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Increasing the Quality of Garlic (*Allium sativum* L.) against the Provision of Foliar Fertilizer and Long Induction of SIPLO

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Abstract

Garlic (*Allium sativum* L.) is one of crops in economic importance has increased considerably of recent years in Indonesia. Garlic roots have endophytic bacteria with the potential to promote plant growth, that is support in agriculture. Improving the quality and quantity of garlic can be done through the improvement of cultivation. Intensification of local potential systems techniques is a novel technology using electricity induction to improve physical chemical and biological properties in the soil. The electricity induction applied to the soil would increase ion and cation exchange in the ground. SIPLO is new technology in agriculture and easy to improve for farmer. The result of combination foliar fertilizer and SIPLO were show a good impact of the application to the production. Induction of SIPLO for 60 minutes and foliar fertilizer of 150 ml / l gave positive results for garlic production.

Keywords: *Allium sativum* L., foliar fertilizer, SIPLO

INTRODUCTION

The increasing population of Indonesia and decreasing production of garlic has caused the domestic market to be unbalanced. Garlic production is decreasing due to the lack of interest of farmers to produce garlic and in other cases imported garlic has good quality and low prices. The problem is that relatively few farmers want to grow garlic due to the high risk of crop failure and decreasing yields. This situation needs encouragement so that farmers have a passion for farming garlic in the optimal sub area. The alternative that can be done is to test the adaptation of varieties in the lowlands and improve cultivation techniques, so that the harvest can be good. Based on FAO start 1999 to 2019, garlic production has decreased for several years even though the land provided is higher (FAO, 2020).

Agricultural development activities in the form of intensive farming systems, apparently leaves a variety of complex problems. One of them is decreasing quality of agricultural land, such as: 1). Productivity is getting lower. Due to the carrying capacity of the land where the soil organic matter content is low, microorganisms, predators, insects, water resources are not functioning properly; 2). The operational costs of cultivation are increasingly expensive; 3). Local potential has not been used optimally for environmental improvement. Agricultural system policy with the use of chemical fertilizers and pesticides has been proven to have a negative impact on agricultural land (Kleijn *et al*., 2009; Geiger et al., 2010).

Agroecosystem degradation is increasingly driving the decline in soil quality. Agricultural land is increasingly infertile. This happens because unwise and not optimal management of land use. The alternative to repair damage to agro-ecosystem can be done by improving cultivation techniques so that local potential can be optimized.

Improvement of garlic cultivation techniques can be done by applying SIPLO technology. SIPLO (Local Potential Intensification System) technique is an integrated system with the optimization of the functions of all local potentials that exist in agricultural land. Potential land should be used properly to be effective for plant growth. The positive aspects of SIPLO are supporting organic crop cultivation and reduce of chemical fertilizers. Land management with the Local Potential Intensification System (SIPLO) is an attempt to bridge the gap that occurs in the system impact of organic farming and conventional farming systems, where the two systems are the advantages and disadvantages (Sugiarto*, et al*., 2013).

The implementation of SIPLO technology on agricultural land is supported by induction tools, which are intended to decompose complex compounds and increase cation exchange

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capacity in soils. The electrification process must be carried out in wetland conditions. Water can function as a conductor in the flow of electric current. The flow of electricity that flows from the SIPLO induction tool will release nutrients that are absorbed and cation exchange occurs quickly. Installation of electrodes on agricultural land during the induction process takes place the release of positive and negative ions that are in the soil. Two poles of the electrode (anode and cathode) are then electrified, so that the electrolysis process occurs, which is Anode: 2H2O – 4e-O2 + 4H+ and Cathode: 2H2O + 2e-H2 + 2OH-. During the electrocuting process there is a displacement of hydrogen ions to the cathode poles and OH anodes (electromigration). This situation is followed by the transition of pore water in the anode area leading to the cathode (electroosmosis). Water flow in the soil pore functions on the OH- increase in the anode polar area (Shang and Masterson, 2000). Restoration of land productivity is mostly done by soil microorganisms, insects and worms that can remodel in a rapid state of physical, chemical and biological more conducive (Munnoli, *et al.,* 2010).

Improving the quality of garlic results requires the availability of nutrients and growth regulators during growth. Meeting the nutritional needs of plants can be assisted by providing fertilizer. Foliar fertilizer is more efficient if the fertilizer is given through the leaves as needed. Fertilizers will be effective for vegetable crops if the amount and concentration is according to need.

MATERIAL AND METHOD

The study was conducted in January 2020 in the Dau District of Malang. Altitude of 665 meters above sea level, average temperature of 240C, 2000-3000 rainfall / year, 80% humidity. The type of soil where the research is alluvial. The equipment used is the SIPLO induction device, Accu 12 volts, aluminum diameter 1 cm length 60 cm, spadio SP9205A avometer, 0.1 mm email wire, pH meter, refractometer, spectrophotometer, foliar fertilizer, garlic seeds of Lumbu Hijau variety. The component of foliar fertilizer is 20% of Nitrogen (N), 15% of Phosphate (P205), 15% of Potassium (K20), 1% Magnesium (MgSO4), Elements and additional compounds Manganese (Mn), Boron (B), Copper (Cu), Cobalt (Co), Zinc (Zn), and others (Agrotani, 2018).

Research using Randomized Factorial Design. Factor I: the duration of induction, i.e. (I0 (control: 0 minutes, I1: 20 minutes, I2: 40 minutes, and I3: 60 minutes) Factor II: foliar fertilizer; (G0: 0 ml/l, G1 : 50 ml/l, G2: 100 ml/l, and G3: 150 ml/l. Laboratory tests are carried out to determine the chlorophyll content of leaves and garlic yield.The analysis inuse is analysis of variance, LSD test 5%, and test regression.

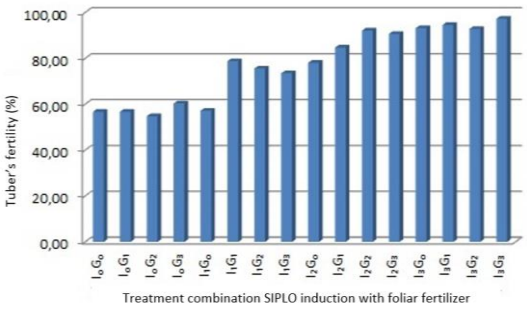
RESULT AND DISCUSSION

Number of Leaves

Increased yield of garlic plants grown on medium plains show different response results. The combination of induction time and giving of fertilizer show real effect on improving results, when compared to controls. Garlic plants are suitable plants in the highlands.

The growth of garlic plants on land with a height of 665 meters above sea level shows relatively good results. This situation is influenced by the availability of nutrients in the soil and supply of nutrients directly through the leaves. The treatment of SIPLO induction and the application of foliar fertilizer can help the nutritional needs of plants. This is very helpful for plants to get nutrient intake which is used during the photosynthesis process. The photosynthate results will then be allocated to the tuber section.

Figure 1. Effect of SIPLO Induction combination and giving foliar fertilizer to garlic's fertility



Long treatment SIPLO Induction of 60 minutes and 150 ml/l (I3G3) of foliar fertilizer showed that there were significant differences in garlic-filled tubers. The effect of SIPLO Induction treatment was proven to be able to increase tuber's fertility 92.89%, 93.29%, 94.63% and 97.35% when compared to controls (56.78%). This could happen due to the availability of nutrients in the soil. It is also supported by the provision of fertilizers through leaves. The foliar fertilizer is very helpful for nutrient uptake through leaf stomata.

Induction of SIPLO and timely application of foliar fertilizer will help the availability of nutrients, when the garlic plant is in the tuber formation stage. Garlic plants need nutrients for growth and formation of tubers. Garlic plants which are planted in plain medium will experience various obstacles, especially the average daily temperature and intensity of sunlight above in the metabolic process to produce maximum photosynthate.

Garlic plant is a type of vegetable that in its growth requires low temperature and sufficient intensity of solar radiation. The desired daily average temperature is around 15-18°C, the intensity of sunlight above 12 hours per day with humidity above 85% (Hilman, Hidayat and Suwandi, 1997).

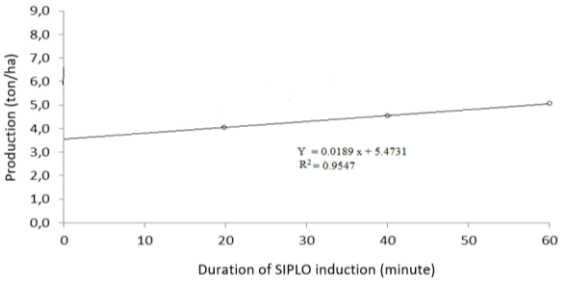
The treatment of SIPLO induction during growth at intervals of once a week and administration of foliar fertilizer proved to be able to help the garlic plants produce even though they were planted on a medium plain of 665 meters above sea level. Land application with electric current with 11-12.5 Amperes can help increase cation exchange in the soil. The release of positive and negative ions of chemical compounds present in the soil greatly helps the availability of nutrients for plants. SIPLO induction application at five-day intervals gives the best economic weight results in lettuce (*Lactuca sativa* L.) compared to controls (Fadli, *et al*., 2018).

When done induction the soil must be wet or inundated. Water is a good conductor for conducting electricity. The existence of an electric current will cause the exchange of ions and cations as well as the release of elements or compounds that are absorbed in the colloidal soil. The passport element is often bound by Ca, Fe or Al compounds, making it difficult for the plant to absorb. Induction application using SIPLO technique can increase soil CEC and release nutrients that are absorbed, so that it can be available for plants (Sugiarto *et.al.,* 2013).

Providing the flow of electric current on agricultural land can improve the degree of soil acidity. Land that has a low pH after induction with SIPLO, the soil acidity can be neutral. Neutral acidity makes macro and micro nutrients more available to plants. Neutral pH conditions are often available in large quantities. Nutrients absorbed by plant roots, enter through the transport network in the form of ions and cations. The phosphor is absorbed by plants in the form of H2PO4- and HPO42- anions derived from P-organic or inorganic. P is available due to the ion exchange complex dominated by base cations under neutral pH conditions. Nutrient exchange is quite effective and availability is optimal when neutral acidity (Prabowo, 2010).

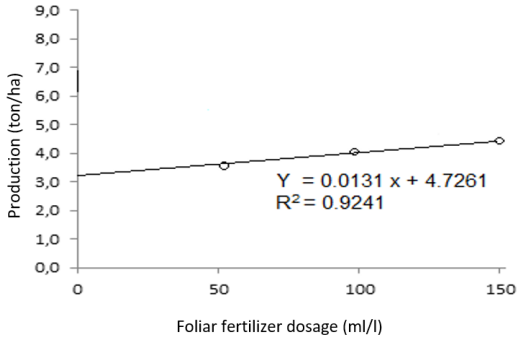
Production of garlic planted on medium plains shows an average yield of 4.7 tons/ha. This situation shows that garlic plants can be developed on land that is at an altitude of 550 - 750 meters above sea level. But the thing to note is that the culture technique must be perfect, so it does not become a limiting factor for plants to produce maximum.

Figure 2. Effect of Duration SIPLO Induction Against Garlic's Results



The results of the regression analysis showed the results of the equation y = 0.0189x + 5.4731 with R2 = 0.9547 (Figure 2.). This situation shows that every one minute addition of SIPLO induction will increase the yield of garlic by 0.0189 tons / ha. The value of determination (0.9547) indicates that the effect of SIPLO induction on the increase in garlic yield was 95.47%. Increased potential for garlic production due to the induction application. Cahya *et al*., (2018) stated that SIPLO induction time 60 minutes and spraying gibberellins 500 mg/20,000 liters can increase dragon fruit yield.

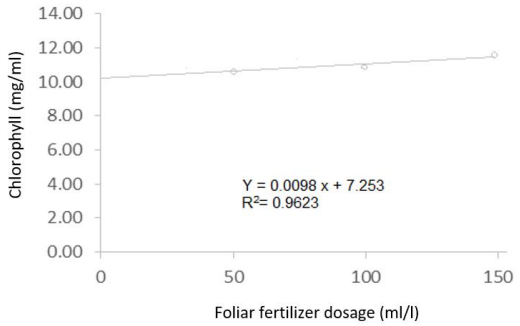
Figure 3. Effect of foliar fertilizer application in garlic productions



The application of foliar fertilizer to garlic plants showed that there was an effect on increasing yield. A dose of 150 ml/l given at 7-day intervals has been proven to increase garlic yield. The results of the regression analysis of giving double shows the results of the equation y = 0.00131x + 4.7261 with R2 = 0.9241 (Figure 3.). This situation shows that every addition of 1 ml/liter of liquid fertilizer can increase the production of garlic by 0,00131 tons/ha. The value of determination (0.9241) shows that the effect of giving a fertilizer to the increase in production of garlic amounted to 92.41%. The application of liquid fertilizer through leaves has proven to be better for vegetable crops (Kurniastuti and Puspitorini, 2018).

The effect of the application of foliar fertilizer on the chlorophyll content of garlic leaves planted on medium plains is presented in Figure 4.

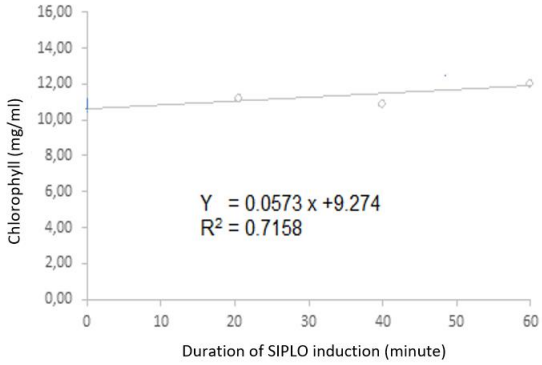
Figure 4. Effect of foliar fertilizer application in garlic's chlorophyll



The results of the regression analysis showed the equation y = 0.0098 x + 7253 with R2 = 0.9623 (Figure 4.). foliar fertilizer in garlic plants greatly affects the increase in leaf chlorophyll content that is equal to 96.23%. This is due to the fact that foliar fertilizer contains several important elements needed by plants in the formation of chlorophyll. Gift foliar fertilizer in garlic plants contribute nutrients more quickly if given through leaves. Excess fertilizer leaf absorption of nutrients through stomata and the effect on plants is quickly visible (Handayo, Hadiastono and Martosudiro, 2013).

Plants in taking nutrients together when there is diffusion of water into the plant web through the roots through xylem in the form of ions or cations. Then transported to the leaves and the process of photosynthesis which will produce photosynthesis. The increasing number of chlorophyll on plant leaves garlic will help photosynthesis plant in the process. The larger the total number chlorophyll on plant leaves and the rate of photosynthesis in producing more maximal photosynthate. The increase will help to the translocation of photosynthate, tubers and therefore the harvest will be better. The results of photosynthate are then transported to all parts of the plant via phloem to parts that need such as tubers, flowers, leaves, stems and roots (Agustina, 2004).

Figure 5. Effect of SIPLO induction duration to garlic's chlorophyll

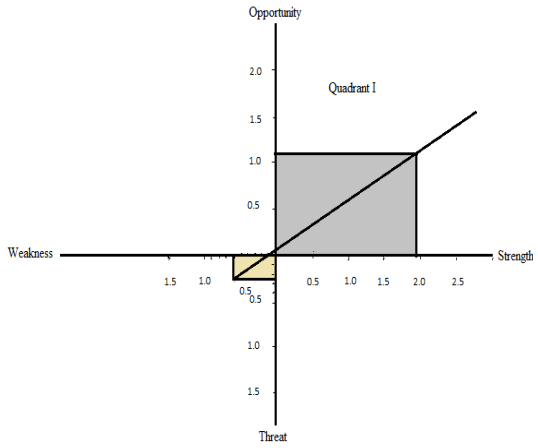


The SIPLO induction treatment for 60 minutes showed the equation y = 0.0573 x + 9.274 with R2 = 0.7158 (Figure 5.). This shows, each addition of 1 minute of SIPLO induction can increase chlorophyll content by 0.0573 mg/ml. The effect of SIPLO induction duration in increasing chlorophyll content of garlic leaves was 71.58%. This is due to more available nutrients and plants can absorb as needed. Electric induction on agricultural land can improve the electrochemical nature of nutrients present in the soil so that the cation exchange capacity is better and the elements absorbed by the soil colloids can be released (Sugiarto et.al., 2013). Green substance formed in plant leaves garlic will play an important role in metabolic processes. An increase in rate of photosynthesis would be better if the chlorophyll plant enough. A higher rate of photosynthesis will be able to produce optimal photosynthate. The increasing number of chlorophyll of garlic will is positive on increased the garlic bulbs.

Strategies policies could be finish, analysis are presented in figure 6. Opportunities for development cultivation garlic in the medium indicating the nature of aggressive (quadrant I). The application of SIPLO induction and delivery of foliar fertilizer could find success in providing

garlic. The cultivation of garlic preferably in land management has supported by the organic matter regularly to make that soil fertility is maintained. The potential environment in promoting growth and earnings from the sale of have the strength with a value 1,96 and of value 1,07 opportunities.

Figure 6. The application of the cultivation of garlic strategy



The policy of farming garlic repairs can be done with regard to the value IFAS (1,906) and EFAS (0,80). The analysis shows the influence of greater than a factor in other external factors for the success of the medium land management.

The implementation of policy can be done by: 1). The technique SIPLO induction and delivery of foliar fertilizer in cultivation garlic in the medium 2). Applied a system of integrated agricultural 3). To repair the agroecosystem 4). Degradation increase the support agricultural land 5). Reduce the use of pesticides excessive 6). The use of fertilizer equal. The implementation of the agricultural system intensive proved impact. ecosystem damage. The use of insecticides and herbicides on organisms, bully and not the target, pollute the air water, land and food, a certain chemical compounds contained in pesticides tending to bind, land soluble in water, security becomes brittle, texture to hold back water, the nutrients in organic matter into decline (Kellogg *et al*., 2000). 7). The organic fertilizers when of land management 8). Assistance and information on the environment 9). Government policy on procurement varieties, superior to the medium a resistant pest and disease through the breeding.

CONCLUSION

Combination treatment of SIPLO with induction time of 60 minutes and leaf fertilizer of 150 ml / l on onion plants which can produce as much as 4.7 ton / ha. This situation increased by 51.80% when compared to the control. SIPLO induction application separately for 60 minutes, obtained leaf chlorophyll content of 12,675 mg / ml and leaf fertilizer application of 150 ml / l, the obtained leaf chlorophyll content was 12,418 mg / ml. Pitched tubers reach 97.35% while the control reached 56.78%.

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