www.sospublication.co.in Journal of Advanced Laboratory Research in Biology

We- together to save yourself society e-ISSN 0976-7614

Volume 3, Issue 3, July 2012 Research Article

The Effect of Mulch, Pruning and Plant Density on Some Traits of Related to Production in Pepino

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Abstract: Pepino (*Solanum muricatum*) a new vegetable crops, is from Solanaceae family and cultivated as annual crops. In order to investigate the effects of mulch, pruning and plant density on some traits of related to production in Pepino, an experiment was conducted based on a randomized complete design with five replications at the Ferdowsi University of Mashhad greenhouse during 2009-2010. Traits such as leaf area, number of panicles per plant, number of fruits per plant, fruit length, fruit diameter and fruit weight. Treatment included: 3 levels of mulch (rice straw mulch, wood chips mulch and control), 3 levels of prune (two peduncular, 3 peduncular and controls) and 2 levels of plant density (3.3 and 4.3 plants per m^2). The results indicated that the effect of mulch in all of the traits was significant ($p \leq 0.01$). Wood chips mulch in all of the traits was better than rice straw and control. Pruning was significant in all of the traits. The number of panicles and the number of fruits per plant were higher in tree peduncular but increasing the number of fruits was associated with a reduction in size. Interaction between mulch and pruning was significant in all of the traits. Plant density applied had significant effects on traits related to fruit.

Keywords: Pepino, Mulch, Pruning, Plant Density.

1. Introduction

Pepino (*Solanum muricatum*) is a plant from Solanaceae family; it has planted annually like tomato. This small plant is herb one or frutescent one and has main wood stem. Its ascendant growth has about 75cm height and several stems (13), in a way that its body is similar to tomato ascendant frutescent but in smaller scale (15). Pepino locally grows in mild regions like Andes Mountains, Colombia and Chili (14). The English term for this fruit is Pepino, is directly from Spanish term which its meaning is cucumber (19). Nowadays, Pepino is considered as a new vegetable in European country, Japan and the United States. The countries such as chili and Sunland export it (14).

The term mulch means covering in English. Mulch is attributed to any covering such as organic materials like straw and rice stubble, vegetable leaf and similar materials on soil surface. But nowadays, natural or artificial materials that can create protective coating on ground are termed mulch (23). Mulches have different types, including live mulch, organic and mineral materials remains. Organic mulch have advantages such as preserving humidity, reducing soil temperature degree fluctuations and increasing organic materials and food elements to soil, in addition to controlling weeds. Performed researches show that existence of covering in soil surface can prevent weed growth because of physical and chemical properties of mulch (4). The most of the different type of weed require lighting for germination, but mulch can prevent to reach light to their seeds. Moreover, mulch can cause decrease in photosynthesis and weed plant growth by producing a stifling layer (5).

Johnson and his colleagues testify production growth by concentrated cultivation techniques in research to two compatible fields: Pepino and melon in Rhineland in Germany. These concentrated plant techniques included: irrigation fertilizer, plastic mulches and cover sheets. The performance is given for 90 tonnes per hectares for melon. The mulch effect was obvious to increase performance but this effect doesn't create because of getting warm of the soil environment, but also it is created by decreasing Botrytis in melon

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and leaf-blight in Pepino (8). Avodoin and his colleagues (2000) show in their research that mulch can cause increased growth and increasing performance of tomato, which its cause is improving growth situation like increasing temperature and soil humidity (3). In other research, applying plastic mulch compares to same, which cause to increase the number of fruit in each bush of eggplant (16).

The issue which causes prune is essential is ability to increase performance by using more plant in surface unit, without any decreasing performance of single bushes. Another issue is easy control of pests and disease (20, 21).

Maroto and his colleagues (2009) concluded that performance in trimming four stems are higher and the number of producing fruit by researching trim effect of four and two stems on Pepino and also there isn't any effect to fruit weight (11). Qualzic and Kuberin researches (2000) on three types of Pepino show that there is a similar performance between two and one stem trim in growth cycle summer-spring, but one stem trimming has better performance in the growth cycle in summer (9). Chervi and Peyvast (2004), by investigating the prune effect on cucumber performance, report that there is a meaning full effect of pruning on all performance indexes in comparison to the same one in possible level of 0.01%. Plant accumulation adjustment is so important in regard to optical application of all factors and producing issues (18). So, that the lake of the number of plants in surface unit cause all factors aren't consumed maximal. On the other hands, increasing accumulation excess of desired limit, cause to increase competence and therefore decreasing performance (10). Suitable space between planting arrays and bushes identify usable growth space for each bush. Therefore identify suitable space between bushes and arrays and planting arrays is determined main factor in the applicable space for each bush. Therefore, its influences on the maximum production and performance (10). Graldo and Flori (2004), investigate the effect of plant density in cucumber they report that increasing plant density and increasing the number of fruit have direct and linear relationship, by applying 0.2, 0.3 and 0.5m space between each bush (6). Usually, increase plant density cause to increase plant performance in surface unit. Higher amounts of accumulation, the competences to adjacent plants cause to decrease performance (17). In 1990, the investigation on tomato bush accumulation is done. According to this investigation, increasing accumulations from 1.9 plants per m^2 to 3.7 and 5.6 plants per m^2 and therefore cause to decrease the wet weight of the stem (1).

2. Materials and Methods

In order to investigate the effects of mulch, pruning and plant density on some traits of related to production in Pepino, an experiment was conducted based on a randomized complete design with five replications at the Ferdowsi University of Mashhad (Iran) greenhouse during 2009-2010. Traits such as leaf area, number of panicles per plant, number of fruits per plant, fruit length, fruit diameter and fruit weight. Treatment included: 3 levels of mulch (rice straw mulch, wood chips mulch and control), 3 levels of prune (two peduncular, 3 peduncular and controls) and 2 levels of plant density (3.3 and 4.3 plants per m^2).

In this investigation, Pepino plant cutting is obtained from grassy brunches and semi-woody which include leaf and healthy skin. Cuttings are cut diagonally that their lengths were 15-20cm and have at least 3-5 healthy buds and are placed in basing of sand and peat. The date of propagation was until the roots reach to suitable volumes last one month. After that, cutting being out and transfer to central field. At the same time to transferring cutting, two levels of plant density were applied which consist of 3.3 and 4.3 bushes per m^2. After placing bushes, mulch sprinkles is performed by two types of rice straw mulch and wood chips mulch, which their thickness was 4cm. The care of prune was performed about one month after transferring to the main field. The analyzing of the data and drawing diagrams is done by means of software like Minitab and excel. The comparison of the medium values is performed by means of software like MSTAT-C and LSD test in possibility level 5 percent.

3. Results and Discussion

3.1 Leaf area

The care of mulch and pruning and also the interaction between mulch and pruning had significant effects on leaf area ($P \leq 0.01$). The most of the leaf area ($30.27cm^2$) is observed in caring wood chips mulch and two peduncular (Fig. 1).

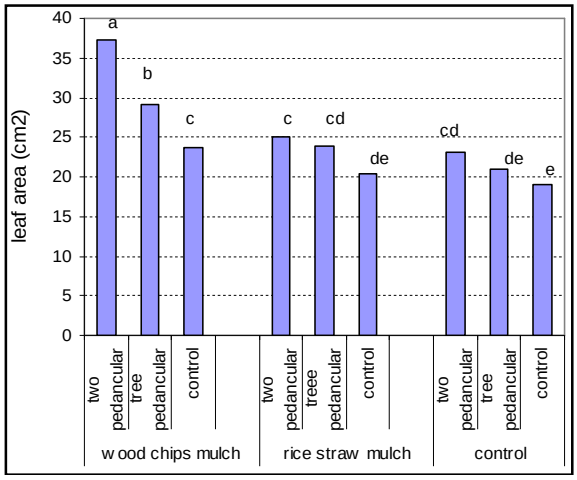

Fig. 1. Interaction effect between mulch and pruning on leaf area.

The wood chips mulch cause a meaningful increase in leaf surface, but the meaningful contrast isn't

observed between caring rice straw and control. Rice straw mulch is so light and has little resistance on the surface, and therefore it possibly can't show meaningful differences in comparison to the same one. The leaf area in two stems trimming is more than tree stems and caring without any pruning. The care of two stems causes to increase the leaf surface because it provides a better situation for growing bush and devoting more than dry matter to growing section. Agele and his colleagues (1990) reach a similar conclusion in investigating on tomato (1).

3.2 Number of clusters in each plant

The caring of mulch, pruning and also their interaction between mulch and pruning have significant effects ($p \leq 0.01$) on the number of clusters in each bush (Table 1). The care of plant density doesn't significant effects on the number of clusters. The maximum number of clusters (44) is observed in wood chips mulch and tree stem pruning and the minimum issues are in the control (Fig. 2).

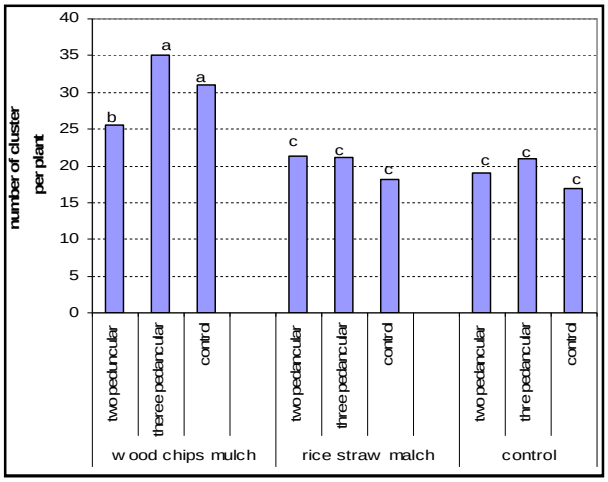

Fig. 2. Interaction effect between mulch and pruning on number of clusters per plant.

The wood chips mulch have more clusters, because of improving environmental situations such as increasing humidity and decreasing soil temperature and therefore increasing plant growth, and tree stems pruning including more lateral stems. It seems that the combination of two factors can increase the number of the clusters and its performance. Gomes and his colleagues (1997) by considering to mulch application in tomato, announce that mulch cause to promote performance by increasing the number of clusters in each bush and increasing growth (7).

3.3 The number of fruit in each plant

The mulch, pruning and also their interaction between mulch and pruning have significant effects on the number of fruit in each plant (Table 1). The maximum number of the fruit in each bush is observed in wood chips mulch and trimming tree stems (Fig. 3). The caring of the tree stems cause to increase the number of fruits, because of having more clusters in each bush. Maroto and his colleagues (2009) conclude that performance is higher in four stems pruning and they produce more fruits, by investigating of the effect of two stems and four stems pruning on Pepino (11).

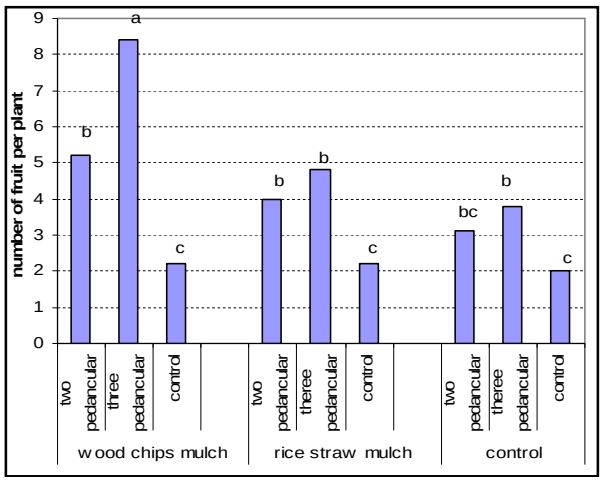

Fig. 3. Interaction effect between mulch and pruning on number of fruit per plant.

3.4 The length of fruit

Mulch, pruning, plant density and interaction between mulch and pruning have significant effects on the length of the fruit. The wood chips mulch and two peduncular causes to meaningful increase in length of fruit. Increasing the space between plants causes increase the length of fruits.

Table 1. Mean square from ANOVA treatment effects of mulch, pruning and plant density and their interaction on the traits measured.

Fruit diameter (mm)	Fruit length (mm)	Fruit weight (gr)	Number of fruit per plant	Number of Spikes Per plant	Leaf area^2 (Cm)	Degree of freedom	Resource changes
184/20**	588/17**	1853/97**	42/34**	1211/99**	672/03**	2	mulch
67/31**	129/60**	624/96**	93/81**	136/56**	407/60**	2	pruning
29/36*	28/79**	87/24*	1/88^{ns}	36/74^{ns}	46/15^{ns}	1	Plant density
7/11^{ns}	25/14**	13/56^{ns}	13/88**	78/30*	78/25**	4	mulch×prune
1/53^{ns}	0/15^{ns}	6/70^{ns}	1/48^{ns}	68/18^{ns}	0/07^{ns}	2	mulch×Plant density
5/12^{ns}	2/45^{ns}	14/17^{ns}	0/14^{ns}	46/63^{ns}	6/77^{ns}	2	prune×Plant density
4/90^{ns}	6/80^{ns}	11/43^{ns}	0/44^{ns}	56/11^{ns}	7/30^{ns}	4	mulch×prune×Plant density
4/69	3/83	16/79	2/72	25/66	17/16	72	Error

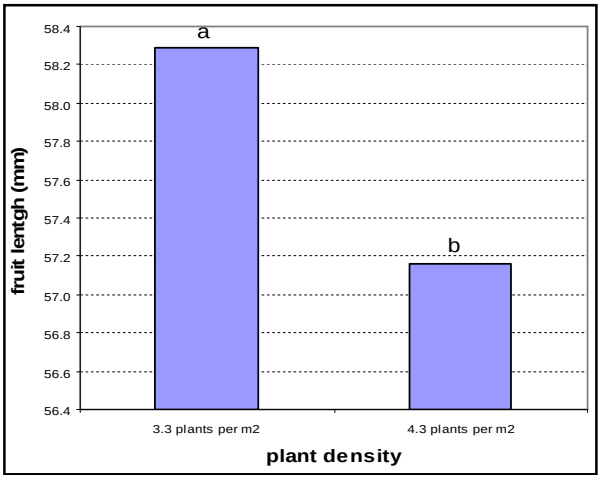

Fig. 4. Effect of plant density on fruit length.

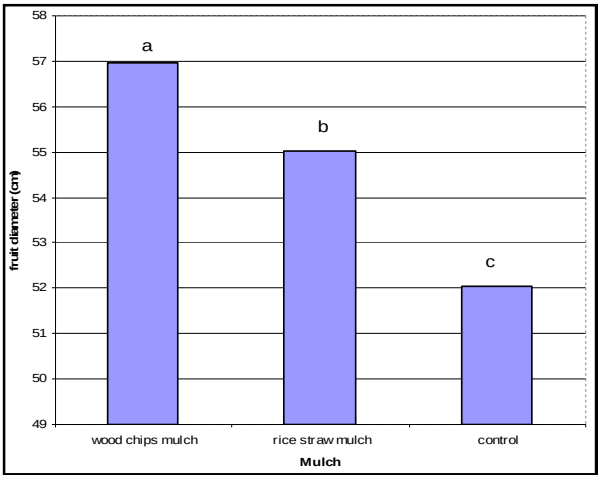

Fig. 6. Effect of mulch on fruit diameter.

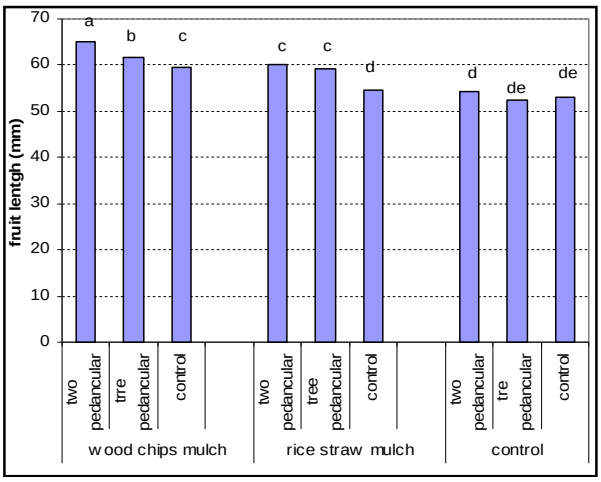

Fig. 5. Interaction effect between mulch and pruning on fruit length.

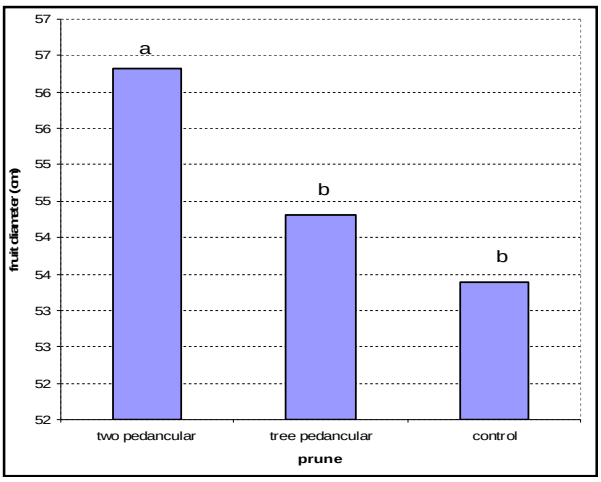

Fig. 7. Effect of pruning on fruit diameter.

Mohammad and Singh (2007), by considering to the effects of pruning and plant density on tomato, announce that the most length and diameter in fruit is seen in little density and the least length and diameter of fruit is related to caring without any pruning (12).

3.5 Fruit diameter

Each of the caring mulch, pruning and plant density on the fruit diameter are being meaningfully in possibility level of 1%. Wood chips mulch, two stem pruning and 3.3 plants per m^2 include fruit with more diameters in comparison to other caring. This conclusion is confirmed to Mohammad and sing's (2007) conclusion (12).

Two stems pruning cause to increase the size of fruit, because it has little fruit. Moreover, two stems of pruning cause to increase bush photosynthesis and increasing production of the dry matter by promoting growth, as a result, it can be effective in producing bigger fruits.

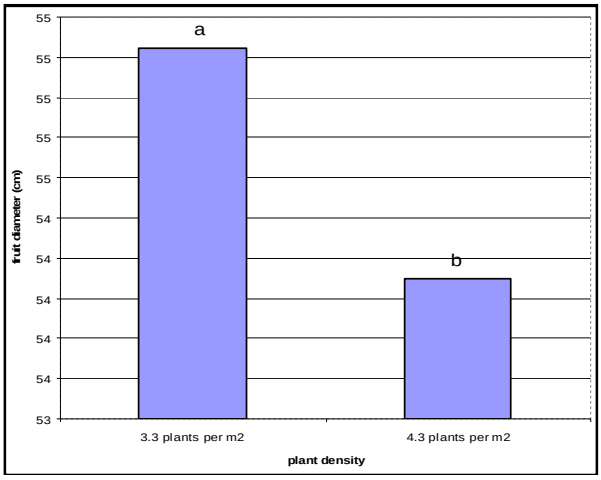

Fig. 8. Effect of plant density on fruit diameter.

3.6 The weight of the fruit

The cares of mulch and pruning are meaningful impossibility level of 1% and plant density in possibility level of 5% of the fruit weight. Since Pepino

has spread and surface roots, apply mulch can cause to increase the weight of fruit by promoting soil humidity.

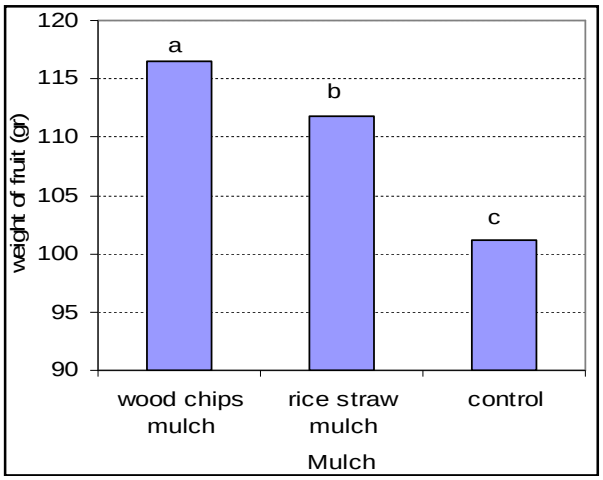

Fig. 9. Effect of mulch on fruit weight.

Wood chips mulch cause meaningful increases in fruit weight in comparison to other cares. Wood chips mulch is effective in increasing fruit weight by promoting all the growing attributes and also preserving soil humidity.

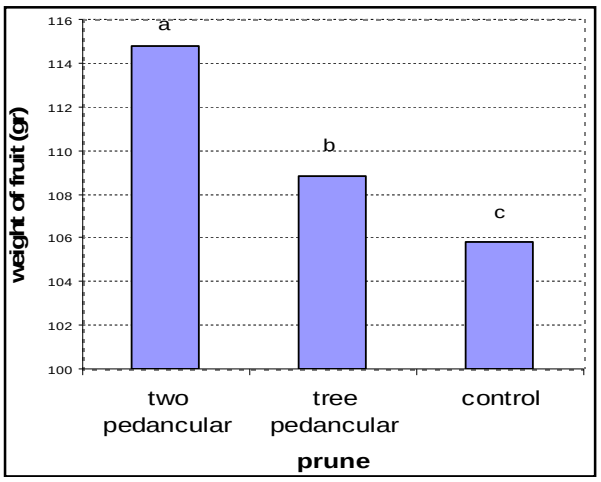

Fig. 10. Effect of pruning on fruit weight.

The most of the fruit weight (124.4 gr) is observed in two stems pruning and the least one is in the control. Two stems pruning include little fruit number and decreasing competence between fruits inside a bush, cause to increase the weight of fruit. Chervi and Peyvast (2004), by considering to the effect of pruning on cucumber performance, announce that there is a meaningful relationship between pruning effect on all the performance indexes, in comparison to control (18). Rafi (1996) in considering the effect of the stem pruning in tomato observed that fruit weight is much in bushes with little stems (22).

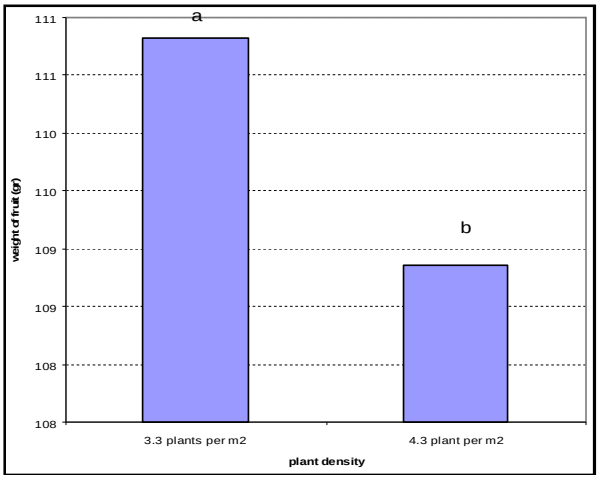

Fig. 11. Effect of plant density on fruit weight.

By increasing plant, density from 3.3 plants per m^2 to 4.3 plants per m^2 fruit weight is decreased. This issue shows that the little plant density can provide more suitable situation for preserving food matter in fruit. In research, which is performed by Qian (2000) on cucumber, he reports the number and the weight of each fruit in the bushes high in little plant density and has a meaningful difference with other cares (20).

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