International Journal of Advanced Research and Review

www.ijarr.in

EFFECT OF PRUNING ON GROWTH AND YIELD OF TARO KIMPUL (XANTHOSOMA SAGITTIFOLIUM) WITH DIFFERENT HARVESTING TIMES

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Abstract

This research was conducted in Batusangkar, West Sumatera using a factorial research in the form of randomized block design (RBD). The species of Taro that used as the experimental material was Taro type in the age of 4 months. The purpose of this research is (1) to know the interaction between leaves pruning and difference of harvest times to the growth and production of Taro, (2) to know the best leaves pruning for growth and production of Taro (3) to know the best harvest times in order to get the best Taro production. The treatments of leave pruning in this study consisted of; without pruning, pruning by leaving 4 leaves, and pruning by leaving 6 leaves. On the other hand, the harvest times treatment is on 6 months, 7 months, and 8 months. The results showed that the interaction between leave pruning and harvesting times had an effect on taros' tuber diameter. On the form of tuber wet weight and length, there were no a significant effect due to the treatment provided, yet the pruning by leaving 6 leaves effected to increase the number of tubers and the productivity of Taro. While the best harvest times to increase productivity of Taro is at the age of 7 and 8 months.

Keywords: leave pruning, productivity, harvest times, Xanthosoma sagittifolium

INTRODUCTION

There are various problems in order to meet food needs in the future: (i) the conversion of agricultural land to non-agricultural land (especially paddy fields), (ii) the disadvantageous climate in agriculture, (iii) pests and diseases, and (iv) the rate of population growth that always increases every year which has an impact on the increasing per capita consumption of rice per year. These problems will lead to the difficulty of food provision, especially when people are still relying only on rice consumption. Based on the fact, the diversification of food from local food resources can be used as the right solution to anticipate the emergence of food insecurity events. Further, taro is quite a potential source of alternative food as a substitute for rice because it is rich in nutrients and low in glycemic index (54/100 g) [1].

The taro production rate depends on some circumstances like cultivars, harvesting times, cultivation techniques, and environmental conditions of growing. The harvest times of taro becomes an important factor to note because taro has no clear ripe period. It is not only caused by the tubers that getting bigger and growing, but also caused by the position of tubers that is below the soil surface in which it is difficult to observe. Taro can be harvested at the age of 4 to 12 months. In case it is harvested more than the time required,

it will make the tubers become hard (woody). So, it is not good anymore to be consumed. On the other hand, if it is harvested too early and the tubers are still young, it will impact on the low yield of tubers obtained. To sum up, there is a decrease of taro harvest index when it is harvested at 5 months, i.e. 33.84 to 39.76%, while the harvest index for taro plants was 60 to 85% [2].

Moreover, plant treatment (intensification) in the form of pruning of leaves is expected to be a solution to improve taro production at harvest time with a faster age. The purpose of pruning a plant is to control the size and shape of plants, accelerate and strengthen growth, and increase the production quality and quantity [3]. By pruning the leaves, it is expected that the leaf form becomes compact and the source distance to the sink becomes shorter so that photosynthesis will be more effective and translocation will be faster and smoothly as well [4]. The pruning of sinks is assumed to divert the assimilate distribution to the sink storage (tuber) [5]. For instance, the reproductive pruning in the yam may increase the tuber weight yield per sample, the tuber weight yield per plot, the tuber circumference and harvest index [6]. In conclusion, the purpose of this study was to examine the effect of the combination of harvest times and leaves pruning on the Taro growth and production.

1. MATERIALS AND METHODS

This research was carried out on the community land located in Nagari Pasia Laweh, Batusangkar, West Sumatera starting on October 2017 to February 2018. The material used in this research was 4 months old Taro plants which had been planted by farmers. The fertilizers used in the plant were Urea (130 g / ha), SP-36 (83 kg / ha), and KCL (83 kg / ha). The tools that used in this research were labels, knives, hoes, gauges, cameras, scissors, millimeter paper, aluminum foil, analytical scales and stationery.

The study was designed using Randomized Block Design (RBD) of two factors. The first factor consisted of three harvesting times treatments, harvest times within 6 months, 7 months and 8 months. The second factor was the pruning treatment of leaves; without pruning, pruning with 4 leaves remaining, and pruning with 6 leaves remaining. Each treatment was repeated 3 times so that there were 27 experimental units. The data analysis was done using F test at 5% level and different data would be tested further using DNMRT test at the level of 5%.

2. RESULTS AND DISCUSSION

2.1 Tuber Wet Weight

The treatment of pruning and harvest times differences did not give effect to the tuber weight form. Regardless of the level of pruning and harvest times given, the same tuber weight results shown as well. The tuber weight data per plant with in 5% DNMRT test result can be seen in Table 1 below. Table 1 shows that each treatment gave almost the same response on tuber weight form. This result caused no visible effect of the treatment given. Although it was not statistically significant, the tuber weight in pruning treatment with 6 leaves remaining had the highest mean value of 0.30 kg and the lowest tuber weight was found in the pruning treatment with 4 leaves remaining, i.e. 0.26 kg. The Taro that harvested at the age of 5 months with a spacing of 1 x 1 m had a tuber weight of 0.14 kg [2].

The excessive pruning would cause a decrease in the weight form of taro tubers because the leaf is an important photosynthetic organ for plants. Therefore, if the amount and area of leaves produced is low, the capacity of plants to produce photosynthesis is low as well. With 4 leaves remaining, the number and index of leaf area yielded were significantly lower when compared with the taro that treated without pruning and 6 leaves remaining pruning. The lower number and index of leaf area contributed significantly to the decrease

of fresh weight of tubers produced. For example, the growth and yield of Colacasia taro tubers were not affected by mild leaf pruning, yet they were affected by excessive pruning of leaves including pruning all leaves. On the contrary, the youngest leaves at age of 3, 4, and 5 months will have a decrease in tuber yield [7].

Table 1. The Taro tuber weight on Leaf Pruning Treatment with Difference in Harvest Times.

Pruning	Harvest Times (month)			Average
	6	7	8	
	----- kg -----			
Without pruning	0,32	0,27	0,28	0,29
4 leaves remaining	0,25	0,26	0,27	0,26
6 leaves remaining	0,27	0,34	0,29	0,30
Average	0,28	0,29	0,28	
Coefficient of Variation	13,16			

The numbers on the same rows and columns show no significant difference according to the F test at the 5% level.

2.2 The Number of Tubers

Based on the pruning treatment, the average amount of tubers per plant obtained were; 9.94 pieces without pruning, 11.14 pieces with 4 leaves remaining, and 12.72 pieces with 6 leaves remaining. The number of tubers in Taro could reach 10 pieces or more with a shape resembling a bottle [7]. Just like the treatment of pruning on sweet potatoes could affect the increase in the total amount and weight of the tuber wet [8].

Table 2. The Number of Tubers per Taro Crops on Leaf Pruning Treatment with Differences in Harvest Times.

Pruning	Harvest Times (month)			Average
	6	7	8	
			-----piece-----	
Without pruning	9,00	9,33	11,50	9,94 b
4 leaves remaining	9,83	11,75	11,83	11,14 ab
6 leaves remaining	11,00	13,00	14,17	12,72 a
Average	9,94	11,36	12,50	
Coefficient of Variation	16,62 %			

The numbers followed by the same lowercase letters in the same column were not significantly different according to the DNMRT advanced test at the 5% level.

According to the observation variable on the total number of tubers per plant, it could be concluded that the pruning treatment by leaving 4 and 6 leaves could increase the number of tubers per plant on Taro. In the contrast, without pruning the number of tubers per plant would be a bit slightly. Table 2 below indicates that no pruning treatment was the lowest average value. The low number of tubers produced in the treatment without pruning gained because at the time of the tuber formation occurred there was competition with some parts of the leaves that became sinks in obtaining assimilate. The closer the canopy of the plant between the leaves is, the leaves will cover each other. The leaf position located at the

bottom would get a lower light intensity resulting in a decreasing rate of photosynthesis. In order for the leaves to remain fully developed, the leaves which were in the lower position must require supply from the leaves on it (source) in the form of assimilates.

2.3 The Length and Diameter of Tuber

Based on the results of the research, it can be seen that the pruning and harvesting times did not give effect to the length form of tuber but it gave interaction to the form of tuber diameter. The average value obtained showed that each treatment gave a similar response to the tuber length form. This matter causes the invisible effects of both treatments used. Although there was no significant difference, the longest tuber form was obtained on the 6 leaves remaining treatment which is 17.60 and the lowest tuber form was obtained on the 4 leaves remaining treatment which is 16.06 cm. The length of the taro tuber can reach 12 - 25 cm [9].

Table 3. The Length and Diameter of Taro on the Various Pruning Leaf and Harvest Times.

Pruning	Harvest Times (month)			Average
	6	7	8	
	-----Length (cm)-----			
Without Pruning	17,03	16,70	15,91	16,54
4 leaves remaining	16,62	15,99	15,57	16,06
6 leaves remaining	15,92	18,53	18,36	17,60
Average	16,52	17,07	16,62	
Coefficient of Variation	13,88 %			
	-----Diameter (cm)-----			
Without Pruning	4,78 a B	5,33 a A	5,04 a A	5,05
4 leaves remaining	4,57 a A	4,70 b A	4,87 a A	4,72
6 leaves remaining	4,66 a B	5,12 a A	4,83 a AB	4,87
Average	4,67	5,05	4,91	
Coefficient of Variation	4,58 %			

The numbers followed by different lowercase letters in the same column and different upper case letters on the same row differ markedly according to the DNMRT advanced test at the 5% level.

On the observation of tuber diameter form, the interaction between pruning treatment on the harvest age 7 and 8 months showed the highest average. While the lowest score was in the pruning treatment harvested at the age of 6 months. Although there was no significant effect on each pruning treatment harvested at 6 months of age, the pruning treatment with the remaining 4 leaves had the lowest average. This result was due to the mild pruning that helped minimize the competition of tubers in obtaining assimilate, so that the tuber growth could be more optimal. However, the excessive pruning treatment affected to the decrease in the leaf quantity and area index. The leaves are the organ of plants that play a crucial role to receive and absorb sunlight and become part of the plant that serves as a place to photosynthesize, so it can produce photosynthate for all parts of the plant. Therefore, if the number and extent of the resulting leaf is very low, it will cause the low capacity of the plants to produce photosynthate as well [10] and affect on the least amount of assimilate

received by the tubers for its developmental needs. A good plant growth can speed up tuber formation [11].

In addition, the small diameter of tubers that harvested when it reached 6 months was suspected as the taro was still more active in utilizing photosynthesis in results on vegetative growth so that the growth of tubers had not been too visible. At a very young age the plant is suspected to be aggressive to do vegetative growth so that the results of photosynthate widely used for the process. Just like in the diameter of cassava varieties of Roti and Lambau Jambi that decreased due to the early harvest times [12].

2.4 Productivity

The pruning treatment by remaining 6 leaves had also a significant effect on the increase of Taro productivity that reached 24,78 tons/ha. Beside, the treatment without pruning and pruning with 4 leaves remaining showed the same average productivity value of 18.38 tons/ha and 18.86 tons/ha (Table 4). The reproductive pruning might increase productivity in 27 genotypes of yam tubers tested [5].

Table 4. Taro Production on Leaf Pruning Treatment with Difference in Harvest Times.

Pruning	Harvest Times (month)			Average
	6	7	8	
	--- ton/ha --			
Without pruning	16,83	17,02	21,29	18,38 b
4 leaves remaining	16,18	19,89	20,50	18,86 b
6 leaves remaining	19,54	29,33	25,48	24,78 a
Average	17,52 B	22,08 A	22,42 A	
Coefficient of Variation	15,52			

The numbers followed by the different lowercase letters in the same columns and rows differ markedly according to the DNMRT advanced test at the 5% level.

The pruning was done in order to make the distance from the source to the sink became shorter so that the photosynthesis would be more effective and translocation became faster and also the leaves pruning might help the translocation of assimilate from the leaves to the tubers. From the results that had been obtained, it could be concluded that the mild pruning effects on the increased productivity of Taro. The activity of leaf photosynthesis would remain optimal by a mild leaf pruning, so the assimilate that used for plant growth later would be fulfilled enough. On the contrary, the excessive pruning could actually decrease the productivity of Taro.

In conclusion, it was predicted that excessive leaves pruning could reduce the place of the photosynthesis process. So that assimilate obtained from photosynthesis results were decreased. As this matter occurred, the growth on the tubers would also be disturbed. Moreover, the main function of leaves is to produce assimilate through the process of photosynthesis and all the active leaves do photosynthesis to produce assimilates that will be utilized by plants for plant growth and production [13].

3. Conclusion

The interaction between leaves pruning and harvest times affects tuber diameter. The pruning with 6 leaves remaining can give the best influence to increase the number of tubers and productivity of Taro. While the best harvest times to increase productivity of Taro is at the age of 7 and 8 months.

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