

EFFECT OF USING PLASTIC MULCH ON CANTALOUPE PLANTS GROWN UNDER PLASTIC HOUSE AND LOW TUNNELS DURING AUTUMN AND EARLY SUMMER PLANTATION

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ABSTRACT

Two field experiments were carried out at Kaha Vegetable Station, Horticulture Research Institute under the condition of Plastic house and low tunnels plantation during autumn and early summer seasons of 1997 and 1998 to study the effect of covering the soil with clear or black plastic mulch comparing with unmulching on the productivity of cantaloupe plants. It was found that clear plastic mulch then black mulching induced obvious increment in vegetative growth as well as earliness of flowering comparing with the control (unmulched). Concerning fruit yield, it was found that clear plastic mulch increased fruit yield under low tunnels at early summer plantation, while under Height tunnels or Plastic house during autumn black plastic mulch was the superior on fruit yield. It was found also that, clear plastic mulch enhanced some fruit characteristics such as total soluble solids as well as total carotene while total acidity did not affected. Generally it can said that mulching the soil under low tunnels in early summer with clear plastic and under height tunnels in autumn with black plastic induced significant increment in cantaloupe fruit yield, while clear plastic mulch was the superior for enhancing total soluble solids and total carotene concentration in cantaloupe fruits.

Keywords: cantaloupe production using mulching under low tunnels and Height Plastic Tunnels.

INTRODUCTION

Cantaloupe is one of the major winter vegetable crops for exportation to Europe countries during the period from mid November until end of March. For producing marketable cantaloupe fruits at this time it require some heating treatments against cold weather. Using the plastic culture such as, plastic houses, high and low tunnels, plastic mulches either under the tunnels or plastic houses are the main methods for this purpose.

In this regard, several investigators showed that using plastic mulch under low tunnels or plastic houses induced obvious promotion for growth, fruit yield and its quality of cucurbit crops. Salman *et al.* (1993) reported that all plastic mulches, i.e. black or clear polyethylene under unheated Plastic tunnels or low tunnel increased soil temperature and vegetative growth of cucumber, AL-Majali and Kasrawi (1995) pointed out that planting muskmelon in furrows and mulching with transparent plastic resulted in longer plants, greater plant dry weight earlier flowering and harvesting compared with unmulched treatment or black mulch. In addition, Cantamutto *et al.* (1995) reported that using plastic muich under Height Plastic Tunnels improved vegetative growth of melon plants compared with unmulched plants grown under the same condition. Kurtar and Abak (1996) showed that mulching under low tunnels had a positive effect on melon root growth. Moreover, Immirzi *et al.* (1998) indicated that plant growth of aubergines,

melon, pepper and tomatoes was faster with the polyon films mulch under low tunnels and produced thicker stronger plants. Uzun *et al.* (1999) reported that tunnels with white plastic mulch increase cucumber plant height.

Concerning fruit yield and its quality, it was found that using black or clear polyethylene mulch under unheated Height Plastic Tunnels or low tunnels increased cucumber fruit yield (Salman *et al.* 1993). Gabriel *et al.* (1994) reported that the early yield of melon was highest with the clear mulch compared with the control or black or white backed with black mulches. They added also that, none of the treatment significantly affected fruit size or total yield. Munguia *et al.* (1994) showed that using plastic mulch (60 caliber) increased muskmelon fruit yields of first and second class by 53.6 and 31.6% respectively compared with the control. However, Schales (1994) pointed out that used 6 plastic mulch treatment on two muskmelon cvs. had little influence on the yield or fruit size. Moreover, AL-Majali and Kasrawi (1995) obtained higher yield and best quality of muskmelon fruits by using transparent plastic mulch compared with black or unmulched treatments. They reported also that unmulched treatment gave the lowest values for all measured parameters except TSS content. Kurtar and Abak (1996) showed that plastic mulch under low tunnel increased early and total yields of melon as well as fruit number but had no effect on fruit weight, fruit rind thickness, fruit flesh thickness, seed cavity width, seed cavity height, pH, fruit flavor and time of fruit maturity, however total soluble solids content was increased, Nesmith (1997) observed that fruit number of muskmelon responded to all plastic mulches treatment, while the treatments had no effect on fruit size or soluble solids. In addition, Immizi *et al.* (1998) obtained 20 days earlier and higher fruit quality of tomatoes, aubergines, melon and pepper by using polyon 20 μm mulch compared with three mulching films and three low tunnel films (Polyon 30 μm , Polyon 50 μm and traditional (L DPE 60 μm). The black mulch under low tunnels increased the marketable yield of cucumber by 60%, while white plastic mulch increased it by 40.3% compared with the unmulched control (Siwek *et al.* 1998). Also, Uzun *et al.* (1999) reported that the highest early yield of cucumber fruits was obtained when the soil covered with plastic mulch under low tunnels.

Thus, this trial was undertaken to make a comparison studies between using two kinds of plastic mulch either under low tunnels in early summer or under plastic house in the autumn season comparing with unmulched treatment on producing early and high marketable cantaloupe yield with best quality.

MATERIALS AND METHODS

Two experiments were carried out during two autumn and early summer seasons of 1997 & 1998 at Kaha Vegetable Station, Horticulture Research Institute. The aim of these experiments was to study the effect of using plastic mulch either clear or black under plastic house in autumn season and low tunnels in early summer season on the growth, flowering, yield and its quality of cantaloupe (*Cucumis melon*, L.). Seeds of the cultivar

Honey Dew-Orange flesh were sown at 7th and 11th of August during the autumn plantation for the first and second seasons respectively. Whereas sown in the early summer plantation at 20th of December in both seasons. Seeds were planted individually in Foam Trays 84 eyes filled with peat moss media supplied with the necessary nutrients. Rows either under plastic house or low tunnel were prepared with width of 1.0 meter and covered with plastic mulch, i.e. clear and black (40 microns). The control treatment left without mulching. In plastic house the seedlings were shifted on 25th August and 2nd September in the first and second seasons, while in the early summer under low tunnel plantation, this process was on 25th and 27th of January in the two seasons respectively spacing between seedlings was 50cm. All agriculture practices took place according to the recommendation of Ministry of Agriculture for cantaloupe plantation.

A randomized block design with four replicates was adopted. Plot area included 3 rows with the length of 6 meter.

Three treatments were used in this study as the following:

- 1- Mulching with clear plastic
- 2- Mulching with black plastic
- 3- control "without mulching"

Each of its used in the two methods of plantation., i.e. under Height Plastic Tunnels as well as low tunnels during both seasons, autumn and early summer.

Data recorded:

1- Plant growth measurement:

A random sample of 3 plants from each plot was chosen 60 days from transplanting in the two seasons to determine branch number and plant fresh weight.

2- Earliness of flowering:

The average number of days from sowing to the opening of the first staminate and hermaphrodite flowers of 25% from the plants per each plot was recorded.

3- Total yield either per plant or per feddan were determinant as well as average fruit weight.

4- Fruit quality:

4-a) Total soluble solids in fruits was estimated by Zeiss hand refractometer.

4-b) Carotenoid Pigments content of fruits in mg/100g fresh weight and total acidity percentage were determined using the methods described by A.O.A.C (1980).

The data were statistically analyzed according to Snedecor and Cochran (1971).

RESULTS AND DISCUSSION

1- Plant growth measurements:

Data presented in Table (1-a) and (1-b) indicate clearly that cantaloupe plants grown under plastic house or low tunnels with using plastic mulch either clear or black significantly increased plant fresh weight compared with the unmulched plants. The highest values of plant fresh weight were obtained from the treatment of clear mulch.

With regard to the effect of mulching on number of branches of cantaloupe plants, data in Table (1-a, b) showed that the increment in branch number attributed to covering the experiment soil with clear plastic mulch did not reach to significant level either under plastic house or low tunnels plantation.

The positive effect of mulched treatments with clear plastic under low tunnels or Plastic house might be attributed to raising soil temperature during the late autumn and early summer seasons which reflected on plant nutrient uptake and encouraged root growth, the same results were reported by Salman *et al.* (1993). They said that all plastic mulches, i.e. black or clear under unheated Height Plastic Tunnels or low tunnels increased soil temperature and vegetative growth of cucumber. Kurtar and Abak (1996) showed that mulching under low tunnels had a positive effect on melon root growth. Immirzi *et al.* (1998) on aubergines melon, pepper and tomatoes and Uzum *et al.* (1999) on cucumber came to similar results.

2- Earliness of flowering:

The results in Table (1-a,b) show clearly that there was no significant effect on the number of days from sowing to the opening of the first male or hermaphrodite flowers due to using clear mulch or black.

Table (1-a): Effect of plastic mulch on the growth and flowering of cantaloupe plants grown under Plastic house during autumn seasons of 1997 and 1998.

Treatments	Growth		Flowering	
	Branch No.	Plant fresh weight (g)	Earliness ♂ days	Earliness ♀ days
1997 season				
Clear plastic mulch	11.6	770.0	62.7	70.8
Black plastic mulch	9.9	674.5	65.3	74.3
Unmulched	10.2	44.5	63.9	71.4
L.S.D at 5%	N.S	174.9	N.S	N.S
1998 season				
Clear plastic mulch	9.9	719.5	62.0	69.4
Black plastic mulch	9.2	641.0	65.7	72.9
Unmulched	9.7	402.5	63.9	71.9
L.S.D at 5%	N.S	174.9	N.S	N.S

Table (1-b): Effect of plastic mulch on growth and flowering of cantaloupe plants grown under low tunnels during early summer seasons of 1997 and 1998.

1997 season				
Clear plastic mulch	7.9	432.0	38.5	46.0
Black plastic mulch	7.7	315.5	36.6	48.0
Unmulched	7.8	261.0	38.2	45.5
L.S.D at 5%	N.S	55.9	N.S	N.S
1998 season				
Clear plastic mulch	5.9	454.6	37.9	47.2
Black plastic mulch	5.9	335.0	42.8	48.9
Unmulched	5.3	278.5	38.9	47.5
L.S.D at 5%	N.S	66.2	N.S	N.S

Under Plastic house or low tunnels during autumn or early summer plantations respectively. In spite of the mulch treatments clear or black tended to give the earliest flowers, i.e. male and hermaphrodite, but the earliest periods not reached to significant level. Generally, it can said that clear or black mulching can give slight reduction in the number of days from sowing till the time of flowering. AL-Majali and Kasrawi (1995) came to similar results, they pointed out that planting muskmelon and mulching with transparent plastic resulted in earlier flowering and harvesting.

3- Total yield and its components:

Data in Table (2-a,b) indicate that using Black plastic mulch in growing season during autumn under plastic house induced significant increment in fruit yield at the two seasons. The relative fruit yield by using this treatment, i.e. black plastic mulch reached to 142.5% while the increment by using clear plastic mulch under plastic house did not reach to significant level and it equal about 106% from the control. Using black plastic mulch also produced heavy fruits comparing with unmulched or the other treatment, i.e. clear plastic mulch, but the increases not reach to the significant level except the second season the treatment, i.e. black plastic mulch induced significant heavy fruits as shown in table (2-a).

Regarding to using plastic mulch under low tunnels plantation during early summer season, the data in Table (2-b) show opposite results comparing with using mulching under plastic house plantation, whereas, clear plastic mulch was better than the black mulch. In other meaning, covering the soil with clear plastic mulch under low tunnels in early summer season produced significant increases in cantaloupe fruit yield in the second season, but the increment in the increment in the first season not reach to significant level. The average increasing were 119.5% and 13.3% with using clear plastic mulch during the two successive seasons respectively. The data show the same trend on the average of fruit weight or fruit yield per plant, whereas, the clear plastic under low tunnels produced significant results in the second season, while in the first season the results not reach to the significant level. Obtained results are in agreement with those reported by Salman *et al.* (1993) on cucumber, Gabriel *et al.* (1994) on melon, Mungive *et al.* (1994) on muskmelon, AL-Majalo and Kasraui (1995) on muskmelon; Kurtar and Abak (1996) on melon and Uzun *et al.* (1999) on cucumber, they reported that using plastic mulch either under low tunnels or plastic houses increased fruit yield.

Table (2-a): Effect of plastic mulch on fruit yield of cantaloupe plants grown under Plastic house during autumn seasons of 1997 and 1998.

Treatments	Growth		Flowering	
	Average fruit weight (g)	Fruit yield / Plant (g)	Total yield ton / fed	Relative fruit Yield
1997 season				
Clear plastic mulch	659.2	751.5	5.0	106%
Black plastic mulch	756.1	985.2	6.7	142.3%
Unmulched " Control"	629.0	701.5	4.7	100%
L.S.D at 5%	N.S	N.S	1.18	-
1998 season				
Clear plastic mulch	591.0	877.4	5.9	115.6
Black plastic mulch	633.5	1100.1	7.3	143.3%
Unmulched " Control"	573.0	767.7	5.1	100%
L.S.D at 5%	N.S	305.5	1.6	-

Table (2-b): Effect of plastic mulch on fruit yield of cantaloupe plants grown under low tunnels during early summer seasons of 1997 and 1998.

1997 season				
Treatments	Average fruit weight (g)	Fruit yield / Plant (g)	Total yield ton / fed	Relative fruit Yield
Clear plastic mulch	513.0	631.0	5.1	115.9
Black plastic mulch	462.0	463.3	4.8	109%
Unmulched " Control"	449.5	477.8	4.4	100%
L.S.D at 5%	N.S	N.S	N.S	-
1998 season				
Clear plastic mulch	322.2	611.0	2.1	123.5%
Black plastic mulch	305.6	477.0	2.0	117.6%
Unmulched " Control"	191.7	341.1	1.7	100%
L.S.D at 5%	58.9	172.1	0.35	-

4- Fruit quality:

The effect of using plastic mulch clear or black on some fruit characteristics, i.e. total soluble solids, carotenoids and total acidity in the fruits produced from plants grown under Height Plastic Tunnels or low tunnels are shown in Table (3- a,b). Total acidity percentage of cantaloupe fruits showed no significant differences between mulching and unmulching treatments under plastic houses or tunnels

Regarding to total soluble solids, data in Table (3- a,b) show clearly plastic mulch under low tunnels plantation during early summer at the second season induced significant increment in TSS concentration of cantaloupe fruits. It is noticed also that total soluble solids were increased in cantaloupe fruits produced from plants grown under mulching either under low tunnels or plastic house but with non-significant increment.

Table (3-a): Effect of plastic mulch on some fruit characteristics of cantaloupe plants grown under plastic house during autumn seasons of 1997 and 1998.

Treatments	Total acidity (%)	T.S.S.	Carotenoids mg/ 100g F.W
1997 season			
Clear plastic mulch	4.1	11.4	0.62
Black plastic mulch	3.8	11.2	0.49
Unmulched " Control"	4.6	10.9	0.41
L.S.D at 5%	N.S	N.S	0.062
1998 season			
Clear plastic mulch	3.9	10.8	0.61
Black plastic mulch	3.7	10.7	0.49
Unmulched " Control"	4.2	9.9	0.40
L.S.D at 5%	N.S	N.S	0.075

Table (3-b): Effect of plastic mulch on some fruit characteristics of cantaloupe plants grown under low tunnels during early summer seasons of 1997 and 1998.

1997 season			
Clear plastic mulch	3.7	10.8	0.53
Black plastic mulch	4.3	9.1	0.48
Unmulched " Control"	4.1	9.3	0.47
L.S.D at 5%	7N.S	N.S	N.S
1998 season			
Clear plastic mulch	3.4	8.2	0.50
Black plastic mulch	4.0	7.8	0.46
Unmulched " Control"	3.9	6.9	0.46
L.S.D at 5%	N.S	1.04	N.S

The results of mulching treatments on the total carotenoids in the two seasons of autumn under plastic house and early summer under low tunnels are shown in Table (3- a, b). In the two autumn seasons, it was clear that significant effect was noticed among clear plastic mulch on carotenoids content in cantaloupe fruits. The same trend was noticed also by using the same treatment under low tunnels during early summer seasons without reaching to the significant level. It was noticed also that the effect of using black plastic mulch on fruit quality was near to the effect of unmulching treatment.

Generally it can recommend that using black plastic mulch under Plastic house during autumn season and clear plastic mulch under low tunnels during early summer plantation produce the highest fruit yield of cantaloupe and in general clear plastic mulch was the better in enhancing fruit quality.

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تأثير استخدام التغطية بالبلاستيك على نباتات الكنتالوب المزروعة تحت الصوب
البلاستيكية والأقبية خلال الموسم الخريفي والصيفي المبكر
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نفذت تجربتان حقلتان بمحطة الخضر بقها - معهد بحوث البساتين تحت ظروف زراعات الصوب البلاستيكية والأقبية خلال الموسمين الصيفي المبكر والخريفي ١٩٩٧-١٩٩٨ لدراسة تأثير تغطية التربة باستخدام البلاستيك الشفاف والأسود مقارنة بدون تغطية على إنتاجية نباتات الكنتالوب. وقد وجد أن التغطية بالبلاستيك الشفاف يليه الأسود أحدث زيادة واضحة في النمو وتبكير التزهير مقارنة بالكنترول (بدون تغطية). وبالنسبة لمحصول الثمار فقد وجد أن استخدام التغطية بالبلاستيك الشفاف في الزراعات الصيفية المبكرة تحت الأقبية أدى إلى زيادة المحصول بينما تحت زراعات الصوب البلاستيكية في الموسم الخريفي كان البلاستيك الأسود المستخدم في التغطية هو الأفضل بالنسبة لمحصول الثمار. هذا وقد وجد أيضاً أن البلاستيك الشفاف قد حسن من بعض صفات الثمار مثل محتوى الثمار من المواد الصلبة الذائبة الكلية والكاروتينويدات بينما لم تتأثر الحموضة الكلية.

وبوجه عام يمكن القول بأن تغطية التربة بواسطة البلاستيك الشفاف تحت الأقبية البلاستيكية والبلاستيك الأسود تحت زراعات الصوب البلاستيكية في العروة الخريفية أدى إلى زيادة معنوية في محصول ثمار الكنتالوب بينما كان تأثير التغطية بالبلاستيك الشفاف هو الأفضل في تحسين تركيز المواد الصلبة الذائبة الكلية والكاروتينويدات في ثمار الكنتالوب.