

Growth and production plant chili pepper (*capsicum annuum*) as a result of the existence pruning leaves

* Widiwurjani Amir Tjokrosumarto ¹ and Djarwatiningsih Pongki Soedjarwo ²

^{1,2} Faculty of Agriculture, Universitas Pembangunan Nasional “Veteran” Jawa Timur, Indonesia

ABSTRACT: Pruning can be done on chili plant. Pruning aims to increase and improve production quality because the nutrients are absorbed by the roots directly distributed to the leaves as the plant so the plant stems will form a strong and upright. Too much leaves also interfere with the production process for it is also necessary to cut the leaves so the results of photosynthesis can be concentrated to the production process. This research examines methods of pruning on chili plants known for massive growth characteristics and production of chili plants before or after harvest. The method consisted of two stages. Phase 1 is testing the leaf pruning consists of cutting 25%, 50% and without pruning. Phase 2 is pruning branches on chili plants which have been harvested in the treatment phase I. Phase II consists of treatment without pruning and pruning. The results showed that treatment pruning the leaves (stage I) effect on the production of chili harvest time in quantity and quality, pruning leaves on chili plants by 50% provides an increase in production, the percentage of flowers become fruit, fruit weight and the pruning of leaves be done when a branch plant reaches about 30 branches (30-40 days).

Keywords: Characteristics, Growth, Production, Pruning

1. INTRODUCTION

Pruning plant is an effort that is practiced by farmers, researchers or managers to get the plant canopy shape that ideal, with the hope of achieving or harvest more plant with better fruit quality. Pruning basically aims to reduce the number of buds, shoots or branches that are not productive, so the growth of the fruit can be maximized. In plants that grow too dense, plant will be difficult to distribute nutrients absorbed from the soil to get to the target that is the production of fruit [1]. Plants that are too dense, causing the fruit is formed into small pieces with the maturation process are too long [2]. The treatment of pruning of the cultivated plants may also reduce interference of pests and diseases [3].

Chili plants usually sprouted a lot that grows from the leaf. These shoots are not productive and will interfere with the growth so that growth is not optimal [4]. Therefore, there should be pruning (discharge) side shoots. Prune side shoots done in chili hybrids between the ages of 7-20 days. All side shoots removed to the plants grow strong and sturdy. When the branch was formed, then trimming the buds stopped. Usually the bud pruning is done 2-3 times. Without pruning the side shoots, chili plant growth will be slow [5].

The effort to increase crop production can be done by trimming the apical bud. This is done with the hope of lateral shoots can grow. Growth can cause the formation of lateral shoots on the plant stem branch pretty much on the main stem armpit. Pruning at the top of the stem can cause stunted growth of apical buds, so further plant growth is not very high with many branches formed plant, which is expected to be a lot plant flower formation. Plant flowers that form will be a lot, it can be

interpreted that crop production will be obtained will be higher [6].

The rejuvenation of pruning is done to stimulate the emergence of new shoots and buds that expected to be productive. The number of productive shoots that arise it is expected to extend the productive lifetime and crop production will increase [7]. Furthermore, it also explained that the trimming is done with the aim to increase the number of productive branches and form the plant canopy ideal conditions regular branching, compact, and sturdy and evenly in all directions (symmetry). Pruning consists of pruning shapes and crop maintenance. The aim is to increase crop productivity [8].

Pruning can provide some influence on physiological processes and plant biomass. Sugar content, the process of opening and closing of stomata, flowering and fruit formation is a process that can be influenced by their trimming. Pruning can stimulate the formation of chlorophyll more [9]. Sugar content in plants will decrease when performed pruning because photosynthesis result many are exposed [10]-[11]. Red chili plant is a plant that can grow more than one year. Red chili crop productivity largely influenced by the vegetative growth of the plants, whereas vegetative growth is the embodiment of the various factors that influence such as the spacing of seeds, soil fertility, climate and so on [12]-[13].

Pruning is usually done at an annual plant, but it is possible to do on crops, especially for crops that have segments where the segments will appear after trimming buds [14]. The pruning of plants kale is a seasonal plant can produce new shoots and branches where the buds and new branches were able to grow normally with the support of sufficient nitrogen fertilization [15]. Furthermore pruning is done after the first harvest, the productive lifetime of chili plants may happen again as before. New shoots will appear after pruning followed rapid vegetative growth for organs absorbing nutrients has been prepared. Builders and fertilization run normally, so the plants can be harvested again in a shorter time [16]. About 3 months-plants could be started in the harvest back to the period of 2-3 months were not significantly different production with yields 1. The production of the fruit can be improved by trimming for the cuts will emerge new shoots (rejuvenation) that enables more productive and get the ideal shape of a tree [7].

To improve efficiency, cultivation can be done through the appropriate technical culture activities, such as pruning settings. Pruning also aims to extend the life cycle of plants because by trimming can appear new shoots that productive [17]. The existence of pruning after the first harvest brings farmers does not have to replant with new plants in the next planting period. It needs to be studied fundamentally by identifying things that happen as a result of their good pruning growth at the beginning and after the first harvest period is completed [4].

In general and overall cultivation of red chilies includes several stages of the farmers needs to a) understand and know the terms grew red chili b) seed selection c) seeding d) When planting e) tillage f) mulching g) planting h) system planting i) fertilizing j) irrigation k) Weed control and harvesting. To further technological innovation also needs to be done based on research results. As for the innovations to be introduced to be applied in the cultivation of the red chili plant is cut to extend their productive so that farmers are expected to harvest crops of chili in the period is longer.

Information gained from basic research are expected to be used as the basis for applied research in the next period that is research on crop cultivation technologies more efficient and applied research on land productivity per unit time.

2. MATERIAL AND METHODS

The research was conducted in March 2016 - November 2016 in the faculty of agricultural field trials. Topics of research on pruning with the objective to assess the growth and production characteristics due to the pruning of leaves before the harvest period and branch pruning after harvest.

2.1 Material

Chilies plant that have been 30 days after planting, scissors, NPK fertilizer, polybag and garden soil

2.2 Method

Using a completely randomized design with two phases:

Phase I is Trimming Leaves (T) consists of three levels that is without crop (T0), pruned 50% (T1) and pruned 25% (T2) and Phase II is the pruning of branches (C) after the crop is harvested Red chili consists of two levels, i.e., without pruning branches and pruned.

2.2.1 Phase One: Pruning Leaves

Pruning is done before the harvesting period is when plant is already established branches as many as 30 branches (of 1 - 1.5 months). Vegetative growth of plant in conditions of maximum. There are three levels of treatment that is without crop (T0) as a control, prune leaves 25% (T1) and prune leaves 50% (T2). The leaves that pruned are overlapping leaves that position. Pruning destination that is not too thick so the air circulation and light penetration can be evenly distributed throughout the plant and to determine how its influence on the growth and production of chili peppers. The number of leaves that pruned according to a predetermined treatment.

2.2.2 Phase Two: Pruning branches / Rejuvenation

Prune after the completion of the first harvest period (5 times the harvest). There are two levels that are without pruning and do pruning branches. Branches pruned branches are old and dried up and unproductive. Usually unproductive branches growing straight upward and the branches that grows from axillary. Pruning is done 2 weeks after the first harvest is stopped. Plants that are treated are derived from plants that were treated in the first stage. The purpose of treatment the second stage is to determine the effect of pruning branches after the first harvest period in the growth and production of chili plants and know the productive lifetime of great chili plant as a result of pruning

Parameter study consisted of observations of the characteristics of generative growth:

- a. flower number : the number of flowers that have bloomed in the morning and do every day after the generative,
- b. fruit number : number of fruit per plant obtained by counting the number of fruit at harvest time I (91 days after planting), harvesting II (98 days after planting), and the next harvest, and the number of total fruit crop (5 times the harvest) that is by adding up all the crops. So is the second period after crop harvest branches,
- c. fruit weight and weight of fruit per plant: weight of the fruit at harvest time I, II, and so on and total fruit weight per plant (5 times the harvest) by adding the entire crop,
- d. fruit length : length of fruit each harvest (5 times the harvest), in 5 grab samples chilies to represent at each plant sample the chili, then averaged.

3. RESULTS AND DISCUSSION

3.1 Result

Table 1 Average Height of Chili Plants at Various Ages Observations

The Treatment t / Age	Plant height (cm) at age			
	days after planting			
	14	21	28	35
T0	34.5 6	40.65	47.5 5	50.13
T1	33.7 7	37.99	45.9 8	48.52
T2	32.8 6	38.74	44.7 9	47.77
LSD	NR	NR	NR	NR

Note: NR: Not Real

Table 2 Average Number of Branches Chilli Plants at Various Ages Observations

The Treatment / Age	Number of branches plant on age days after planting			
	14	21	28	35
T0	4.10	13,60	22.87	29.46
T1	4.21	12,21	22.11	30.22
T2	4.11	12.98	24.44	30.44
LSD	NR	NR	NR	NR

Note: NR: Not Real

Table 3 Average Diameter of the Base of Chilli Plants at Various Ages Observations

The Treatment / Age	stem diameter (mm) plant at the age of ... days after planting			
	14	21	28	35
T0	33.43	43.56	62.66	75.22
T1	35.28	45.23	64.91	73,25
T2	33.67	45.12	63.56	73.22
LSD	NR	NR	NR	NR

Note: NR: Not Real

Table 4 Average Total Flowers in Various Age Observations

Treat- ment / Age	Number of Flowers at Age days after planting							
	2	2	3	49	5	63	7	77
	1	8	6		6		0	
T0	19.1	68.5	100. 4	134.6	150. 4	160.8	161. 2	162.9
T1	20.9	73.9	123. 2	150.8	175. 8	185.4	187. 3	190.6

T2	19.8	75.4	110.4	142.0	167.2	173.4	180.1	181.3
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LSD	NR	NR	NR	NR	NR	NR	NR	NR
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Note: NR: Not Real

Table 5 Average Number of Fruits on the Different Age Observations

Treat- ment / Age	Number of Flowers at Age days after planting							
	2 1	2 8	3 6	49	5 6	6 3	70	77
T0	12.3	40.6	60.4	70.3	80.4	87.3	90.5	110.9
T1	14.4	53.2	75.8	85.2	93.3	100.7	110.5	133.6
T2	12.7	50.5	68.5	75.9	83.3	90.6	103.6	115.4
LSD	NR	NR	NR	NR	NR	NR	NR	NR

Note: NR: Not Real. The figures were accompanied by the same letters in the same column are not significantly different meaning in the stage of least significant difference test 5%

Table 6 Average Weight per Fruit Crops, Fruit and Weight Length per Fruit

Treat- ment / Age	Characteristics of Plant Production Due to The existence of Chili Pruning Leaves					
	Fruit weight (g) per plant	fruit weigh th (cm)	fruit per (g)	Fruit amou nt	Flowe rs Amou nt	Percenta ge of flowers become fruit
T0	1204.1	11.2	10.6	113.3	162.9	69.6
	a			a	a	
T1	1416.9	12.8	10.5	135.7	190.6	71.2
	b			c	c	
T2	1277.9	11.8	10.6	120.6	181.3	66.5
	a			b	b	
LSD	83.3	NR	NR	2.7	2.5	NR

Note: NR: Not Real. The figures were accompanied by the same letters in the same column are not significantly different meaning in the stage of least significant difference test 5%

Table 7. Generative Growth Characteristics Plant after Pruning of Rejuvenation

Treat- ment / Age	Generative growth characteristics plant after pruning of rejuvenation					
	Age started floweri ng (10 florets)	The amou nt of flowe rs	The amou nt of fruits	Total fruit weig ht	Total harvest of stage I and stage II	Percenta ge of flowers become the fruit (%)

TOP 0	10.4 a	196.6 a	150.9 a	574.7 a	1778.8 a	77.15
TOP 1	7.6 a	211.7 a	160.4 a	630.4 b	1834.6 a	75.85
T1P O	15.9 b	255.8 b	212.4 b	775.7 c	2192.7 b	83.01
T1P 1	7.2 a	296.3 c	237.4 c	1026. 0d	2442.9 c	80.17
T2P 0	12.7 a	252.3 b	216.1 b	1050. 9e	2328.8 b	85.60
T2P 1	7.9	313.9 c	236.0 c	1050. 7e	2328.6 b	75.24
LSD	6.2	20.0	19.2	20.6	24.9	NR

Note: NR: Not Real. The figures were accompanied by the same letters in the same column are not significantly different meaning in the stage of least significant difference test 5%

Implementation of pruning the leaves on the plant chili influence on vegetative growth characteristics in plants include plant height, branch number, stem diameter, and the number of productive branches. The data obtained from the study are presented in the tables 1 to the table 3.

In the table 1 we can see that there is an increase in of plant height with age plants and pruning the leaves on the plant does not affect the characteristics of chili plants. Chili plants showed that the plant height was not significantly different between the plant that pruned 25%, the plant that pruned 50% and the plant without pruning.

In the table 2 it can be seen that there are increasing number of branch plant with age plant and trimming the leaves on the plant does not affect the characteristics of the branch chili plants. Chili plants have a number of branches of plant were not significantly different between the plant that pruned 25%, the plant that pruned 50% and the plant without pruning.

In the table 3 it can be seen that there is the addition size in diameter at base plant with age plant and leaf pruning on chili plants do not affect the characteristics of stem diameter at the base of chili plants. Chili plants showed stem base diameter plant were not significantly different between the plant that pruned 25%, the plant that pruned 50% and the plant without pruning.

In the table 4 it can be seen that there is an increasing amount of interest in plants with age of the plant (up to age 77 days) and pruning the leaves on the plants affect the characteristics of on the amount of chili plants flower. Pruning leaves significant effect on the amount of interest chili plants. Number of highest flowers on pruning leaves at 25% followed by the number of flowers on chili plants pruned 50% and the lowest was in the chili plant that not pruned.

In the table 5 it can be seen that there is an increasing number of fruits on the plant due to the increasing age of the plant (up to age 84 days and 91 days) and pruning the leaves on the plants affect the characteristics of the amount of chili fruit chili plant. Pruning leaves significant effect on the number of pieces of chili plants. The highest number of fruit on a leaf pruning by 25% followed by the number of fruit on chili plants pruned 50% and the lowest was in the chili plants that not pruned.

Pruning leaves affects the production characteristics chili plants which includes the weight of fruit per plant, fruit length, fruit weight apiece total amount of fruit, flower number, and percentage of interest so the fruit. Table 6 also shows the pruning of leaves 50% (T1) to provide support for an increase in weight of fruit per plant, number of fruit crops, and the number of flowers per plant. Fruit quality can be demonstrated by the length parameter of fruit and fruit weight per fruit that not significantly different in the three treatments tested.

In the table 7 it can be seen that the life begins to flower after a period of relative pruning phase II was not significantly different than the treatment of pruning the leaves 25% of Phase I but without

pruning stage II. Pruning phase II gives a tendency accelerate the emergence of interest so that this condition will spur the next harvest season.

3.2 Discussion

Pruning is a way to cut in order to remove unwanted parts of the plant, with the aim to create better plant growth [18].

Chili production can be improved in many various ways. One is through proper cultivation efforts, including maintenance. Among the common maintenance practices by farmers are pruning shoots that grow in the leaves. Pruning is intended to strengthen the trunk and reduce unnecessary vegetative growth at the bottom of the body plant and directed to the top, as well as to expand the air circulation and sunlight penetration to all parts of plant. It is also to expand the air circulation and sunlight penetration to all parts of the plant. Pruning is also intended to create a cleaner environment and hygiene so that the plant can be free from pests and diseases. The overall objective is that plants can deliver results and maximum fruit quality [10].

Plant growth and development can be affected by various factors, among others, is a plant growth regulator or commonly called the PGR, such as for example auxin. Auxin is formed coleoptile or part of the rod tip and root function on lengthening of the apical bud, the first shoots that grow rapidly, as a result of the apical dominant, which delays the growth of lateral buds are buds that emerge from axillary [19].

Pruning is done when the plant leaves about 30 days after planting when the plants enter the vegetative phase maximum. Characteristics of chili plants showed that the average number of productive branches, the amount of interest and the number of pieces in the period of growth before harvest not significantly different. This suggests that before trimming chili crop conditions uniform.

The amount of productive branches at various pruning treatments also showed significant differences. This shows that with the pruning of leaves affects the formation of flowers and fruit. Plants with a different number of leaves due to the trimming has photosynthesis different capabilities in supporting the formation of flowers and fruit and assimilate the use of competition that occurs between organs of chili plants can affect adversely. Without pruning means allowing existing leaves on the plant itself to compete with other organs in using assimilate while the leaves that have old and unproductive if not pruned it will tend to be parasite [20]. Leaf pruning can stimulate branches of plant more productive. The increasing number of productive branches pruning plant due caused fruit buds are formed and the number of leaves more and more productive [21].

Pruning can improve plant health, stimulate the flowering process, improve the quality and quantity of fruit, improving seed quality and can maintain a balance between growth and fruit branches, number of branches on the plant will affect the quality of the fruit and seed quality. Branch plants in small amounts, it is possible fruit and seed quality will increase. Leaf pruning performed when the plant was 30 days after planting and the characteristics of chili plants after pruning the leaves can be shown in the table 1, table 2 and table 3. Characteristics of chili plants showed that the average number of productive branches, the number of flower amount and the number of pieces in the period of growth before harvesting was not significantly different.

Pruning leaves an impact on the characteristics of chili plants produce fruit in both quantity, quality and percentage flowers into fruits were not significantly different. Pruning the leaves can cause assimilate the resulting plants can be concentrated to the fruit and there was no use assimilate competition between vegetative organs and fruits so as to obtain the crop (production) more.

In the table 6 it can be seen that the pruning leaves an impact on the characteristics of chili plants produce fruit in terms of quantity and quality as well as the percentage flowers into fruit. Pruning the leaves can cause assimilate the resulting plants can be concentrated to the fruit and there was no use assimilate competition between vegetative organs and fruits so as to obtain the crop (production) more. The dry material is supplied into the seed or fruit is the result of plant metabolism, but whether it assimilates dumped is assimilate before flowering or after flowering or when charging on seeds or fruit [22]-[23].

Pruning branches to form the chili crop canopy also affects the increased production from the sun

as an energy source can be distributed evenly on the leaf surface [24]. Pruning shoots despite increasing the amount of fruit, which indirectly also increase the fruit weight and the weight of dry seeds per plant, but it did not affect the quality of seeds produced. This is caused by the increasing number of leaves on plants pruned bud followed by increasing the amount of fruit that is formed [21]. Thus, the increase of photosynthesis in the leaves as a source offset by increasing the amount of fruit as the user, so the balance of resources and the user will be retained as the plant that not pruned bud.

In general, the maximum net photosynthesis increases during leaf development and will reach a maximum just after full leaf development. In almost all the generative phase of photosynthesis will be used by flowers and fruit growing. Growth and development of that maximum leaf will cause flowers and fruits are well developed, thus the possibility of fall flowers or fruit to be small. Increased fruit are formed and grow at least fruit fall

Rejuvenation pruning will delay the harvest, because the plants need time for rehabilitation. Judging from the physiological aspects of plants, the pruning treatments are accompanied by cleaning all components for the assimilation of plants is an event that is very drastic and will lead to further plant growth [25]. Pruning promotes growth of new shoots quicker, which can potentially stimulate flowering. The results showed that treatment cuts the crop may increase interest yield, improve the quality and appearance of flowers or plants for the better figure. Lateral shoots are the subject observer correlation by apical buds, so if the apical bud trimmed, then only the top of the lateral buds will grow rapidly. Effect of pruning on plant growth through the shoot, was very influential, appeared shoots faster.

The maintenance pruning effectively increases the number of young fruit that survived and reduce the percentage of young deciduous fruit [26]. The disposal of plant shoots do not affect the growth plant represented by stem diameter and plant yield that represented by the amount of fruit and fruit length. Disposal of axillary buds also has no effect on the growth and yield [10].

Bean plants that are pruned can cause apical dominance to be suspended; causing auxin accumulates on top of the area. Through interactions with other growth hormone auxin accumulates in the body and affects the plant meristem at the buds so emerged lateral shoots [27].

Pruning rod can cause the dormant buds to be active and grow into a new branch as well as the expected productive branches. Pruning branches do not cause a decline in production due to the fact that pruned branch is the old branch (unproductive). Pruned branches will be replaced with the emergence of new shoots sprout. Such a condition can also occur in plants judgments. Pruning shoot tips led to the formation of lateral branches, so that the axillary buds which grow very rapidly as a whole can compensate for the loss of plant shoots, both of growth and of a given outcome [27]. Condition number of leaves were not significantly different can be influenced by the number of leaves that are a little thin or not plated. Thin leaves that occur can be thought to result from environmental influences at the time of the study. When the research carried out right when entering the dry season, so the plants adapt to environmental conditions little short of water and most of the leaves undergo accelerated aging and leads to reduced sunlight during photosynthesis so photosynthesis production declined. This is consistent with a trunk diameter of bean plants. The results showed no significant different diameter, each observation. That is because the plant observations made when plants began to enter the generative phase, so that the vegetative growth start stalled. The main benefits of pruning shoots among others, will reduce competition between the results of photosynthesis in the leaves with fruit and reduce the incidence of disease, as well as cuts in tomatoes could increase fruit size [21]. If the excessive growth of shoots pruned, the circulation of air around the canopy gets better, this situation will reduce the humidity microclimate around the plant and so will reduce the incidence of the disease. Cucumber plants are not pruned bud usually produce good fruit, but its small size, this causes the fruit to seed quality is not good.

The pruning techniques can be divided into two, heading back and thinning out. Heading back is done by cutting the shoots branch while thinning out dispose lateral branches [28]. Tomato plant parts that can be trimmed are the lateral shoots, the shoots of apical buds or stems of plants, as well as most flowers and fruits. The improvement of cultivation techniques is also important in supporting increased production tomato. The cultivation of tomatoes consists of several important stages, one of which cut shoots. Cuts are also useful in the field of breeding [29]. Plants with treatment without

pruning shoots have higher yield potential and have a medium resistance susceptible to wilt disease. Different types of foliage, leaves the child lies on the main leaf bones, fruit shape, the cross-sectional pieces, end of the shaft, tip shape of fruit, number of fruit cavity, and shows the diversity of green fruit [30].

Pruning axillary buds have consequences on the practice of crop cultivation due to changes in plant profiles that pruned. In pepper, pruning axillary bud causes the stems of plants to be higher due to the branching pushed to the top. Weighing the top of this branching easily fall resulted in plant so needed the aid of crutches stem of the plant with the installation of marker. As a result, this pruning practice cause's additional work is not a bit like the installation work marker. This additional work has consequences for the need for additional well costs for labor and materials supply stakes for chili plants have the ability to perform high compensation against the loss of part of the vegetative organs. Losing the growth of shoots immediately transferred to the growth of axillary buds growing beside the form in significant amounts. Pruning shoot tips led to the formation of lateral branches. Their lateral branches or axillary buds that grow and develop very rushed as a whole can compensate for the loss of shoots discharge shoot tips on soybean increasing branching but did not give a positive effect on results [10].

4. CONCLUSION

Treatment of pruning the leaves on the plants affect the production of large chili red chili harvest time both in quantity and quality. Pruning leaves on a large chili plants by 50% provides an increase in production, the percentage of fruit and flowers become weight of the fruit. Pruning branches leaves performed when the plant reaches about 30 branches (30-40 days).

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