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Article

Influence of Rhizobacteria and Seed Pruning on Plant Growth and Results Red Chili (*Capsicum annum L.)*

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Zahanis*, Fatimah, Devi

Agrotechnology Study Program, Faculty of Agriculture, Universitas Tamansiswa, Padang, Indonesia

Abstract. This study aims to determine the effect of rhizobacteria and seed pruning on the growth and yield of red chilies. This research has been carried out in the Malvinas Delta permanent nursery, Padang Watershed Management Agency (BPDAS). This experiment used a factorial completely randomized design with 2 factors. The first factor was pruning the seeds, namely: without pruning, trimming at 21 days after sowing, trimming at 30 days after sowing. The second factor is the provision of rhizobacteria which consists of: without rhizobacteria and given rhizobacteria. The observations made in the experiment were plant height, number of primary branches, age of flowering, age at first harvest, length of fruit, number of fruit planted, and weight of fruit planted. The results of the experiment showed a significant interaction between pruning seeds and giving rhizobacteria to the growth and yield of red chilies at the plant height and number of branches. The influence of rhizobacteria on the growth and yield of red chilies on the parameters of the age of flowering, number of fruit planted, and fruit weight of the plant with a yield of 156.70 g/plant. There is an effect of pruning on the vegetative phase and no effect on the generative phase of red chili plants.

Corresponding Author :
Zahanis
Agrotechnology Study Program, Faculty of Agriculture, Universitas Tamansiswa, Padang, Indonesia
Email : zahanis@gmail.com

1. Introduction

Red chilies are one of the important vegetable commodities among the global community. This plant is classified as an annual plant and for the Indonesian people it is a plant that is very well known as a flavoring ingredient and a complement to various special dishes.(1-3)

The community's need for chili is getting higher in order to fulfill the community's nutrition, so that the demand for chili products from year to year is also increasing. Chili can be used as a food flavoring and contains several types of vitamins, namely A, Bl, C iron, and phosphorus so that it plays an important role in improving health. Therefore, the increasing number of chili processing industries into instant products causes instant products to be available in various forms so that people's consumption of these commodities will also increase.(1-3)

The area of chili cultivation in Indonesia in 2013 was 124,110 ha with a production of 1,012,879 ton, however in 2014 the area of chili cultivation increased to 128,734 ha, but the production also increased by 1,074,602 ton. In 2015, the planted area for chilies decreased to 120,847 ha, with the production also decreasing, namely 1,045,182. The causes of the increase and decrease in chili production in Indonesia are reduced land area and the attack of pests and diseases in chili plants.(4-7)

Figure 1. Red Chili (*Capsicum annum L.*)

This production is still low compared to the potential yield of this plant, which is 12 tons per hectare. Chili production can be increased in many ways. One of them is through proper cultivation of plants, including their maintenance. Among the maintenance practices commonly practiced by farmers is pruning the seeds. The pruning is an effort to reduce unnecessary plant parts with the aim of optimizing plant parts that are important for growth and production. Than, seedling pruning causes the dominance of the apicle to stop so that the growth of shoots and branches increases due to the accumulation of auxin in the shoot area being channeled to lateral shoots. Seed pruning aims to produce new shoots or branches.(8-10)

Treatment of pests and diseases of red chili plants, which currently generally use pesticides, can cause ecological problems.(11-12) This situation results in soil and water pollution, a high risk of poisoning for humans who treat pesticides and plants, the possibility of high pesticide residues in marketed products and high production costs. Efforts to control pathogens have been carried out through crop rotation, sanitation, using resistant varieties and chemically with bactericides, but they are not yet effective, so it is necessary to find other alternatives, including by reducing (Plant Growth Promoting Rhizobacteria (PGPR). Rhizobacterial isolates can function as a trigger for plant growth and as an antagonistic agent against plant pathogens.(13-15)

The purpose of this study was to determine the effect of rhizobacteria and seed pruning on the growth and yield of red chilies.

2. Method

This experiment was carried out in the nursery of the Padang Watershed Management Agency (BPDAS), at an altitude of 5 meters above sea level. This experiment used a factorial completely

randomized design with 2 factors. The first factor was pruning of the seeds, namely: without pruning, trimming at 21 days after sowing, trimming at 30 days after sowing. The second factor is giving rhizobacteria which consists of: without rhizobacteria and giving rhizobacteria.

3. Results and Discussion

Plant height

Table 1. Height of red chili plants with rhizobacteria and seed pruning

Rhizobacteria	Pruning (cm)		
	No. Trims	rune 21 DAS	Prune 30 DAS
Without rhizobacteria	26.90 Ba	30.40 Aa	24.97 Bb
Given rhizobacteria	22.76 Ab	12.11 Bb	26.92 Aa
KK = 14.03 %			

Table 1 shows that the height of red chilies shows an interaction between rhizobacteria and different pruning of seeds in each treatment. The highest plant height without rhizobacteria was found at the pruning at 21 days after planting with a height of 30.40 cm. Treatment with riobacteria resulted in plant height at pruning 30 days after planting which resulted in a height of 26.92 cm. The results without pruning showed that the plant height without rhizobacteria was 26.90 cm, pruning 21 days after planting showed the highest yield without rhizobacteria, namely 30.40 cm and for pruning at 30 days after planting the plant height with rhizobacteria was 26.92 cm.

Applications without rhizobacteria and pruning seeds 21 days after planting showed the highest plant height, namely 30.40 cm. This is because the rhizobacteria have not been able to increase the height of the red chili plants, and the effect of pruning at 21 days after planting is a good age for pruning because at that time the plants are still in the vegetative period, so the plants will not be disturbed during their generative period such as pruning. age 30 days after planting.

The growth of the vegetative phase in plants is generally characterized by the dominance of apicles, namely competition between shoots and lateral shoots so that pruning the shoots during the vegetative period will increase plant height.

Number of Primary Branches

Table 2. Number of red chili primary branches on rhizobacteria and seed pruning

Rhizobacteria	Pruning (branch)		
	No Trim	Prune 21 DAS	Prune 30 DAS
Without rhizobacteria	7.11 Aa	7.22 Aa	5.00 Ba
Given rhizobacteria	4.33 Ab	5.11 Ab	4.67 Aa
KK = 14.03 %			

Table 2 shows that the number of primary branches of red chili shows an interaction between rhizobacteria and different pruning of seeds in each treatment. The highest number of branches treated without riobacteria was found on pruning 21 days after planting with 7.22 branches.

Treatment with rhizobacteria resulted in the highest number of branches found in pruning 21 days after planting with 5.11 branches. The results without pruning showed a large number of branches without the riobacterial treatment, namely 7.11 branches, and pruning 21 and 30 days after planting showed the highest yields with no pruning treatment, namely 7.22 and 5.00 branches.

Applications without rhizobacteria and pruning seeds 21 days after planting showed the highest number of primary branches, namely 7.22 branches. It is possible that rhizobacteria have not maximized their role in spurring the growth of the primary branches of red chili plants and the effect of pruning at 21 days after planting is the best age for pruning because at that time the plants still have energy for vegetative growth while pruning at the age of 30 days after planting. planting produces primary branches which are of little consequence because the plant has almost entered the generative phase. The diversity of many branches is caused by cutting the shoots causing the growth of apical shoots to be stunted so that the plant is not too tall and has many branches so that the formation of many flowers.

Age Out of The Flower

Table 3. Age out of red chili flowers by giving rhizobacteria and pruning the seeds

Rhizobacteria	Pruning			Average
	Prune 21			
	No Trim	DAS	Prune 30 DAS	
Without rhizobacteria	42.78	43.55	45.00	43.77 b
Given rhizobacteria	47.33	51.44	52.89	50.55 b
Average	45.05 B	47.49 AB	48.94 B	
KK = 4.78 %				

Table 3 shows the expiry date of the flowers red chilies without rhizobacteria was 43.77 days and given rhizobacteria, showed that the age of flowering was 50.55 days. Application rhizobacteria not able to accelerate the release of red chili flowers, it is possible that the role of rhizobacteria has not been maximized in accelerating the release of flowers, this is influenced by environmental factors and also the effect of giving rhizobacteria which is given by watering the roots. The results of this study are different from those conducted by Kong et al (2018) that chili plants that have been given rhizobacteria of vegetative and genetic growth increase and are able to protect chili plants from CMV infection. Rhizobacteria can accelerate the flowering process because the bacteria will help plants absorb and fulfill their nutrient elements.(16)

Rhizobacteria dissolve and increase the availability of phosphorus (p) and manganese (Mn) in soil and increase the ability of plants to absorb sulfur (S). This is supported by the statement of Maftu'ah et al., (2019), which states that the availability of phosphorus nutrients will accelerate flowering.(17)

Table 3 also shows the age at which the red chili flowers appeared without pruning the lowest was 45.05 days, not significantly different from the 21 DAS pruning, resulting in the appearance of red chilli flowers at 47.49 days, but significantly different from the 30 DAS pruning resulting in the appearance of chili flowers the longest red is 48.94 days. This is because at the age of 30 DAS pruning, at that time the plants have almost entered the generative phaseThe energy needed to prepare for the flowering phase is used to repair plants that are disturbed by pruning treatment. And the pruning treatment caused the flower to last 75% longer than the pruning treatment.

The age of the first harvest

Table 4. Age at first harvest of red chilies by giving rhizobacteria and pruning the seeds

Rhizobacteria	Pruning (day)			Average
		Prune 21	Prune 30	
	No cropping	DAS	DAS	
Without rhizobacteria	120.00	126.33	123.78	123.37
Giver rhizobacteria	125.56	116.89	128.33	123.59
Average	122.78	121.61	126.05	
KK = 5.39 %				

In the pruning treatment showed no significant difference, between treatment without trimming with cutting at 21 days and cutting at 30 days. This is because pruning has no effect on the age of the first harvest, and is more influenced by genetic factors, and if it is related to the age of flowering (table 3) shows no significant effect, so that in turn, the age of the first harvest also has no significant effect. According to Soedjarwo etl al (2018) the pruning treatment has the advantage of ripening fruit faster, increasing crop yields and reducing pests.(18)

According to Datta et al (2013), the harvesting age of chilies is influenced by several factors, including genetic, environmental, and a combination of several measures. Here, phosphorus plays its role in transferring energy in leaf cells so that it can increase the working efficiency of chloroplasts, and phosphorus will stimulate root growth and accelerate flowering and fruit ripening.(19)

Fruit length

Table 5. Length of red chilies with rhizobacteria and seed pruning

Rhizobacteria	Pruning (cm)			Average
		Prune 21	Prune 30	
	No Trim	DAS	DAS	
Without rhizobacteria	9.89	9.27	10.10	9.75
Giver rhizobacteria	10.96	10.29	10.65	10.63
Average	10.42	9.78	10.37	
KK = 13.61 %				

Table 5 shows the fruit length with rhizobacteria and pruning had no significant effect. Fruit length without rhizobacteria was 9.75 cm and with rhizobacteria was 10.63 cm. This is due to the fact that rhizobacteria have not been able to contribute element P, as the phosphate solubilizing bacteria needed for the length of the chilies.

Table 5 also shows that pruning has no effect on fruit length. The length of the fruit at 21 days pruning was 9.78 cm and 10.37 cm at 30 days pruning, while without pruning it produced fruit that was 10.42 cm. This is because pruning has no effect on fruit length. According to Gowtham et al (2018), plant growth and production will be determined by the rate of photosynthesis which is controlled by the availability of nutrients and water. During the reproductive phase, the reproductive

use area shares the results of the assimilation for the vegetative growth area. This causes the resulting photosynthate to be focused for transfer to the fruit for its development.(20)

Number of fruit per crop

Table 6. Number of fruits in red chili plants with description of rhizobacteria and pruning of seeds

Rhizobacteria	Pruning (fruit)			Average
		Prune 21	Prune 30	
	No Trim	DAS	DAS	
Without rhizobacteria	127.78	141.00	139.00	135.93 b
Giver rhizobacteria	156.89	149.89	142.5	150.93 a
Average	142.33	145.45	142.5	
KK = 9.07 %				

Table 6 shows the number of fruit planted by giving rhizobacteria a significant effect. The number of fruits planted without rhizobacteria was 135.93, while 150.93 were given rhizobacteria. This is because the provision of rhizobacteria plays a role in optimizing the formation of fruit, the mechanism of rhizobacteria in increasing growth and yields by producing growth regulators such as IAA, free nitrogen fixation (21). The results of Taufik's (2010) study stated that observations of the number of fruits in chilli plants showed that chili plants given rhizobacteria produced a higher number of fruit compared to those without rhizobacteria.(22)

Table 6 also shows the results of pruning which did not significantly affect the number of fruit planted. The number of fruits without pruning was 142.33 and at 21 days of pruning was 8.27, while the highest number of fruit was at 30 days of pruning with 9.00. The pruning in addition to increasing the number of flowers to produce fruit, then it can also improve the quality of flowers and the appearance of plants for the better, but can also decrease plant yields.

Fruit formation is strongly influenced by the availability of P nutrients in addition to the contribution of other nutrients from fertilizers. The role of the P element is spurringin the generative phase so as to spur the maturity of the flower and the age of the harvest, thereby increasing the number of fruit on chili plants.

Fruit weight per crop

Table 7. Fruit weights of red chilies by giving rhizobacteria and pruning the seeds

Rhizobacteria	Pruning (g/plant)			Average
		Prune 21	Prune 30	
	No Trim	DAS	DAS	
Without rhizobacteria	135.56	145.55	144.44	141.85 b
Giver rhizobacteria	162.56	156.33	151.22	156.70 a
Average	149.06	150.94	147.83	
KK = 13.61 %				

Table 7 shows the fruit weight planted by giving rhizobacteria has a significant effect. Plant weight without rhizobacteria 141.85 g/plant, and using rhizobacteria was 156.70 g/plant. This is because the mechanism of rhizobacteria directly synthesizes metabolites such as compounds that stimulate the formation of phytohormones such as indole acetic acid (IAA), this hormone is an active form of the auxin hormone found in plants. According to Rahni (2012), the function of the IAA hormone for plants includes increasing cell development, stimulating flowering, stimulating root formation and increasing the activity of other enzymes so that IAA can improve crop quality and yield. The better the plant growth, the better the fruit, because plant production is determined by the vegetative growth of the plant.

Table 7 also shows that the results of pruning did not significantly affect the weight of the fruit in the plant. The lowest fruit weight was at 30 days pruning, which was 147.83 g/plant, while without pruning the fruit weight was 149.06 g/first, and the highest fruit weight was at 21 days pruning, which was 150.94 g/plant. It is assumed that the effect of pruning can increase the vegetative phase based on plant height and number of branches (Table 1 and Table 2) but it has not been able to increase the fruit weight of the plant.

4.Conclusion

There is a significant interaction between pruning seeds and giving rhizobacteria to the growth of red chilies on plant height parameters. The best height was 30.40 cm with no rhizobacteria and pruning at 21 days after planting and the number of branches treated without rhizobacteria and 21 days after planting, the number of branches was 7.22. There was an effect of rhizobacteria on the growth and yield of red chilies on the parameters of flowering age, number of fruit planted, and fruit weight. The best results were obtained by giving rhizobacteria, namely fruit weight 156.70 g/plant. There is no effect of pruning on the growth and yield of red chilies. Based on the conclusion, it is suggested to cultivate red chili plants by administering rhizobacteria.

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