J. BIOL. ENVIRON. SCI.,
2011, 5(14), 105-110

The Effects of Shrub Pruning and Fruit Thinning on Seed Germination and Seedling of Tomato in the Next Generation *(Lycopersicon esculentum* Mill*)*

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ABSTRACT

Seed is the main principle of agricultural products and it has a key role as first consumable input to transfer genetic Characters. In this investigation the effects of cultivar, shrub pruning and fruit thinning on qualitative and quantitative characteristics of tomato (seed and seedling) have been evaluated. Experiment was performed by factorial analysis (3×2×3) with 5 replications in completely randomized design (CRD). First treatment was three cultivars of tomato, second treatment was two styles of shrub pruning, in which all of subsidiary branches are removed (Type 1) and one cluster and leaf on subsidiary branches are remained and then extras removed (Type 2) and Third treatment was fruit thinning. Each tomato cultivar was fruit thinned to three different levels (4, 5 and 6 fruit for each plant). The results showed that all treatments had significant influence on weight of 1000 seeds for the next generation. The effects of cultivar and fruit thinning were significant on germination percentage. But shrub pruning did not affect the germination percentage of seeds. Also effects of cultivar and fruit thinning were considerable on fresh and dry weight of seedling root and stem. The effect of fruit thinning and cultivar were significant on height and the number of seedling leaflet. Totally fruit thinning and shrub pruning had a vital role in increasing qualitative and quantitative characteristics of seed and seedling.

Key words: *Lycopersicon esculentum*, Germination, Growth of seedling, 1000 grain weigh.

INTRODUCTION

Hybrid seed production of tomatoes is expensive, because it needs spending too much time and money. Their initial quality depends on their genetic characteristics. But other important characteristics including seed germination, seedling emergence and the weight of 1000 seeds depend on the circumstances of the native plant. One of the criteria of seed vigor is the amount of dry matter (seed weight). Germination and seedling emergence requires a lot of energy which are supplied from the oxidation of seed storage materials. The seeds should have enough food stored to provide seedling growth, in order to achieve self sufficiency they are dependent on seed storage materials. Therefore the average weight of 1000 seeds is important for seed quality (Grigoryan 1977, Macdonald 1998). Number and seed weight per fruit depends on variety and the number of carpel that is located inside the fruit which usually includes 1% to 5% of the fruit weight (Bertin et al.2003). Large fruits with moderate carpel usually has 4% of the weight, they got a little of seed, but these seeds have a lot of weight. (Prokhorov and Potanov 1988). As suggested by Doijode (2001) tomatoes with large seeds have a higher germination rate. Enhancement of seed weight can increase germination; following this process performance would be raised (Piccolo et al. 1993). Expending thousand seed weight lead to improve germination and is very impressive on the function. There is a positive correlation between fruit weight, germination and weight of 1000 seeds (Akbari et al. 2004, Khan 2003).

As shown by Chitraderi (2000) the weight of 1000 seeds has effect on seedling height and fresh and dry weight of seedling root and stem. Large seeds produce big seedling with high fresh and dry weight and great seeds have faster germination (Agrawal 1995). As shown by Singh and Dillon (1985) there is a positive correlation between weight of seeds and the percentage of seed germination. Seed masses with low weight will produce week seedling. Production methods and farming operations can be effective on germination, number of leaves and fresh and dry weight of seedling in the next generation. Pruning native plants can enhance seed dry weight; therefore leaf area would be increased which leads to more photosynthesis and seed storage materials (Arancon et al. 2002).

MATERIALS AND METHODS

In this study three cultivars of tomato (Faraon, Akdenis, and Dominator) were selected. During plant growth, pruning bush and fruit thinning were performed, which was carried out by two styles of shrub pruning , in which all of subsidiary branches are removed (Type 1) and one cluster and leaf on branches are remained and then extras removed (Type 2) . Each tomato cultivar was fruit thinned to three different levels (4, 5 and 6 fruit for each plant). To remove and decomposition the gelatinous layer which was covered surrounding the

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seeds, fermentation was used. Thus, after picking ripe fruit (red stiff) they were cut in to transverse layers then the content of carpel was removed. This mixture was poured in to the test tubes. To prevent insect activity the head tube was covered. Then, tubes were placed in Incubator (72 hours at 30°C). After two weeks the mixture which contained seeds were washed thoroughly with tap water for 10 min and sterilization was done by immersing them in 5% sodium hypochlorite solution for 10 min. Seed became dry in the laboratory at 30°C, final seed moisture which was determined with oven was 10%. Then these seeds were used to assess 1000 grain weight and greenhouse experiments. They were planted in boxes which contained a mixture of Vermiculite then the number of leaves, transplant height, fresh and dry weight of seedling root and stem was calculated. Dry weight of seedling root and stem was measured after drying in the oven at 30°C. Traits measured were included fruit weight, average weight of 1000 seeds, germination, dry weight of seedling root and stem.

Effect of treatments were verified based on ANOVA using Excel program and the means were compared using LSD test at 5% level.

RESULTS AND DISCUSSION

The effect of cultivar, bush pruning and fruit thinning on seed germination percentage

The result of this experiment demonstrated that there was an important difference between three cultivars in seed germination. Our results are similar to Lower and Cadrgari (1965), Jorge and Ray (2004), Hawthorn and Pollard (1954) and Hendrikus and Velduizeu (1986). Shrub pruning did not affect seed germination. But, the number of fruit on the plant was essentially important on germination (Table.1). It can be concluded that less fruit on clusters and native plants causing enlargement of the fruit, as a result 1000 weight of seeds and power of germination would be increased for the next generation. This result is similar to Saitokatsuya et al. (2002) .Also Bangerth and Hol (1984) reported that the summation fruit weight results in increasing the seed weight and germination.

Fruit weight average:

The results show that cultivar, Pruning plants and fruit thinning had significant effects on fruit weight. Balance of the number of fruit in plants is very important to obtain maximum performance with the highest quality. Plants with more fruit, lead to less growth and small fruit (Neamati and Kruchkov 2002). Sikes and Coffey (1976) reported that fruit is a storage source which leads to decrease nutrient absorption by other organs. So, pruning bush and fruit thinning are very important to increase the growth of native plants and Producing fruit with good weight. These results are in close agreement with our findings .Also this study demonstrated that fruit weight average in Akdenis cultivar was more than others. In addition, plant pruning showed significant differences. So the second type of pruning had the biggest fruit (Table.1). It should be noted that there are a lot of leaves in pruning type 2 comparing type 1, thus, pruning type 2 leads to more photosynthesis and fruit weight. Fruit thinning also showed significant differences. So the highest average of fruit weight was related to plants with four fruits. This result confirms the results of Neamati and Kruchkov (2002) they reported that increasing the number of fruits decrees average weight of fruit. The interaction between cultivar and thinning fruit (Table 4), cultivar and bush pruning (Table 2), fruit thinning and pruning plants (Table 3) showed an important difference. This difference may be due to genotype.

Table 1. Comparison of the simple effects of traits studied.

		1000 Grain weight (g)	Germination%	Fruit weight (g)	Number of leaves	height (cm)	Fresh weight of root (g)	Dry weight of root (g)	Fresh weight of stem (g)	Dry weight of stem (g)
Cultivar	Akdenis	3.64a	79.9b	143.8a	4.43b	7.9b	0.32b	1.79b	0.59c	0.06b
	Faraon	3.47c	48.1c	134.5b	5.03a	8.2a	0.36a	2.40a	0.92a	0.09a
	Dominator	3.54b	83.4a	127.3c	5.03a	8.1ab	0.26c	1.72b	0.74b	0.07ab
Shrub pruning	Type 1	3.64a	76.6a	133.3b	4.84a	8.03a	0.34a	2.14a	0.76a	0.08a
	Type 2	3.46b	74.3a	137.1a	4.82a	8.12a	0.28b	1.80b	0.73b	0.07a
fruit Thinning	4 fruit	3.63a	85.9c	138.2a	4.78a	7.5c	0.24c	1.23b	0.65c	0.07b
	5 fruit	3.52b	69.1b	135.9b	4.70a	8.8a	0.41a	2.90a	0.81a	0.08a
	6 fruit	3.50b	56.4a	131.6c	4.73a	7.9b	0.29b	1.78b	0.77b	0.07b

Means with similar letters in each column are not significantly different by LSD multiple range test ($p< 0.05$)

Table 2. Comparison of interaction between variety and shrub pruning for traits studied.

Shrub pruning	cultivar	1000 Grain weight (g)	Germination %	Fruit weight (g)	Number of leaves	height (cm)	Fresh weight of root (g)	Dry weight of root (g)	Fresh weight of stem (g)	Dry weight of stem (g)
Type 1	Akdenis	3.66a	67.0d	146.4a	4.47b	8.2c	0.35b	1.87bc	0.57f	0.057e
	Faraon	3.67a	67.0d	136.9c	5.00a	7.2f	0.41a	2.80a	0.91b	0.096a
	Dominator	3.60b	77.9c	128.0e	5.07a	8.7b	0.26e	1.76c	0.81c	0.083c
Type 2	Akdenis	3.63b	92.8a	141.3b	4.40b	7.7d	0.29d	1.72c	0.60e	0.061d
	Faraon	3.28d	29.1e	132.1d	5.07a	9.1a	0.30c	2.00b	0.93a	0.090b
	Dominator	3.48c	88.9b	126.6f	5.00a	7.5e	0.26e	1.68c	0.66d	0.063d

Means with similar letters in each column are not significantly different by LSD multiple range test ($p< 0.05$)

Table 3. Comparison of interaction between shrub pruning and fruit thinning for traits studied.

Shrub pruning	Fruit thinning	1000 Grain weight (g)	Germination %	Fruit weight (g)	Number of leaves	height (cm)	Fresh weight of root (g)	Dry weight of root (g)	Fresh weight of stem (g)	Dry weight of stem (g)
type 1	4 fruit	3.59c	90.3a	134.3d	4.67b	7.7c	0.27e	1.54d	0.68d	0.07a
	5 fruit	3.51e	75.9c	137.8c	4.93a	8.2b	0.46a	3.27a	0.83a	0.09a
	6 fruit	3.83a	45.7f	139.2a	4.93a	8.2b	0.28d	1.62d	0.79b	0.08a
type 2	4 fruit	3.68b	81.4b	137.5c	4.93a	7.3d	0.20f	0.93f	0.63c	0.06a
	5 fruit	3.54d	62.2e	138.5b	5.00a	9.4a	0.36b	2.53b	0.79b	0.08a
	6 fruit	3.17f	67.1d	124.0e	4.53b	7.6c	0.29c	1.93c	0.76c	0.07a

Means with similar letters in each column are not significantly different by LSD multiple range test ($p< 0.05$)

Table 4. Comparison of interaction between cultivar and fruit thinning for traits studied.

fruit Thinning	cultivar	1000 Grain weight (g)	Germination %	Fruit weight (g)	Number of leaves	height (cm)	Fresh weight of root (g)	Dry weight of root (g)	Fresh weight of stem (g)	Dry weight of stem (g)
4 fruit	Akdenis	3.68c	95.0a	143.3b	4.6d	8.47c	0.24f	3.20b	0.68d	0.07b
	FAraon	3.43f	73.0f	140.1c	4.6d	7.73e	0.30d	1.60e	0.82c	0.09ab
	Dominator	3.80a	89.7b	124.2g	5.2b	6.32g	0.18g	0.82g	0.47f	0.05b
5 fruit	Akdenis	3.51e	80.8d	144.3a	4.3e	7.45f	0.44a	2.90c	0.62e	0.06b
	FAraon	3.57d	45.0h	137.1d	5.6a	9.33b	0.36c	2.30d	1.00a	0.10a
	Dominator	3.49e	81.3c	133.1e	5.0bc	9.67a	0.43a	3.50a	0.81d	0.06b
6 fruit	Akdenis	3.74b	63.8g	143.8ab	4.4de	7.92e	0.28e	1.20f	0.46f	0.05b
	FAraon	3.43f	26.2i	126.3f	4.9c	7.52f	0.42b	3.30b	0.94b	0.09ab
	Dominator	3.49g	79.2e	124.7g	4.9c	8.26d	0.16h	0.83g	0.93b	0.09ab

Means with similar letters in each column are not significantly different by LSD multiple range test ($p< 0.05$)

Average weight of 1000 seeds:

The results of our experiment showed that cultivar, pruning and fruit thinning had a significant effects on the weight of 1000 seeds, so that the highest grain weight belongs to Akdenis, bush pruning of type 1 with four fruit (Table 1). The results showed that by increasing the fruit weight, the weight of 1000 seeds would be increased. Consequently there is a positive correlation between fruit weight and average weight of 1000 seeds. Our result confirms the results of Prokhorov and Potanov (1988). They stated that large fruits have fewer seeds while, they have more weight of 1000 seeds. Genard et al. (2009) reported that there is a positive correlation between fruit weight, 1000 grain weight and germination. He also reported that pruning native plants provides a better conditioning for increasing the efficacy of light and increase photosynthesis, on the other hand fruit thinning, result in reducing the number of fruit, improvement of fruit quality and generating large seeds.

Seedling height and number of leaves:

The results showed that pruning native plants, was not essential different on seedling height and number of seedling leaves for the next generation. Also, fruit thinning did not show a main difference on the number of seedling leaves while it was visible on seedling height (Table 1). These results are coordinating with results which obtained from Sanjeev et al (2008) .They expressed that every factor that increases the 1000 grain weight can affect the height of transplant. It seems that pruning bush and fruit thinning lead to production of larger fruits and seeds so seedling height would be increased for the next generation.

Fresh and dry weight of seedling root and stem:

Results showed that there was a significant difference between Cultivar, bush pruning and Fruit thinning in fresh and dry weight of seedling root and stem for the next generation. So that the most fresh and dry weight of seedling root and stem percentage were obtained on Faraon cultivar, bush pruning of type 1 with five fruit (Table 1). Piccolo et al. (1993) reported that increasing the 1000 grain weight results in increasing the fresh and dry weight of seedling root and stem. Generally pruning bush and fruit thinning increase the quality of fruit and seed. On the other hand, high quality of seeds causes the creation of stronger transplants that leads to increase fresh and dry weight of seedling root and stem. These results are in accordance with the findings of Gomec and Gomez. (1984).

CONCLUSIONS

From the current study it was concluded that several factors (cultivar, bush pruning and fruit thinning) can influence the germination, weight of 1000 seeds and fresh and dry weight of seedling root and stem in the next generation. There was a major difference in the cultivar. The difference between the three tomato cultivars was due to genotype. Hybrid seed production of native farm conditions and methods of pruning bush and fruit thinning according to this study had a large impact on the quality of seed germination, 1000 grain weight, seed quality and seedling for the next generation. So, high quality seeds will produce a much better crop of tomatoes. For these reason native tomato plants need pruning and thinning.

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