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Response of "Anna" Apple Trees to Different Orchard Floor Management Systems

Naglaa K.H. Serry, Mohamed S.M. Ali and Nada E. Mohammed

Department of Horticulture, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt

Abstract: Taking a 10-year- old "Anna" apple trees, located at 6th October company orchard, Ismailia, Egypt as test unit. Apple trees were planted at 3*4 m apart in sandy soil under drip irrigation system. Trees were treated during 2016 and 2017 seasons, to study the effect of different plastic colours used as orchard floor management (OFM) system as follow: a- Black polyethylene plastic 0.12 mm. b- Silver/Brown (Reflective) polyethylene plastic 0.12 mm. C- White polyethylene plastic 0.12 mm. d- Control (bare soil). All plastic sheets were cut in strips of three meter long and two meter width and put from the tree trunk to the tree canopy. The results demonstrated that, all plastic mulch covering treatments caused an increment in soil temperature and moisture in both seasons and recorded the highest values of shoot length, No. of leaves/shoot and leaf area in a comparison with the control treatment. Also, all mulching treatments had a significant increment in average fruit weight (g), initial fruit set (%), final fruit set (%), no. fruit/tree, yield per tree (kg), yield efficiency (%) and crop density (%). Moreover, the applied treatments increased significantly leaf N, P, K, contents as compared with the control. Concerning, physico-chemical characteristics of the fruit, all treatments significantly influenced by increasing fruit length, fruit diameter, firmness, SSC, acidity and *a** colour value. Statistical analysis indicated that among all polyethylene plastic colours used as orchard floor management system, the White polyethylene was most suitable for the "Anna" apple orchards.

Key words: Apple "*Malus domestica* L." · Orchard Floor Management Systems · Plastic mulching

INTRODUCTION

Apple "*Malus domestica* L." is one of the most important horticultural deciduous fruit crop in Egypt. The total area cultivated with apple is 72264 feddans produced 798574 tones according to FAOSTAT [1].

Plastic mulching has turned into globally applied horticultural practice for its moment economic advantages, Represented in, abundant yield, early harvest season, maintenance and improved fruit quality and increased water-use proficiency. Nonetheless, information of the sustainability of plastic mulching stays dubious as far as both an ecology and agronomic viewpoint.

Mulching is characterized as the application or making of any soil cover that comprises a hindrance to the exchange of heat or moisture [2]. They also change the spectral characteristics of light around the plant and stifle soil water misfortune by dissipation [3 - 5]. Because of the microclimatic changes instigated by utilizing plastic mulches of different colours; increments in percent seedling emergence, growth and yield have been scored with cucumber, broccoli and lettuce, tomatoes and bell peppers [6, 7, 4]. In This direction, covering the soil surface can inhibit weed growth due to the reduction of light levels below mulch [8]. So the competition for water and nutrients will be decreased, also can control soil erosion and improve fruit duality [9].

Natural organic product creation has been consistently expanding as of late because of the fantastic returns for cultivators. The most significant natural product crops are Pears and Apples. Cultivators considering changing from traditional to organic production can confront difficulties with soil nutrition management one of the most pertinent [10].

Using organic mulch increase the soil organic matter and can control soil temperature fluctuation under mulch although using of black plastic mulch conserve the soil moisture through reducing evaporation [11, 12].

Corresponding Author: Naglaa K.H. Serry, Horticulture Department, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt 41522.

Mulching black polyethylene plastic as OFM in "Le Conte" pear orchard was effective and increased leaf N, P, K contents [13].

Previous studies discovered that alternative administration practices may improve soil quality when contrasted with traditional administration practices [14-16].

This survey basically study the role of plastic mulching as orchard floor management application (OFM) on Anna apple (Golden delicious x Red hadassiya) trees vegetative growth, leaf mineral contents, tree productivity, fruit quality, Finally, weed growth and soil properties (temperature and moisture).

MATERIALS AND METHODS

This experiment was conducted during 2016, 2017 seasons at 6th October company orchard, Ismailia, Egypt, on 10-year- old "Anna" apple trees, the pollinator was Dorset Golden and the trees planted at 3*4 m apart in sandy soil under drip irrigation system. To study the effect of different polyethylene plastic colours on soil temperature and moisture, vegetative growth, tree productivity and fruit quality. All trees were subjected to the same agricultural practices.

Treatments included:

- Black polyethylene plastic 0.12 mm.
- Silver / Brown (Reflective) polyethylene plastic 0.12 mm.
- White polyethylene plastic 0.12 mm.
- Control (bare soil).

All plastic sheets were cut in strips of three meter long and two meter width and put from the tree trunk to the tree canopy.

Measurements and Determinations

Soil Temperature and Moisture:

- Soil moisture was determined gravimetric before 24 h of irrigation at depth of 10 and 15cm.
- Soil temperature was recorded at depth of 10, 15cm with a digital soil thermometer. (digital Therm. Lab "8" Stem Hi-Temp. China)

Vegetative Growth: Number of shoots/branch were recorded at the growth cessation at the end of the growing season, Shoot length (cm) was measured at the end of the growing season, No. leaf/shoot and Leaf area/shoot (cm^2).

Canopy circumference (m), Canopy diameter (m), Tree height (m), Tree volume (m^3) was calculated from the following equation

Tree volume = (4/3)* (canopy diameter/2)^2 * (tree height) * (3.14).

Trunk cross-sectional area (TCA) was calculated from the following equation:

$$TCA\ (m^2) = \frac{(trunk\ circumference)^2}{4*3.14}$$

Leaves N, P and K Content: At the beginning of August at harvest time, leaf samples were taken. From the mid zone of current season's shoots (the third leaf on shoots) 10 leaves per replication (tree), from all sides of the tree and analyzed for N, P and K contents. The sample was prepared according to Evenhuis and Dewaard [17] method. N and P were assessed calorimetrically and K was determined by Flame photometer according to Evenhius [18]; Murphy and Riley [19]; Karla [20] and Wilde *et al.* [21], respectively. Concentrations of N, P and K were expressed as percent.

Tree Productivity: Initial fruit set (%), Final fruit set (%), No. fruits per tree, Average fruit weight (g), Yield / tree (kg), Yield efficiency (%) was calculated as follows:

$$\text{Yield efficiency \%} = \frac{tree\ yield(kg)}{TCA}$$ and Yield density (%) was calculated as follows:

$$\text{Yield density \%} = \frac{\text{No. fruits}}{\text{TCA}}$$ and

Fruit Physico-Chemical Characteristics: Samples of 10 fruits from mature Anna Apple were harvested from each tree for determination of Physico-chemical characteristics. Average fruit weight (g), fruit length (cm), fruit diameter (cm) and fruit shape index (diameter/length), firmness (kg/cm^2) was determined according to Magness and Taylor [22] pressure tester using a 5/16 plunger, two readings were taken on the pulp of each fruit after peeling.

Soluble solids content (SSC) (%) determined by using ATTAGO hand refractometer, acidity (mg/100 ml juice) using A.O.A.C. [23] and starch index the phase of starch degradation was assessed by the iodine test, utilizing a solution of 40 g KI + 10 g I2/l H2O. Fruits cut along the greatest diameter were soaked into the solution for 10-15 min and allowed to dry for one minute, after which the percentage staining was recorded. This percentage esteem was divided by 9 and the subsequent figure was subtracted from 9 to give a value on the starch disappearance scale (0–9), where 1-3 = immature; 4-6 = mature; 7-9 = over mature and 9 the complete degradation of the starch content [24].

Three different estimations at three equidistant points on the equatorial region of each individual fruit was done on 10 fruit of each treatment using a chromameter (Minolta CR 300 color-difference meter, Ramsey, NJ), which provided CIE L*, a* and b* values. Negative a* value indicates green while positive a* value indicates red colour. Positive b* value indicates yellow rind colour while negative b* value indicate blue colour [25, 26]. Colour was expressed as red colour (a* value) at harvest time.

Statistical Analysis: All Treatments arranged in a randomized complete block design with 4 replicates each of one tree, statistically analyzed by using the Co-Stat program version 3 (Co.Hort. Software) and treatments means were statistically compared using the Duncan's multiple range test ($P \leq 0.05$) [27].

RESULTS AND DISCUSSION

Concerning the effect of plastic colours application used as OFM on soil temperature and moisture of apple orchard, it is clear from Figs. (1 and 2) that there was a significant ($P \leq 0.05$) different among plastic colours applications during 2016 and 2017 seasons in both depths (10 or 15 cm). As for soil temperature in both seasons, a significant increment observed in black polyethylene plastic treatment of 29.8 and 28.5, (10 cm) and 29.5 and 29.2 (15 cm) followed by the reflective of 28.8 and 27.8, (10 cm) and 28.7 and 28.4 (15 cm), then white polyethylene film of 27.6 and 26.9 (10 cm) and 27.7 and 27.8 (15 cm). While, the control (uncovered soil) recorded the lowest values of 26.5 and 25.5 (10 cm) and 26.6 and 26.4 (15 cm) in both seasons respectively. Generally, all plastic mulch covering treatments scored an increment in soil temperature in both seasons and in both depth when compared with control treatment. Truax and Gagnon [28] used a cover crop as a mulching to improved soil structure and water infiltration of apple orchard. The same results have been reported by Nathan *et al.* [29]; Bowen *et al.* [30] and Mika *et al.* [31]. In addition Fawzia [32] on pear found that, around the trunk of mulching trees would in general increment soil temperature more than white plastic.

As for soil moisture the obtained data in Figs. (1 and 2) refers to that all plastic colours mulching treatments caused an increment in soil moisture values which gave a significant ($P \leq 0.05$) highest values than control. In the first season, the maximum value noticed with black and reflective plastic mulch covering treatments in both depth. But, in the second season the highest significant value scored with the black polyethylene plastic in both depth followed by reflective and white plastic mulch covering, respectively. The control treatment scores the lowest value of soil moisture in both depth. These results additionally appeared to be in accordance with those observed by Truax and Gagnon [28]; Marsh *et al.* [33]; Nathan *et al.* [29] and Lindhard *et al.* [34] who reported that mulching with cover crops improved soil structure and water infiltration on apple orchards and they also revealed that the same treatment with black plastic as soil cover had high soil moisture content. A few ongoing studies in humid districts have distinguished advantageous impacts of mulching on apple tree performance, soil moisture content and biological activity in orchard soils [35].

Data presented in (Table 1) showed that no significant ($P \leq 0.05$) effect of plastic colours application used as OFM of "Anna" apple on number of shoots per main branch in the two seasons.

There was a significant ($P \leq 0.05$) increment in shoot length as affected with different mulching treatments. Results (Table 1) revealed that, mulching with plastic films beneath the trees recorded the highest increment in shoot length, in both seasons. The highest value was obtained by black polyethylene plastic film treatment followed by reflective and white, respectively. The lowest value in both seasons recorded with the control. This increase in shoot length with mulching treatments comparing to the control may be due to the increment in soil temperature and moisture which affected in root growth stimulation [36]. Moreover, Mika *et al*. [31] and Lindhard *et al*. [34] found the same results. Regarding the influence of plastic colours mulching treatments used as OFM on number of leaves per shoot results tabulated in (Table 1) showed that black, reflective, white plastic mulch and control recorded 37.0, 35.0, 37.7 and 27.4 leaves in the first season and 34.1, 34.3, 35.00 and 26.40 leaves per shoot in the second one, respectively. It was demonstrated that mulching trees with white polyethylene films significantly ($P \leq 0.05$) increased the number of leaves per shoot as compared with the control. While, no significant differences were found among mulching treatments in both seasons. These results came in agreement with those found by Davison [37]; Neilsen *et al*. [35] and Aly *et al.* [38]. For the leaf area index as affected by different mulching treatments, data showed in (Table 1) that, mulching with plastic films around the trees gave the highest leaf area index as compared with the control which gave the lowest values in both seasons. No significant ($P \leq 0.05$) difference was found among three mulching with plastic films.

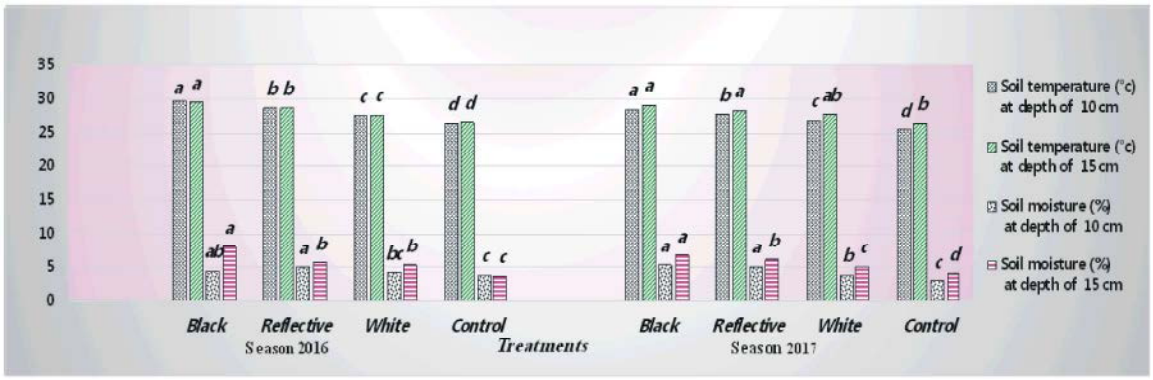

Fig. 1: Soil temperature and moisture as affected by different plastic colours used as OFM on "Anna" apple in 2016 & 2017 seasons

Values followed by the same letter (s) are not significantly different at P ≤ 0.05 according to the Duncan's multiple range test

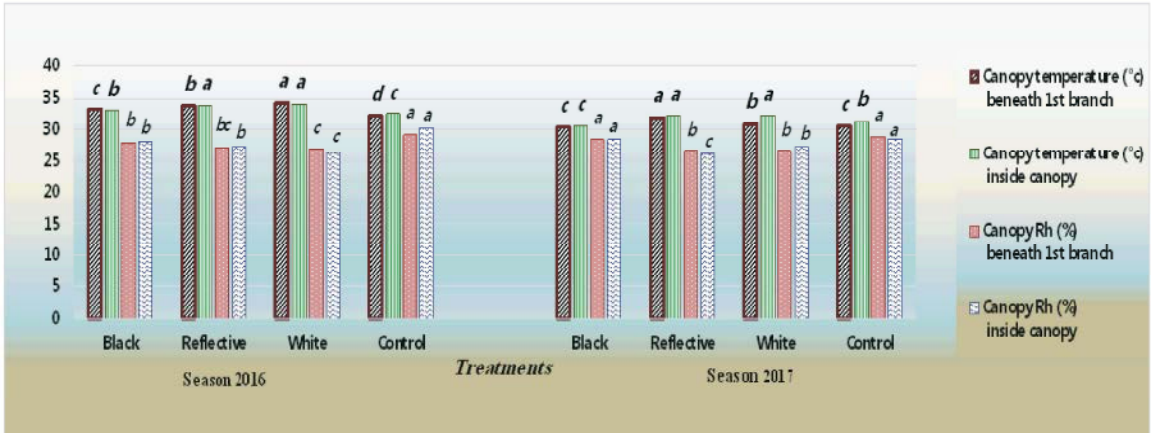

Fig. 2: Canopy microclimate as affected by different plastic colours used as OFM on "Anna" apple in 2016 & 2017 seasons

Values followed by the same letter (s) are not significantly different at P ≤ 0.05 according to the Duncan's multiple range test

This increment in leaf area values comparing to the control might be expected to the root growth stimulation caused by increased soil temperature and moisture given under mulching coverings with plastic films which resulted in early top growth. These results were similar with those revealed by Lindhard *et al.* [34] and Mika *et al.* [31].

As the differences among tested treatments with plastic colours application, on tree characteristics of "Anna" apple in 2016 and 2017 seasons Data tabulated in (Table 2) showed that a significant (P ≤ 0.05) differences in circumference, diameter, volume and height but, no significant different in TCA, of the tree among all treatments. White polyethylene plastic film treatment recorded the highest significant values in all characteristics followed by black and reflective treatments as compared with the control which gave the lowest values in both seasons. These findings came in line with those noticed by Mika *et al.* [31] and Aly *et al.* [38] demonstrated that the apple trees had the most vigorous growth.

Regarding the impact of treated with plastic colours application used as OFM on leaf content N, P, K percentage of "Anna" apple trees as shown in Table (3). All applied treatments significantly (P ≤ 0.05) increased leaf N, P and K in a comparison with the control treatment in both seasons. Mulching with white plastic recorded the highest values of element nutrients followed by black and reflective with no significant different among them. The control treatment had the lowest value in both seasons. All mulching treatments significantly increased nutrient elements in the two seasons as compared with control.

Table 1: Effect of different plastic colours used as OFM on vegetative growth of "Anna" apple trees in 2016 & 2017 seasons

Treatments	No. shoots/main branch	Shoot length (cm)	No. leaves/shoot	Leaf area/shoot (cm^2)
		Season 2016		
Black	4.12 a	45.9 a	37.0 a	40.80 a
Reflective	3.50 a	40.8 ab	35.0 a	41.30 a
White	3.90 a	38.8 b	37.7 a	42.30 a
Control	4.40 a	32.1 c	27.4 b	36.80 b
		Season 2017		
Black	4.30 a	45.4 a	34.1 a	40.60 a
Reflective	3.70 a	30.7 b	34.3 a	41.00 a
White	3.70 a	39.3 b	35.0 a	41.30 a
Control	4.20 a	32.6 c	26.4 b	35.80 b

The values within each column with different letters are significantly different at P = 0.05 according to the Duncan's multiple range test.

Table 2: Effect of different plastic colours used as OFM on tree characteristics of "Anna" apple in 2016 & 2017 seasons

	Canopy		Tree		
Treatments	Circumference (m)	Diameter (m)	Volume (m^3)	Height (m)	TCA (m^2)
			Season 2016		
Black	9.2 ab	2.8 b	27.9 b	2.3 b	2.6 a
Reflective	8.5 b	2.6 b	26.8 b	2.2 b	2.4 a
White	9.8 a	3.5 a	33.5 a	2.8 a	2.7 a
Control	7.3 c	2.1 c	17.4 c	1.7 c	2.0 a
			Season 2017		
Black	9.5 a	2.7 b	28.4 b	2.3 b	2.7 a
Reflective	9.0 a	2.5 b	27.6 b	2.2 b	2.5 a
White	9.7 a	3.2 a	32.2 a	2.6 a	2.7 a
Control	7.5 b	2.2 c	17.9 c	1.8 c	2.1 a

The values within each column with different letters are significantly different at P ≤ 0.05 according to the Duncan's multiple range test.
TCA = trunk cross-sectional area

Table 3: Effect of different plastic colours used as OFM on leaf N, P and K content (%) of "Anna" apple trees in 2016 & 2017 seasons

	Season 2016			Season 2017		
Treatments	N (%)	P (%)	K (%)	N (%)	P (%)	K (%)
Black	2.4 a	0.64 b	1.34 a	2.5 a	0.60 b	1.34 a
Reflective	2.4 a	0.62 b	1.36 a	2.4 a	0.62 b	1.33 a
White	2.6 a	0.68 a	1.39 a	2.7 a	0.67 a	1.38 a
Control	2.0 b	0.39 c	1.16 b	2.0 b	0.38 c	1.11 b

The values within each column with different letters are significantly different at P ≤ 0.05 according to the Duncan's multiple range test

In the same pattern, Frimanslund [39] and Fawzia [32]) on pear, Neilsen *et al.* [35]; Nathan *et al.* [29]; Mika *et al.* [31] and Aly *et al.* [38], on apple there was a significant increase in nitrogen level over the normal level. Also, Nathan *et al.* [29] found a shortage in feedback about the influence of mulching in high-density apple orchards in irrigated areas where daily irrigation and fertigation relied upon to lessen potential elements supplement and water stresses. Besides, mulching plays a vital role being developed of potassium- deficiency.

The data presented in (Tables 4 and 5) indicated that the effect of various treatments of mulching on tree productivity and Physico chemical parameters of the "Anna" apple fruits viz., initial fruit set (%), final fruit set (%), average fruit weight (g), fruit number per tree, yield per tree (kg), yield efficiency (%), crop density (%), fruit length (cm), fruit diameter (cm), fruit shape index, firmness (lb/cm^2), SSC(%), (%) acidity (mg/100 ml juice) and starch index. All treatments caused an increment in initial fruit set (%), final fruit set (%), average fruit weight (g), fruit number per tree, yield per tree (kg), yield efficiency (%), crop density (%), fruit length (cm), fruit diameter (cm) and fruit firmness (lb/cm2) as contrasted with control treatment. It was demonstrated that, mulching trees with white polyethylene significantly (P ≤ 0.05) increased the fruit physical properties as compared with control treatment in both seasons. At the same time, it was significantly differed from cover crops with either black or

Table 4: Effect of different plastic colours used as OFM on Tree productivity of "Anna" apple in 2016 & 2017 seasons

Treatments	Initial fruit set (%)	Final fruit set (%)	Average Fruit weight (g)	No. fruit/tree	Yield/tree (kg)	Yield efficiency (%)	Crop density (%)
				Season 2016			
Black	48.30 a	12.50 b	127.20 b	112.30 ab	12.30 b	0.05 b	0.47 a
Reflective	44.80 a	13.10 b	136.50 ab	104.50 b	12.00 b	0.05 b	0.45 a
White	49.90 a	17.30 a	163.50 a	129.80 a	16.90 a	0.06 a	0.49 a
Control	36.50 b	10.10 c	96.20 c	78.00 c	9.70 c	0.03 c	0.30 b
				Season 2017			
Black	48.40 a	13.10 b	140.30 b	114.30 b	17.70 b	0.08 b	0.48 a
Reflective	46.50 a	12.10 b	139.30 b	104.80 b	17.20 b	0.08 b	0.46 a
White	53.00 a	17.00 a	156.30 a	132.30 a	22.20 a	0.09 a	0.50 a
Control	38.20 b	9.70 c	124.10 c	83.00 c	13.80 c	0.04 c	0.33 b

The values within each column with different letters are significantly different at P ≤ 0.05 according to the Duncan's multiple range test.

Table 5: Effect of different plastic colours used as OFM on fruit characteristics of "Anna" apple in 2016 & 2017 seasons

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit shape index	Firmness (lb/cm^2)	SSC (%)	Acidity (mg/ 100 ml juice)	*Starch index
				Season 2016			
Black	7.22 a	6.45 a	1.11 a	17.6 a	11.6 a	0.47 b	6.49 a
Reflective	7.14 a	6.35 a	1.12 a	17.6 a	11.8 a	0.48 b	6.05 a
White	7.31 a	6.49 a	1.13 a	17.7 a	11.8 a	0.43 b	6.17 a
Control	6.44 b	5.42 b	1.18 a	16.4 b	10.8 b	0.57 a	6.78 a
				Season 2017			
Black	7.71 a	6.78 a	1.14 a	17.7 a	11.5 a	0.48 b	6.61 a
Reflective	7.68 a	6.87 a	1.12 a	17.8 a	11.6 a	0.49 b	6.42 a
White	7.73 a	6.78 a	1.14 a	17.8 a	11.8 a	0.46 b	6.56 a
Control	6.54 b	5.58 b	1.17 a	16.2 b	10.6 b	0.59 b	6.42 a

The values within each column with different letters are significantly different at P ≤ 0.05 according to the Duncan's multiple range test.

* scale 1-9; 1-3= immature; 4-6 = mature; 7-9 = over mature

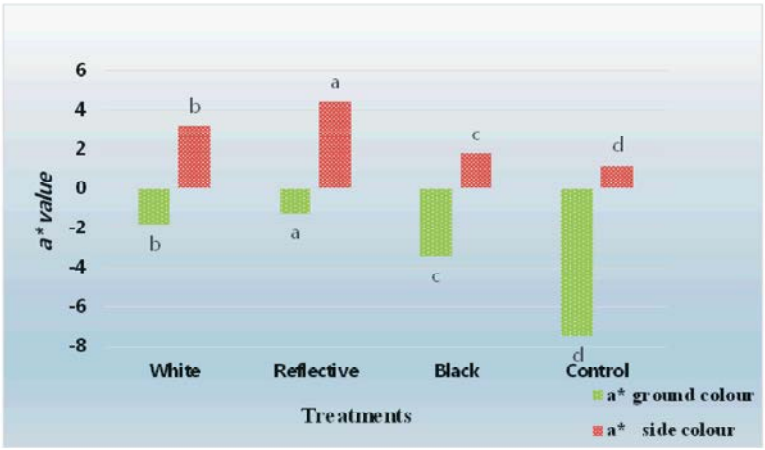

Fig. 3: Effect of different plastic colours used as OFM on a* colour value of ground and side of "Anna" apple fruit at harvest time. The values. the values are means of two seasons

*Values followed by the same letter (s) are not significantly different at P ≤ 0.05 according to the Duncan's multiple range test

reflective in both seasons. No significant different among all treatments on "Anna" apple fruit shape index. These findings were confirmed with those demonstrated by El-Seginy [40]; Reganold [41] and Aly *et al*. [38]. While, counterproductive with Mika *et al*. [31] noticed that no significant different of mulching treatments on average fruit weight and firmness. They all proposed that, the higher dampness and temperature and better supplement accessibility by decrease of filtering offered by mulching may have been the purposes behind the increase in fruit physical properties.

As for fruit chemical characteristics, Data tabulated in (Table 5) indicated that all mulching treatments decreased % acidity in a comparison with the control (uncovered soil) in both seasons, while the reverse was happened with SSC %. Statistical analysis cleared that mulching with white plastic films significantly ($P \leq 0.05$) increased all chemical of fruit characteristics, except acidity during 2016 and 2017 seasons. As for, starch index there was no significant different among all treatments. These notes with in agreement with those observed by Finn Mage [42]; Lindhard *et al*. [34] and Aly *et al*. [38]. While, disagree with those noticed by El-Seginy [40].

REFERENCES

1. FAO, 2017. Food and Agriculture Organization of the United Nation. FAOSTAT http://wwwfaoorg.
2. Rosenberg, N.J., P.G. Blad and S.B. Verma, 1984. Microclimate: The biological environment. John Wiley and Sons, New York.
3. Hunt, P.G., G.J. Kasperbauer and T.A. Methemy, 1989. Soybean seedling growth responses to light reflected from different coloured surfaces. Crop Science, 29: 130-133.
4. Decoteau, D.R., M.J. Kasperbauer and P.G. Hunt, 1990. Bell pepper plant development over mulches of diverse colours. HortScience, 25: 460-462.
6. Peirce, L.C., 1987. Vegetables: Characteristics, production and marketing. John Wiley and Sons, New York.
8. Harrington, K.C. and T.A. Bedford, 2004. Control of weeds by paper mulch in vegetables and trees. New Zealand Plant Protection, 57: 37-40.
9. Szewczuk, A. and E. Gudarowska, 2006. Effects of mulching in a nectarine orchard in sustainable fruit production. Department of horticulture, University of agriculture in Wroc³aw Rozbrat, 7: 50-334. Wroc³aw, Poland J. Fruit Ornamental Plant Trees., 14: 217-223.
10. Granatstein, D., 2002. Tree fruit production with organic farming methods. Organic Fruit Production, 15: 1-12.
11. Barzegar, A.R., A. Yousef and A. Daryashenas, 2002. The effect of addition of different amounts and types of organic materials on soil physical properties and yield of wheat. Plant and Soil., 247: 295-301.
12. Van Der Westhuizen, J.H., 1980. The effect of Black Plastic Mulch on Growth, Production and Root Development of Chenin blanc Vines under dry land conditions S. Afr. J. Enol. Vitic., 1(I): 1-6.
13. Eid, T.A. and F.I.I. Abou Grah, 2012. Effect of Some Mulching Treatments on Water use Efficiency, Yield and Mineral Composition of "Le-Conte" Pear Trees. Annals of Agric. Sci., Moshtohor, 50(1): 11-19.
14. Reganold, J.P., L.F. Elliott and Y.L. Unger, 1987. Long-term effects of organic and conventional farming on soil erosion. Nature, 330: 370-372.
15. Reganold, J.P., J.D. Glover, P.K. Andrews and H.R. Hinman, 2001. Sustainability of three apple production systems. Nature, 410: 152-164.
16. Swezey, S.L., M.R. Werner, M. Buchanan and J. Allison, 1998. Comparison of conventional and organic apple production systems during three years of conversion to organic management in coastal Calif. Amer. J. Alter. Agric., 13: 162180.
17. Evenhuis, B. and B.W. Dewaard, 1980. Principles and practices in plant analysis. FAO Soils Bull., 38(1): 152-163.
18. Evenhuis, B., 1976. Simplified methods for foliar analysis, Parts I-VII. Internal Report Dept., Agric. Res., Royal Tropical Inst., Amsterdam, pp: 1-13.
19. Murphy, J. and J.P. Riley, 1962. A modified single solution method for determination of phosphorus in natural water. Anal. Acta, 27: 31-36.
20. Karla, Y.P., 1998. Handbook of reference for plant analysis. Boca Raton, Boston, London, New York, Washington, D.C. CRC Press, pp: 1-291.
21. Wilde, S.A., R.B. Corey, J.C. Lyer and G.K. Voigt, 1985. Soils and Plant Analysis for Tree Culture. 3rd Ed. Oxford. IBH. New Delhi, pp: 1-218.
22. Magness, J.R. and C.F. Taylor, 1925. An improved type of pressure tester for the determination of fruit maturity. U. S. Dept. Agric. Circ, pp: 350-358.
23. AOAC, 1998. Official Methods of Analysis. 16th. Edition. William S., Published by Association of Official Analytical Chemists. Washington, D.C.
24. Szalay, L., V. Hajnal, S. Nemeth, G. Ficzek and B. Vecsei, 2013. Fruit quality parameters of forigen apricot cultivars in Hungray. Acta Horticulture, 981: 675-678.
25. McGuire, R.G., 1992. Reporting of objective colour measurements. HortScience, 27: 1254-1255.
26. El-Shiekh, A.F., 2002. Quality, storability and decay of fresh-cut slices and whole peach fruits treated with ultraviolet (UV-B) irradiation. J. Agric. Sci. Mansoura Univ., 27(8): 5505-5524.
27. Duncan, D.B., 1955. Multiple range and multiple F. tests. Biometric, 11: 1-42.

28. Truax, B. and D. Gagnon, 1993. Effects of straw and black plastic mulching on the initial growth and nutrition of Butternut, white ash and bur oak. Forest Ecol. and Manag., 57(1-4): 17-27.
29. Nathan, L., M. Hartwig and H.U. Ammon, 2002. Cover crops and living mulches. Weed Sci. Soc. Amer., 85: 45-56.
30. Bowen, P.A., C.P. Bogdanoff and B. Estergaard, 2004. Impacts of using polyethylene sleeves and wavelength selective mulch in vineyards. I. Effects on air and soil temperatures and degree day accumulation. Can. J. Plant Sci., 4: 545-553.
31. Mika, A., W. Treder, Z. Buler, K.B. Rutkowski and K.B. Michalska, 2007. Effects of orchard mulching with reflective mulch on apple tree canopy irradiation and fruit quality. J. Fruit & Orn. Plant Res., 15: 41-54.
32. Fawzia, M. Eissa, 2008. Effect of the use of coloured plastic mulching on growth, yield components and fruit quality of Le-Conte pear trees. Minufia J. Agric Res., 33(5): 1157-1177.
33. Marsh, K.B., M.J. Daly and T.P. McCarthy, 1996. The effect of understory management on soil fertility, tree nutrition, fruit production and apple fruit quality. Biol. Agric. and Hort., 13: 161-173.
34. Lindhard, P., R. Hanna and K. Birka, 2007. Cover crop and mulching effects on yield and fruit quality in unsprayed organic apple production. Biol. Agric. & Hort., 15: 12-18.
35. Neilsen, G.H., E.J. Hogue, T. Forge and D. Neilsen, 2008. Mulches and biosolids affect vigor, yield and leaf nutrition of fertigated high density apple. Agric. and Agric-Food Canada, Pacific Agric-Food Res. Centre, Summerland, B.C.
36. Jones, T.L., L. Sandwell and C.J. Talent, 1978. The effect of soil temperatures when associated with low air temperature on the cropping of early tomatoes. Acta Hort., 76: 167-171.
37. Davison, J.G., 1982. Black plastic benefit young fruit trees and Bushes. Blasticulture, 193: 35-40.
38. Aly, M.A., N.A. Abd El-Megeed and A.M.A. Yousif, 2010. Organic Fertilization, Cover Crops and Plastic Mulching Effects on Soil Temperature and Moisture, Vegetative Growth, Yield and Fruit Quality of "Anna" Apple Trees. Alex. Sci. Exch. J., 31(4): 394-403.
39. Frimanslund, E., 1984. Young pear trees in soil with black plastic mulching compared to grass. Forsaking Landbruk, 35: 35-40.
40. El-Seginy, Amal M.,. 2000. The effect of mulching and clean cultivation on Le-conte pear trees grown in new reclaimed area. J. Agric. Sci. Mansoura Univ., 25(12): 8053-8061.
41. Reganold, J., 2006. Sustainability of organic, conventional and integrated apple orchards. Plant Management Network. Dep. of Crop & Soil Sci., Wash. State Univ., Pullman, WA 99164.
42. Finn, Mage, 1982. Black plastic mulching, compared to other orchard soil management methods. Scientia Horticulture, 16: 131-136.