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Percentage of Flower and Fruit Fall, and Red Chili Production in Ultisol Applied Biostimulants and Inorganic Fertilizers

Persentase Gugur Bunga dan Buah, serta Produksi Cabai Merah pada Ultisol yang Diaplikasikan Biostimulan dan Pupuk Anorganik

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ABSTRAK

Ultisol memiliki permasalahan utama ketersediaan hara yang rendah sehingga menyebabkan tingginya persentase gugur bunga dan buah serta menurunkan produksi cabai merah. Penelitian ini bertujuan untuk mengetahui efektivitas biostimulan dalam mengurangi persentase gugur bunga dan buah, penggunaan dosis pupuk anorganik, serta perannya dalam meningkatkan produksi cabai merah pada Ultisol. Metode yang digunakan pada penelitian ini yaitu ekperimental menggunakan rancangan acak kelompok (RAK) dengan 9 perlakuan. Perlakuan yang digunakan yaitu aplikasi biostimulan siram dan tanpa disiram ke tanah dengan berbagai dosis pupuk anorganik. Adapun dosis pupuk yang digunakan yaitu 100%, 75%, dan 50% berdasarkan rekomendasi pemupukan. Hasil penelitian menunjukkan aplikasi biostimulan yang dikombinasikan dengan pupuk anorganik berbagai dosis berpengaruh nyata terhadap berat buah per tanaman dan produksi cabai merah, namun berpengaruh tidak nyata terhadap persentase gugur bunga dan buah, serta jumlah buah per tanaman. Aplikasi biostimulan dan berbagai dosis pupuk anorganik cenderung meningkatkan gugur bunga, jumlah buah per tanaman, dan persentase gugur buah. Biostimulan yang dikombinasikan dengan pupuk anorganik mampu mengurangi penggunaan pupuk sebanyak 50%. Produksi cabai merah dengan aplikasi biostimulan dan pupuk anorganik dosis 50% mencapai 5,36 ton/ha. Hasil analisis kelayakan ekonomi cabai merah yaitu R/C ratio 1,69 dan B/C ratio 0,69 yang berarti budidaya cabai merah dengan aplikasi biostimulan ini menguntungkan dan layak dikembangkan. Jadi, aplikasi biostimulan mampu mengurangi penggunaan pupuk sebesar 50% dan mampu meningkatkan produksi cabai merah.

Keywords: analisis kelayakan ekonomi, *Capsicum annuum*, lahan suboptimal

ABSTRACT

Ultisol has main problem of low nutrient availability causing a high percentage of flowers and fruit fall and reducing red chili production. This study aimed to find out effectiveness of biostimulants in reducing percentage of flower and fruit fall, use of inorganic fertilizer doses, and their role in increasing production red pepper in Ultisol. The method used experimental and randomized block design with 9 treatments. The treatment used application of flush biostimulants and without watering into soil with various doses inorganic fertilizers. The fertilizer doses were 100%, 75%, and 50% based on fertilization recommendations. The study results showed that application of biostimulants combined with inorganic fertilizers of various doses had a significant effect on fruit weight/plant and red pepper production, but had an insignificant effect on the percentage of flowers and fruits, as well as number of fruits/plant. Application of biostimulants and various doses of inorganic fertilizers tended to increase fall of flowers, number of fruits/plant, and the percentage of fruit fall. Biostimulants combined with inorganic fertilizers were able to reduce fertilizer use as much as 50%. Production of red pepper with application of biostimulants and 50% of inorganic fertilizers reached 5.36 tons/ha. The results of the economic feasibility analysis of red chili peppers were 1.69 R/C and 0.69 B/C ratio, meaning that the cultivation of red chili with application of biostimulants was profitable and worthy of development. So, application of biostimulants is able to reduce fertilizers by 50% and increase production of red peppers.

Keywords: economic feasibility analysis, *Capsicum annuum,* suboptimal land

INTRODUCTION

Red chili is a horticultural commodity that is in great demand by the public but the production of red chili is relatively low. Low chili production is caused by the lack of available nutrients and occurs due to several factors, namely plant physiological factors and also external factors in the form of land used (Gare et al., 2017). Fruit-drop often occurs due to plant physiological factors where the lack of growth regulators, especially auxin, and the low availability of nutrients such as K, Mg, and B are inhibitors of defoliation, flowers, and fruits (Mends-Cole et al., 2019; Tamilselvi et al., 2019). Low chili production is also due to land that does not support the growth of plants such as Ultisol (Cornelissen et al., 2018). Ultisol is a type of soil that is often used in cultivation, but is categorized as suboptimal land or sour dry land due to its characteristics that are less supportive of plant growth and its low nutrient availability (Pan et al., 2020).

One of the products that can increase the efficiency of absorption and availability of nutrients, biostimulants and inorganic fertilizers. Biostimulants are formulations of plant or microorganism bioactive compounds that aim to increase the efficiency of absorption of nutrients, tolerance to abiotic stresses and plant quality (Gemin et al., 2019; Ricci et al., 2019). Biostimulants cannot work optimally if the nutrients contained in the soil are low, so fertilization is necessary. Of course, before fertilizing with inorganic fertilizers to overcome the high acidity and saturation of Al and the low availability of nutrients and organic matter in Ultisols, organic matter and liming are added (Lin et al., 2018). The application of NPK fertilizer as much as 4 g/pot combined with biochar can increase the availability of macro nutrients N, P, and K as well as sweet corn production in Ultisols (Panjaitan et al., 2022). The application of NPK fertilizer at a dose of 16.7 g/plant on okra can increase the availability of nutrients in Ultisols (Kayode & Adeoye, 2021).

The application of NPK fertilizer to Ultisol has been proven to increase the availability of nutrients for plants, but it has not yet been proven whether or not it can interact with biostimulants so that it can reduce flower and fruit fall, the use of inorganic fertilizers, and increase the production of red chili when combined. Biostimulants from seaweed extracts can reduce the use of inorganic fertilizers and increase the availability of nutrients in Ultisols (EL Boukhari et al., 2020). Biostimulants from seaweed extract are equipped with hormones such as auxin, gibberellins, cytokinins and complementary nutrients such as N, P, K which play a role in supporting plant growth and production (Ali et al., 2021). The benefits of using biostimulants have also been proven. This study aimed to test effectiveness of biostimulants in reducing use of inorganic fertilizer doses, the percentage of flower and fruit fall, and their role in increasing red chili production in Ultisol in Experimental Garden of Universitas Sriwijaya.

MATERIALS AND METHODS

The research was carried out in June-December 2021 at the Experimental Garden of the Faculty of Agriculture, Sriwijaya University, Indralaya. The study was designed with a Randomized Group Design (RAK) with 9 levels of treatment. Each treatment was repeated 3 times so that there were 27 experimental units.

The treatment level was B0 = Control (100 % recommendation of Urea + NPK fertilizer); B1 = Biostimulant 12 L/ha seed application concentration 100 ppm; B2 = Biostimulant 12 L/ha seed application concentration of 100 ppm + 50% recommended NPK + Urea fertilizer; B3 = Biostimulant 12 L/ha seed application concentration of 100 ppm + 75% recommended fertilizer NPK + Urea; B4 = Biostimulant 12 L/ha seed application concentration of 100 ppm + 100% recommended NPK+ Urea fertilizer; B5 = Biostimulant 12 L/ha seed application concentration 100 ppm and watered on soil; B6 = Biostimulant 12 L/ha seed application concentration of 100 ppm and watered on soil + 50% recommendation of NPK + Urea fertilizer; B7 = Biostimulant 12 L/ha seed application concentration of 100 ppm and watered on soil + 75% recommendation of NPK + Urea fertilizer; B8 = Biostimulant 12 L/ha seed application concentration of 100 ppm and watered on the soil + 100% recommended NPK + Urea fertilizer.

Land Preparation

Land preparation was carried out by spraying the field using herbicides and manually cleaned of plant debris and weeds. The tillage was performed using a hand tractor by flipping the soil to make it loose. After the first tillage, liming of 1 x Aldd with a dose of dolomite of 0.98 tons/ha and the addition of organic matter in the form of chicken animal manure, with a dose of 20 tons/ha as the basic treatment. The lime and chicken manure were mixed with the ground, then beds were made with a size of 1.2 m x 4 m and incubated for 2 weeks.

Seed Preparation

The seed preparation was conducted with 2 treatments, namely with seed treatment and without seed treatment. The seeds used Lado F1 seeds, all off seeds (seed treatment and without seed treatment) soaked with warm water with a temperature of 50^0C for 1 hour to break up the seed dormancy period (Shafaei et al., 2016). The seed treatment was carried out by soaking the seeds in the biostimulants for 15 minutes (Sivachandiran & Khacef, 2017). After that, the seeds were germinated using straw paper for 3 days, then the germinated seeds were transferred to polybags for nursery. Seedlings were carried out using polybags measuring 15 cm x 20 cm until the plants have 5-6 leaves and then transferred to beds with a spacing of 60 x 70 cm.

Fertilization

The fertilizers used inorganic fertilizers NPK 16-16-16 and urea. The recommended 100% fertilizer dose of NPK 16-16-16 was 300 kg/ha or 12.6 g/plant and urea fertilizer 200 kg/ha or 8.4 g/plant for one planting period. The recommended 75% fertilizer dose was given 9.45 g/NPK fertilizer plant and 6.3 g/urea fertilizer plant. The application of NPK fertilizer as much as 6.3 g/ plant and urea fertilizer 4.2 g/plant for a recommended dose of 50%. The application of NPK fertilizer was carried out 2x according to the treatment, at 14 and 42 days after transplanting to the beds. Urea fertilizer was applied 7 days after transplanting. Application of inorganic fertilizer used tugal system in the soils. Fertilization was done according to the treatment and done in the afternoon. The biostimulant application was watered twice on the ground, 10 and 35 days after transplanting. The biostimulant needed for each application was 1 ml/plant and applied to the soil.

Maintenance

Plant maintenance was performed by embroidering plants on dead plants, watering 2x a day every morning and evening, caring and weeding weeds around the plant, monitoring and handling of pests using vegetable pesticides and methyl eugenol.

Harvesting

Harvesting was carried out according to the criteria of harvesting with a characteristic of 60% full red and shiny fruit, whole and dense in shape. Harvesting was first performed at 11 MST to 19 MST with 9 harvests performed once a week. Harvesting was carried out by picking the chili fruit along with its fruit stalks.

Observed Variables

The variables observed in this study were percentage of flower fall (%), number of chilies per plant, percentage of fruit fall (%), weight of the chilies per plant (g/plant), the production of chilies (ton/ha), and the feasibility analysis of curly red chili economy.

Data Analysis

The obtained data were analyzed using the ANOVA analysis by comparing the calculated F value and the table F at a 95% confidence level. If F count is greater than the F table then treatment influences significantly. A further test procedure was conducted to find out the differences between treatments using the Least Significant Difference LSD at a level of 5%.

RESULTS

Percentage of Flowers Fall

Based on analysis of variance in the application of biostimulants and urea and NPK fertilizers at various doses and had no significant effect on the percentage of curly red chili flowers fall in Ultisols. The average percentage of interest loss was calculated by comparing the number of flowers that fall with the total number of flowers formed and multiplied by 100% (Table 1).

Biostimulants provision for both on seed treatment and pouring over the soil, with or without by the application of inorganic fertilizers tended to increase the fall of curly red chili peppers. The lowest average percentage of flower fall was 34.17% found in the B0 treatment (urea and NPK fertilizer application with a dose of 100%), while the highest average interest fall percentage of 44.76% was found in the B3 treatment (biostimulant application on seeds + urea and NPK fertilizer application at a dose of 75%).

Table 1. The average percentage of flowers fall (%) of red chili plants

Treatments	Percentage of Flowers Fall (%)
B0 (Kontrol/ 100% NPK&Urea)	34.17 ± 0.26
B1 (Biostimulant application to seed)	40.77 ± 22.81
B2 (Biostimulant application to seed + 50% Urea & NPK)	36.11 ± 6.00
B3 (Biostimulant application to seed + 75% Urea & NPK)	44.76 ± 26.88
B4 (Biostimulant application to seed + 100% Urea & NPK)	39.68 ± 22.11
B5 (Biostimulant application to seed & soil)	40.86 ± 8.41
B6 (Biostimulant application to seed & soil + 50% Urea & NPK)	40.64 ± 9.89
B7 (Biostimulant application to seed & soil + 75% Urea & NPK)	42.31 ± 23.73
B8 (Biostimulant application to seed & soil + 100% Urea & NPK)	35.18 ± 16.63

Number of Fruits per Plant

The application of biostimulants and various doses of urea and NPK had no significant effect on the number of fruits per plant in Ultisol based on analysis of variance. The average number of chilies served was data on the number of good and rotten fruits that fall and was calculated for each harvest (Table 2). The lowest average number of chilies per plant was in the B5 treatment (application of biostimulants to seeds and pouring over the soil) with a total of 83.15 pieces, while the average number of chilies per plant was the highest at 142.45 pieces in the B6 treatment (application of biostimulants to seeds and pouring over the soil and the addition of inorganic fertilizers at a dose of 50%).

Persentage of Fruits Fall

Based on the analysis of variance, the application of biostimulants and urea and NPK fertilizers at various doses had not significant effect on the percentage of curly red chili fruit fall on Ultisol. The average percentage of fallen fruit was calculated by comparing the number of fallen fruit with the total fruit (good and fallen fruit) and multiplied by 100% (Table 3). The lowest average percentage of fruit fall of 62.67% was found in the control treatment (B0), that was the application of urea and NPK fertilizers with a dose of 100%, while the highest average was in the B7 treatment (application of biostimulants to seeds and pouring over the soil with the addition of urea and NPK fertilizers at a dose of 75%) with a percentage of 72.67%. Based on the average percentage of fruit fall, the application of biostimulants both in the seed treatment and watering to the soil, without or followed by the application of inorganic fertilizers, was seen to increase curly red chili fruit fall.

Table 2. The average number of fruits per plant

Treatments	Number of Fruits
B0 (Kontrol/ 100% NPK&Urea)	117.34 ± 37.28
B1 (Biostimulant application to seed)	90.83 ± 34.74
B2 (Biostimulant application to seed + 50% Urea & NPK)	86.63 ± 15.88
B3 (Biostimulant application to seed + 75% Urea & NPK)	128.82 ± 40.22
B4 (Biostimulant application to seed + 100% Urea & NPK)	95.61 ± 23.99
B5 (Biostimulant application to seed & soil)	83.15 ± 12.55
B6 (Biostimulant application to seed & soil + 50% Urea & NPK)	142.45 ± 50.80
B7 (Biostimulant application to seed & soil + 75% Urea & NPK)	88.08 ± 15.83
B8 (Biostimulant application to seed & soil + 100% Urea & NPK)	81.99 ± 29.09

Table 3. The average percentage of fruits fall during the growth of red chili plants

Treatments	Percentage of Fruits Fall (%)
B0 (Kontrol/ 100% NPK&Urea)	62.67 ± 1.70
B1 (Biostimulant application to seed)	68.67 ± 8.26
B2 (Biostimulant application to seed + 50% Urea & NPK)	72.33 ± 4.19
B3 (Biostimulant application to seed + 75% Urea & NPK)	68.67 ± 4.11
B4 (Biostimulant application to seed + 100% Urea & NPK)	69.33 ± 8.01
B5 (Biostimulant application to seed & soil)	71.33 ± 2.36
B6 (Biostimulant application to seed & soil + 50% Urea & NPK)	72.00 ± 7.26
B7 (Biostimulant application to seed & soil + 75% Urea & NPK)	72.67 ± 6.18
B8 (Biostimulant application to seed & soil + 100% Urea & NPK)	68.67 ± 7.59

Weight of Chilli Fruits per Plant

Based on the analysis of variance in the treatment of biostimulant applications and various doses of urea and NPK fertilizers, they significantly affected the chili fruit weight in Ultisol. The results of the Least Significant Difference (LSD) test with a level of 5% biostimulant treatment of seed application and watering of the soil as well as the application of various doses of urea and NPK fertilizer to red chili fruit weight from harvest 1 to harvest 9 (Table 4). The highest weight of fruit per plant was 241.20 g/plant, namely in the B6 treatment (application of biostimulants on seeds and soil and 50% dose of urea + NPK fertilizer). The lowest average fruit weight of 109.50 g/plant was found in the B8 treatment (biostimulant seed application and pouring over the soil and 100% dose of urea and NPK fertilizers). The results of the Least Significant Difference (LSD) test at the level of 5% showed that the B6 treatment (application of biostimulants to seeds and pouring over the soil as well as urea and NPK fertilizers dose of 50%) was significantly different from the B8 treatment (biostimulant of seed application and pouring over the soil + 100% dose of inorganic fertilizer), but did not significantly influence from the control treatment of B0 (application of 100% urea fertilizer and NPK).

Treatment B6, namely a combination of biostimulants with a dose of 50% inorganic fertilizer, was the best treatment to increase chili fruit weight per plant. The weight of the chilies produced in this study when compared with the descriptions of the varieties cultivated was classified as below average. Fruit weight per plant of Lado F1 curly red chilies could produce 1.0-1.5 kg, this figure was of course much higher when compared to the results obtained during the study. This was because many chilies fall and rot caused by pests and diseases, thereby reducing the weight of chilies. The difference between fruit attacked by pests and healthy chilies (A) rotten chilies were attacked by fruit flies, (B) ripe and healthy chilies, (C) anthracose infested chilies (Figure1).

Yield of Red Chili

The production of this chili was the result of observing fruit weight which was converted to tons/ha. Based on the analysis of variance in the treatment of biostimulant applications and various doses of urea and NPK fertilizers, they had a significant effect on curly red chili production in Ultisol. The results of the Least Significant Difference (LSD) test with a 5% level of biostimulant treatment of seed application and watering to the soil and the addition of various doses of urea and NPK fertilizers to curly red chili production in Ultisols (Table 5).

The highest average chili production was 5.36 tons/ha in the B6 treatment (application of biostimulants to seeds and soil and 50% dose of urea + NPK fertilizer). The lowest average chili production was found in the B8 treatment (biostimulant of seed application and soil watering and 100% dose of urea and NPK fertilizer) of 2.38 tons/ha.

The results of the Least Significant Difference (LSD) test at the level of 5% showed that the B6 treatment (application of biostimulants to seeds and pouring over the soil as well as urea fertilizer and NPK doses of 50%) was insignificantly different from the B3 treatment (seed application biostimulants + 75% doses of urea and NPK fertilizers), but significantly different from the B0 control treatment (application of 100% urea and NPK fertilizers).

Economic Feasibility Analysis

The development of chili cultivation, of course, economically needs to be accompanied by an economic feasibility analysis to find out the advantages and feasibility of the chili commodity cultivated. The results of the economic feasibility analysis of curly red chili (Table 6). Analysis of the economic feasibility of curly red chili in one planting period required a production cost of 1,121,800.00 IDR. The selling price of chili per kg was

41,100.00 IDR based on the results of surveys on the market. From the results of the cultivation of curly red chili peppers carried out, it produced 46.09 kg of chili in one planting period receiving as much as 1,894,299.00 IDR. Based on the results of the research conducted, the value of the R/C ratio obtained was 1.69, where the value of the R/C ratio was > 1, which means that curly red chili farming was profitable. The B/C ratio value obtained was 0.69 which means that farming was feasible to continue.

Table 4. The average of weight of chilli fruits per plant

Treatments	Weight of Chilli Fruits (g/plant)
B0 (Kontrol/ 100% NPK&Urea)	204.24 $_{bc}$
B1 (Biostimulant application to seed)	131.25 $_{a}$
B2 (Biostimulant application to seed + 50% Urea & NPK)	131.51 $_{a}$
B3 (Biostimulant application to seed + 75% Urea & NPK)	215.84 $_{bc}$
B4 (Biostimulant application to seed + 100% Urea & NPK)	148.80 $_{ab}$
B5 (Biostimulant application to seed & soil)	118.55 $_{a}$
B6 (Biostimulant application to seed & soil + 50% Urea & NPK)	241.20 $_{c}$
B7 (Biostimulant application to seed & soil + 75% Urea & NPK)	145.73 $_{ab}$
B8 (Biostimulant application to seed & soil + 100% Urea & NPK)	109.50 $_{a}$

Note: Numbers followed by the same letters show no significant differences in the 5% LSD test

(A) (B) (C)

Figure 1. Chili fruit was attacked by fruit flies, healthy fruit, and chili fruit was attacked by anthracnose

Table 5. The average yield red chili in each treatment

Treatments	Yield (tons/ha)
B0 (Kontrol/ 100% NPK&Urea)	4.68 $_{bc}$
B1 (Biostimulant application to seed)	2.77 $_{ab}$
B2 (Biostimulant application to seed + 50% Urea & NPK)	2.84 $_{ab}$
B3 (Biostimulant application to seed + 75% Urea & NPK)	4.94 $_{cd}$
B4 (Biostimulant application to seed + 100% Urea & NPK)	3.41 $_{abc}$
B5 (Biostimulant application to seed & soil)	2.63 $_{a}$
B6 (Biostimulant application to seed & soil + 50% Urea & NPK)	5.36 $_{d}$
B7 (Biostimulant application to seed & soil + 75% Urea & NPK)	3.00 $_{abc}$
B8 (Biostimulant application to seed & soil + 100% Urea & NPK)	2.38 $_{a}$

Note: Numbers followed by the same letters show no significant differences in the 5% LSD test.

Table 6. Analysis of the economic feasibility of curly red chilies

Description	Grade
Production cost (p)	1,121,800.00 IDR
Income (q)	1,894,299.00 IDR
Profit (r=q-p)	772,499.00 IDR
R/C Ratio (s=q/a)	1,69
B/C Ratio (t=r/a)	0,69

DISCUSSION

Based on the research results on the application of biostimulants and various doses of inorganic fertilizers, different results were obtained for each of the observed variables. The variable percentage of flower and fruit fall and the number of fruits per plant showed that the application of biostimulants and various doses of inorganic fertilizers had no significant effect. When the research was conducted, treatments using biostimulants tended to increase flower and fruit fall. This is presumably because the biostimulants used in this study underwent an anaerobic decomposition process, resulting in an unpleasant odor. This is in line with (Agyeman & Tao, 2014) which states that immature organic liquid fertilizer tends to be unstable, has an unpleasant odor, this indicates the occurrence of anaerobic decomposition can produce compounds such as phenolic acids, ammonia, nitrites, iron and manganese which are toxic to plants (phytotoxic).

It is suspected that the application of inorganic fertilizers and biostimulants was not the main factor causing fruit drop in this study. Another factor that causes chili fruit fall is external factors that come from pests and diseases that attack red chilies. This of course also affects the fruit weight per plant, where the fruit weight of the chilies produced in this study when compared with the descriptions of the varieties cultivated are classified as below average. Fruit weight per plant of Lado F1 curly red chilies can produce 1.0-1.5 kg, this figure is of course much higher when compared to the results obtained during the study.

One of the pests that causes a decrease in fruit weight and a high percentage of fruit fall is the fruit fly. Fruit fly attacks cause the fruit to rot, emit a liquid with an unpleasant odor, and over time the liquid contained in the fruit will run out, the fruit will dry out and fall off (Muhlison et al., 2021). Apart from pests, the factor causing the low fruit weight and high percentage of fruit fall in this study was anthracnose disease. In field observations, the fruits infected with anthracnose are wrinkled and have black spots like dry wounds. Chili fruit that is attacked over time will dry and fall off, this causes very low fruit weight.

Although various obstacles were encountered in this study in various variables, the number of fruits per plant, fruit weight per plant, and plant production with the addition of biostimulants, seed applications and watering the soil were able to increase the number of fruits and chili production and reduce the need for urea and NPK fertilizers by as much as 50% in Ultisols. Treatment B6 (seed application biostimulant and soil flush and 50% inorganic fertilizer) is the treatment with the highest production and can reduce the use of inorganic fertilizers by as much as 50%, but when compared to the average production of red chilies in Indonesia, the figures obtained are still far below the average flat. The chili production in Ogan Ilir only reached 2.75 tons/ha, while the chili production in Ultisol in Indralaya could reach 5.36 tons/ha, meaning that it was still 2x higher than the chili production in Ogan Ilir. According to Yusuf et al. (2021), biostimulants are substances that can be poured into the soil, or near plants, very good for plant growth and resistant to stress, biostimulants are not the main nutrients but help to make nutrients available to plants so that when combined with NPK fertilizer it is more optimal for provide nutrients for plants.

Ultisols are soils that absorb a lot of P nutrients in the soil. these nutrients are usually bound by Al and Fe ions (Muktamar & Lifia, 2020). Phosphate (P) is a macro nutrient needed by plant especially in fruit formation (Soltan et al., 2021), so the addition of inorganic fertilizers such as pearl NPK is needed to increase the production of chilies produced by plants. Based on this research, it is suspected that biostimulants are able to increase the availability of P nutrients in Ultisols which are adsorbed by soil colloids. Biostimulants from seaweed extracts with application in low concentrations can improve plant physiological responses such as increasing plant growth, increasing the primordia phase and yields, improving plant quality and increasing the nutrients in the soil so they can be available to plants (Battacharyya et al., 2015).

Every plant has the capacity to absorb nutrients, of course, if the lack or excess of nutrients can cause the results obtained to be less than optimal. In the B6 treatment, the combination of biostimulants of seed and application of pouring over the soil and inorganic fertilizers was the treatment with chili weight per plant, the highest red chili production, and proven to reduce the need for inorganic fertilizers as much as 50%. The results obtained in the B3 treatment were insignificantly different from the B6 treatment. The application of biostimulants to seeds alone could increase the production and reduce the use of inorganic fertilizers as much as 25%. This is in line with (Ertani et al., 2015), that the use of biostimulants is often proposed in agriculture because the compounds contained in them are safe and environmentally friendly. The biostimulants can also reduce the use of inorganic fertilizers because they can increase micro and macro nutrients for plants to affect the plant morphology. Biostimulants are also very helpful in maximizing soil work to be able to increase crop production (Calvo et al., 2014). The use of fertilizer is also one of the determinants of crop production, if the dosage given is not correct according to the type, dosage, time and method of application it will have an unfavorable impact on plants and soil. In the B8 treatment (application of biostimulants to seeds and pouring water over the soil and inorganic fertilizer dose of 100%) became the treatment with the lowest production. This is thought to be due to the large amount of nutrients available because it uses a 100% dose of fertilizer coupled with the application of biostimulants that work to increase the nutrient availability causing plants to be no longer able to accommodate and absorb nutrients. This is suspected to cause plant productivity to decrease so that the production of red chili peppers also decreases. Excessive use of fertilizers can decrease soil and crop productivity (Kumar et al., 2017).

In this study, the economic feasibility analysis was carried out useful for finding out the feasibility and advantages of cultivating red chili using the biostimulants. The analysis of the feasibility of growing curly red chili peppers used the R/C ratio and B/C ratio. The revenue-cost ratio (R/C ratio) is a comparison between receipts and total production costs incurred (Thijssen, 2015). The value of the R/C ratio was < 1, meaning that the farm business suffered a loss, while if the value of the R/C ratio is 1, then the farm business is in a breakeven state (Bangun, 2020). Based on the conducted study results, the R/C ratio obtained 1.69, where the R/C ratio value was > 1, meaning that this curly red chili farming business provided benefits. The next analysis used the B/C ratio. The benefit-cost ratio is a comparison between the net profit obtained and the total production costs incurred (Thijssen, 2015). If the value of B/C ratio is > 0, then the farming business is worth continuing and giving profits, while if the value of B/C ratio is < 0, the farming business is not worth continuing and experiencing losses (Kullmann & Thiel, 2018). Based on the results of the study, the B/C ratio obtained was 0.69, meaning that the farming business was worth continuing and giving profits. The result of the performed economic feasibility analysis showed that the cultivation of curly red peppers could provide benefits and was worthy of development and continued.

CONCLUSSION

Based on research results, the application of biostimulants to seeds and watering them on the ground was able to reduce the use of inorganic fertilizers by 50% and was able to increase red chili production and the cultivation of red chili with application of biostimulants was profitable and worthy of development, but had not been able to reduce the percentage of flower and fruit fall in Ultisols at the Sriwijaya University Experimental Garden.

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