yellow Podsolic Soil

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Keywords:
Chickpeas *(Phaseolus vulgaris* L.); Local micro-organisms of Bamboo Shoots; Red Yellow Podsolic Soil; Chicken Manure

ABSTRACT
This study aimed to determine the effect of the interaction of chicken manure and Local Micro-Organisms (MOL) on bamboo shoots on the growth and yield of chickpeas in Red Yellow Podsolic soil. This study used a randomized block design (RAK) with a factorial pattern consisting of two treatment factors, namely the first factor was the dose of chicken manure with 3 treatment levels (a), namely: a_1= Dose of chicken manure 1.2 kg/ plot (10 tons/ha), a_2= Dose of Chicken Manure 1.8 kg/plot (15 tons/ha), a_3= Dose of Chicken Manure 2.4 kg/plot (20 tons/ha), second factor was MOL concentration bamboo shoots with 3 treatment levels, namely: m_1= giving MOL 0.0125%, m_2= giving MOL 0.025 %, m_3= giving MOL 0.0375%. So there are 9 treatment combinations, namely a_1m_1, a_1m_2, a_1m_3, a_2m_1, a_2m_2, a_2m_3, a_3m_1, a_3m_2, and a_3m_3. Based on the results of the study showed that treatment with chicken manure had a very significant effect on the variable number of branches, the number of pods per plant, weight of pods per plant, weight of pods per plot, and significantly affected the variables of plant height and number of pods per plot. The MOL treatment of bamboo shoots had a very significant effect on the variables of plant height, pod weight per plant, and had a significant effect on the variables of number of branches, number of pods per plant, number of pods per plot, and weight of pods per plot. The interaction of giving chicken manure and MOL of bamboo shoots had no significant effect on all observed variables. Treatment levels A3 and M3 gave the best results on plant height variables 531.00 cm, number of branches 4.00 branches, number of pods/plant 36.00 pods, number of pods per plot 264.00 pods, pods/plant weight 248.67 g, pod weight per plot 2.92 kg.

INTRODUCTION

Chickpeas are a type of legume that has many uses. As a vegetable ingredient, chickpea pods can be consumed young or consumed seeds. Chickpeas are not native to Indonesia but come from southern Mexico and Central America. Chickpeas are one of the vegetable sources of vegetable protein that are widely consumed by the people of Indonesia. Based on data from the Central Statistics Agency (BPS) and the Directorate General of Horticulture (2019), the harvested area of green chickpeas in Indonesia is 24,635 ha, production is 299,311 tons and productivity is 12.15 tons/ha. Production this year was lower than the previous year at 327,378. This condition encourages the need for efforts to increase the production of chickpeas through agricultural cultivation by optimizing existing local resources.

Red Yellow Podsolic Land (RYP) is the largest land in the province of West Kalimantan with an estimated land area of 10,515,703 ha, while the land area of RYP in the Landak district is 606,535 ha (BPS, 2005). Red Yellow Podsolic soil type has a medium profile development, with red to yellow colour, argillic horizon, acid, thin with low cation exchangeability and wet saturation. This soil type is the most dominant.

The physical and chemical characteristics of the land become one of the determinants of productivity and quality of crop yields in vegetable farming. This relates to the influence of the nature and characteristics of the types of production inputs used in the production process. The characteristics and types of production inputs need to be adjusted to the needs to optimize plant growth and yield as a form of profitable farming.

Fertilizers have a very important role in agriculture in increasing soil fertility and plant growth. The dependence of farmers on inorganic fertilizers is very high and the reduced supply of subsidized fertilizers from the government creates problems for farmers throughout Indonesia. Excessive use of inorganic fertilizers in the long term will be detrimental, in addition to being more expensive and difficult to obtain due to a lack of supply from the government, it can also damage the environment, such as hardening of the soil structure and decreasing soil micro-organisms which results in a decrease in soil productivity. The environmental crisis that is happening lately is raising public awareness of the importance of saving the environment as well as Indonesian farmers starting to implement environmentally friendly organic agriculture (Handayani et al., 2015).

Chicken manure is one of the organic fertilizers that greatly affects the availability of nutrients and also greatly affects the physical and biological properties of the soil. Hakim et al. (1986) stated that organic matter is an important ingredient in creating soil fertility. Broadly speaking, organic matter improves soil properties including soil physical, chemical, and biological properties. Organic matter improves the physical properties of the soil by making the soil loose so that it is better aerated and easier for plant roots to penetrate. Organic matter in sandy-textured soil will increase the binding between particles and increase the water-holding capacity. Soil chemical properties are improved by increasing cation exchange capacity and nutrient availability. while the effect of organic matter on soil biology is to increase the energy needed for the life of soil micro-organisms (Sutanto, 2002). The rate of decomposition of soil organic matter depends on the type of organic residue. Organic materials that have a low C/N ratio, low lignin and polyphenol content will decompose quickly. On the other hand, those with a high C/N ratio and high lignin and polyphenol content will be difficult to decompose (Stevenson, 1986).

At this time, one of the micro-organisms that have begun to be developed for biological fertilizers is Local Micro-Organisms (MOL). MOL is a liquid containing micro-organisms (bacteria) that are useful for plants and soil fertility such as *Rhizobium* sp., *Azospirillum* sp., *Azotobacter* sp., *Pseudomonas* sp., *Bacillus* sp., and phosphate solubilizing bacteria. The MOL solution contains many micro and macronutrients and contains bacteria that have the potential to decompose organic matter, growth stimulants and as agents for controlling pests and plant diseases so that MOL can be used both as decomposers, biological fertilizers and as organic pesticides, especially as fungicides. These natural materials are a preferred place as a medium for living and developing micro-organisms that are useful

in accelerating the destruction of organic materials (decomposers) or as additional nutrients for plants (Rahayu & Tamtomo, 2017). One of the materials that can be used as MOL is bamboo shoots. Local Micro-Organisms of bamboo shoots are known to have high organic C- and gibberellin content so that they can stimulate plant growth. The MOL solution of bamboo shoots also contains micro-organisms that are very important in plant growth, namely *Azotobacter* bacteria and *Azospirillum* bacteria. The content of the MOL solution of bamboo shoots can also be used as a growth stimulant for the vegetative phase of plants such as the leaves, stems, and roots (Gustomi et al., 2018).

According to research by Sobari et al. (2018), the use of chicken manure added with phosphate-solubilizing microbes can increase the P-available and vegetative growth of robusta coffee plants. The results of the study by Samosir and Gusniwati (2014) showed that giving 50 ml/l of MOL water for bamboo shoots gave the highest yield on the growth of oil palm seedlings on the parameters of plant height, leaf area, root dry weight, and dry weight. The results of Sukasih's research (2018) stated that the MOL of bamboo shoots can increase the growth and yield of mustard greens at a dose of 60 ml/l of water. Thus, this study aimed to determine the effect of the interaction of chicken manure and Local Micro-Organisms (MOL) in bamboo shoots on the growth and yield of chickpeas (*Phaseolus vulgaris* L.) on the Red Yellow Podsolic soil.

METHOD

The location of the research was carried out in Serimbu Village, Air Besar District, Landak Regency which is a Red Yellow Podsolic land, carried out from June - August 2020. The materials used were chicken manure, Local Micro-Organisms (MOL) for bamboo shoots, chickpea seeds, stakes, Urea, SP36, KCl, and protoop herbicides. The tools used were hoes, machetes, thermometers, hygrometers, meters, analytical scales, measuring cups, plastic buckets, hands sprayers, cameras, and stationery.

This study used a Randomized Block Design (RBD) with a factorial pattern consisting of two treatment factors, namely the first factor was the dose of chicken manure with 3 treatment levels, the second factor was the concentration of MOL in bamboo shoots with 3 treatment levels.
Factor I: Composition of the dose of chicken manure (a), namely:
a_1= Dosage of Chicken Manure 1.2 kg/plot (10 tons/ha)
a_2= Dosage of Chicken Manure 1.8 kg/plot (15 tons/ha)
a_3= Dosage of Chicken Manure 2.4 kg/plot (20 tons/ha)
Factor II: The MOL concentration of bamboo shoots are:
m_1= Giving MOL 0.0125%
m_2= Giving MOL 0.025%
m_3= Giving MOL 0.0375%
So there were 9 treatment combinations, namely a_1m_1, a_1m_2, a_1m_3, a_2m_1, a_2m_2, a_2m_3, a_3m_1, a_3m_2, dan a_3m_3. Each treatment was repeated 3 times and each treatment consisted of 15 plants. So the number of plants used was 3 x 3 x 3 x 15 = 405 plants.

Research Implementation
1. Land Preparation
The land used had a Red Yellow Podsolic soil type, before being used, the land was cleared of wild plants and light soil tillage was carried out by ploughing and then heavy tillage was carried out. The land that had been processed was then made experimental plots with a size of 120 x 100 cm consisting of three groups, where one group consisted of 9 plots, the distance between groups (blocks) was 100 cm, while the distance between one plot and another was 50 cm.

2. Provision of Chicken Manure
Manure was given one week before planting with the appropriate dose of treatment.

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3. Chickpeas Seed Planting
The spacing used was 50 cm x 20 cm so in one experimental plot there were 15 plants. At the time of planting in one planting hole, 2 seeds were planted.

4. Giving MOL
The treatment of giving Local Micro-Organisms (MOL) was given at the time of planting, 10 DAP, 20 DAP, 30 DAP, 40 DAP by sprinkling into the soil with a concentration according to the treatment and 3,750 ml of solution sprinkled per plot.

5. Provision of Urea, SP36 and KCl Fertilizers
In addition to providing chicken manure, basic fertilizers (urea, SP36 and KCl) were added at a dose of 1/2 the recommended dose, namely 18 g urea/plot, 15 g SP36/plot, 15 g KCl/plot. SP36 and KCl fertilizers were given at planting time, while urea was given 2 times with dose (9 g/plot) at 1 WAP and dose (9 g/plot) at 3 WAP.

6. Plant Maintenance
Maintenance activities carried out include:
1) Embroidery was done on seeds that do not grow.
2) Thinning was done in planting holes where more than one seed grows to leave one plant that grows the healthiest.
3) Installation of stakes after the plant was 15 DAP.
4) Weeding was done by pulling weeds by hand or using tools.
5) Watering was carried out on plants if it does not rain in the morning and evening.
6) Pest and disease control was carried out when an attack occurs.

7. Harvesting
Harvesting was done when the plants were 50 days old and the pods noticed the characteristics of the colour of the pods being rather young and gloomy, the surface of the skin was a bit rough, the seeds and pods were not yet protruding, and the pods will make a popping sound when broken. Harvesting was done in stages, i.e. every 2-3 days and was stopped when the plants are 80 days old or 7 harvests (Susila, 2006).

Parameters observed in this study were plant height (cm), number of branches, number of pods per plant, number of pods per plot, the weight of pods per plant (g), and weight of pods per plot (kg). The data obtained were analyzed using the F test at the level of 5% and 1%, then further tested with the 5% HSD test.

RESULTS AND DISCUSSION

Table 1
Average Results of Interaction of Chicken Manure and MOL of Bamboo Shoots on All Observation Variables of Chickpeas Plants (Phaseolus vulgaris L)

Treatment	Plant Height (cm)	Number of Branches	Number of Pods Per Plant	Number of Pods Per Plot	Pod Weight Per Plant (g)	Pod Weight Per Plot (kg)
a_1	433.93^{a}	1.93^{a}	24.78^{a}	202.56^{a}	166.41^{a}	2.02^{a}
a_2	459.56^{ab}	2.44^{a}	26.41^{a}	223.67^{ab}	179.67^{a}	2.32^{ab}
a_3	507.19^{b}	3.52^{b}	33.85^{b}	243.89^{b}	263.59^{b}	2.63^{b}
m_1	426.44^{a}	2.30^{a}	25.15^{a}	205.22^{a}	177.63^{a}	2.16^{a}
m_2	467.19^{ab}	2.56^{ab}	28.93^{ab}	215.00^{ab}	184.56^{a}	2.28^{ab}
m_3	507.04^{b}	3.04^{b}	30.96^{b}	249.89^{b}	220.48^{b}	2.53^{b}
a_1m_1	371.89	1.78	21.00	174.33	147.89	1.93
a_1m_2	441.78	1.89	25.67	194.00	149.89	1.99

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Treatment	Plant Height (cm)	Number of Branches	Number of Pods Per Plant	Number of Pods Per Plot	Pod Weight Per Plant (g)	Pod Weight Per Plot (kg)
a_1m_3	488.11	2.11	27.67	239.33	201.45	2.13
a_2m_1	428.22	2.00	22.89	206.33	157.67	2.15
a_2m_2	448.44	2.33	27.11	218.33	170.00	2.26
a_2m_3	502.00	3.00	29.22	246.33	211.33	2.54
a_3m_1	479.22	3.11	31.56	235.00	227.33	2.38
a_3m_2	511.33	3.44	34.00	232.67	233.78	2.59
a_3m_3	531.00	4.00	36.00	264.00	248.67	2.92

Note: The numbers followed by the same letter are not significantly different according to the Significant Honest Difference Test (HSD) at the 5% level

Based on the results of the analysis of diversity in Table 1, it showed that the interaction between chicken manure (a) and the MOL of bamboo shoots (m) had no significant effect on all observed variables. However, each treatment (a) and (m) showed a significant effect on all observed variables. The treatment of manure at the a_3 level and the MOL level of bamboo shoots at the m_3 level showed the highest results on all observed variables. Meanwhile, the interaction between chicken manure and MOL of bamboo shoots with a_3m_3 treatment showed the highest results for all observation variables.

The application of chicken manure and MOL of bamboo shoots did not have a significant effect on all observation variables, presumably due to the nutrient content and dose given not being able to meet the needs of chickpeas plants. The dose of fertilizer application is very important to note because it can affect the ability of fertilizer to be absorbed by plants (Suhastyo & Setiawan, 2020). As described by Lingga and Marsono (2003), macro and micronutrients are needed by plants for growth, if a deficiency can cause stunted plant growth. According to Lingga (1991), plant development is closely related to cell division, the availability of N, P and K in sufficient quantities affects the process of phosphate transport and the formation of chlorophyll in leaves. According to Setyamidjaja (1986), the elements N, P and K in the plant body play a role in spurring the growth and division of new cells, thus directly affecting plant growth. Meanwhile, plants that lack excess nutrients will cause growth that is not optimal. Added by Poerwowidodo (1993) stated that the deficiency of N, P, and K in the vegetative and generative phases of the plant will cause the plant to experience chlorosis, inhibition of cell division and consequently the shrinkage of plant growth. As Rinsema (1986) argued that N can increase the ratio of protoplasm to the cell wall so that it can cause an increase in cell size and K plays a role in protein synthesis, as a catalyst in the transformation of flour, sugar and plant fat and elements of K collect at the growing point and play a role in accelerating growth. meristematic tissue. Furthermore, P plays a role in increasing carbohydrates in the photosynthesis process and plays an important role in meristem cell division, so that the weight of the pods produced will be higher.

Chicken manure is known to contribute nutrients that can meet plant growth because the content of N, P, K and water in chicken manure is higher than that of cow, horse and goat manure (N 1.00%, P 0.80%, K 0.40% and water 55%) (Lingga & Marsono, 2010). According to Hartatik & Widowati (2006) that the application of chicken manure on the soil can substitute N and K artificial fertilizers, increase soil pH, reduce Al-dd, and increase soil P, Ca, and Mg nutrient content. In addition, organic fertilizers also function to absorb and retain water, to maintain the humidity of the surrounding microenvironment. According to Barus (2011), the application of organic fertilizers has an important role in increasing soil fertility. The important chemical functions of organic matter are: (1) organic fertilizers can provide macro (N, P, K, Ca, Mg, and S) and micronutrients such as Zn, Cu, Mo, Co, B, Mn, and Fe even in small amounts; (2) increase the cation exchange capacity (CEC) of the soil, and (3) can form complex compounds with metal ions such as Al, Fe, and Mn.

MOL is a solution that contains micro-organisms that are useful for decomposers of organic matter, growth stimulants, and as agents for controlling pests and plant diseases such as *Rhizobium* sp.,

Azospirillum sp., *Azotobacter* sp., *Pseudomonas* sp., *Bacillus* sp., and phosphate solubilizing bacteria (Julita et al., 2004). The absence of influence from the interaction between chicken manure and MOL of bamboo shoots is suspected that the micro-organisms contained in MOL have not been able to create favourable conditions for plants, the microbial population does not increase so that the process of mineralization of organic compounds into inorganic in the soil does not take place quickly, causing nutrients to become unavailable to plants. MOL of bamboo shoots contains organic C and gibberellins which are growth regulators that play a role in stimulating the elongation of stem segments, involved in the initiation of fruit growth after pollination also increases the leaf size of some plant species (Marpaung et al., 2018; Wicaksono et al., 2016). However, in this study, the content of growth regulators in the MOL of bamboo shoots was thought to not affect the growth of chickpeas. This is following George et al. (2008) who stated that the use of low concentrations of cytokinins can not necessarily increase the elongation process optimally and high doses can reduce shoot growth due to cell failure in the elongation process.

The content of the element nitrogen (N) plays an important role in plant vegetative growth such as plant height (Rangkuti et al., 2017). According to Marsono (2011), the element nitrogen (N) plays a role in stimulating vegetative growth, namely the formation of stems, roots and leaves. Hanafiah (2010) stated that elements (N), (P) and (K) play a role in stimulating cell division in the apical meristem tissue which will stimulate cell elongation so that the plant will grow taller, cell division in the apical meristem will also be followed by primordial cell division. leaves that will form the leaves. According to Lakitan (2011), phosphorus (P) is an essential nutrient that plays a role in stimulating root development. A good root development system will expand the area of nutrient uptake, thereby increasing the amount of water and nutrient uptake. Salisbury & Ross (1995) stated that N plays an important role in preparing plant hormones, namely cytokinins and auxins. Cytokinins function in cell division and auxins play a role in cell elongation.

CONCLUSIONS

Based on the results of the study, it was shown that treatment with chicken manure had a very significant effect on the variable number of branches, the number of pods per plant, weight of pods per plant, weight of pods per plot, and significantly affected the variables of plant height and number of pods per plot. The MOL treatment of bamboo shoots had a very significant effect on the variables of plant height, pod weight per plant, and had a significant effect on the variables of number of branches, number of pods per plant, number of pods per plot, and weight of pods per plot. The interaction of giving chicken manure and MOL of bamboo shoots had no significant effect on all observed variables. Treatment levels A3 and M3 gave the best results on plant height variables 531.00 cm, number of branches 4.00 branches, number of pods/plant 36.00 pods, number of pods per plot 264.00 pods, pods/plant weight 248.67 g, pod weight per plot 2.92 kg.

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