Current Science International
ISSN: 2077-4435

Volume : 07 | Issue : 04| Oct.- Dec. 2018
Pages**:** 750-761

Impact of Mulching on Productivity of Onion in Siwa Oasis

Hafez, M.R. and S.S. Gomaa

Department of Plant Production, Desert Research Center, Matariya, Cairo, Egypt

Received: 25 Oct. 2018 / Accepted: 24 Dec. 2018/ Publication date: 30 Dec. 2018

ABSTRACT

An experiment was conducted at the experimental farm of Siwa Oasis Research Station, Desert Research Center (Khimisa farm) during two consecutive winter seasons of 2016-2017 and 2017-2018 to study the effect of three different soil mulching treatments (black plastic poly ethylene 60 Micron thickness, transparent plastic poly ethylene 60 Micron thickness and straw of minced date palm leaves at the rate of 1 kg /m^2), in addition to without soil mulching treatment, the treatments were assessed directly before transplanting of two onion cultivars (Giza-20 and Beheri). The results showed that soil mulching with black plastic had significant superiority in most studied characters of vegetative growth and yield followed by straw of minced date palm leaves when compared with transparent plastic which was gave the lowest values followed by control treatment. On the contrary, mulching with transparent plastic increased average soil temperature and leads to disadvantages on growth and yield. All mulching treatments did not have sufficient effect on weed suppression. Giza-20 cultivar slightly increased growth and yield parameters as compared with Beheri in both growing seasons. The interaction treatments of black mulching with Giza -20 cultivar gave the highest values of vegetative growth characters and total yield through both growing seasons.

Keywords: Onion, soil mulching, onion cultivars, weed control, soil temperature.

Introduction

Egyptian onion production and consumption has been sharply increased in latterly ten years, where planted area was increased from 36390 ha in 2006 to 84878 ha in 2016 (FAO, 2016), and the planted area distributed at Nile valley and newly reclaimed lands.

Mulching was used to cover soil surface around the plants to create congenial conditions for the growth include temperature moderation (Lal Bhardwaj, 2013 and Wang *et al*., 2016) reduce water evaporation(Zribi *et al.*, 2015 and Prosdocimi *et al.*, 2016) and weed infestation (Lamont, 1993). Mulching is applicable and successfully used to most vegetables such as tomato (Moreno and Moreno, 2008)on Potato (Edwards *et al.*, 2000) on muskmelons, watermelons, squash, cucumbers, peppers, eggplant and okra(Lamont, 2017). Polyethylene plastic mulches has been widely used in agriculture due to the countless advantages they have (Moreno *et al.*, 2017), Increasing soil temperature and reduce water evaporation in vegetable production(Lal Bhardwaj, 2013 and Wang *et al.*, 2016).It has being a beneficial effects on growth (Lal Bhardwaj *et al.*, 2011; Sarolia and Lal Bhardwaj 2012), early yield (Tarara, 2000; Lamont, 2005 and Lamont, 2017) productivity (Wang *et al.*, 2016 and Zhang *et al.*, 2018) and quality (Lamont, 2017).Black plastic mulch was the most commonly used in agriculture, transparent plastic mulch is also used in some areas due to its warming characteristics (Wang *et al*., 2017).Higher temperatures could have a disadvantage in certain cases, especially in hot climates *ie*., decreased soil microbial biomass, organic matter mineralization and supposes an environmental risk (Moreno and Moreno, 2008). As a result, most productive agricultural soils are now being affected by plastic pollution, seriously threatening soil health, so resolving environmental key issues by non-biodegradable and non-recoverable polyethylene (PE) became our goal (Marion *et al*., 2017).Organic mulch as a biodegradable material was efficient in reduction of nitrates leaching, improve soil physical properties, prevent erosion, supply organic matter, regulate temperature and water retention, improve nitrogen balance and take part in nutrient cycle, as well as increase the biological activity (Hooks and Johnson, 2003; Muhammad *et al.,* 2009; Sarolia and Lal Bhardwaj, 2012). The appropriate application rate of straw mulch should be established for site-specific soil and environmental conditions (Mulumba and Lal, 2008). The application rate ranged from 600-800 g/m^2 (Lal Bhardwaj, 1984), 500 g/m^2 (Jordan *et al.* 2010). Under semi-arid conditions,

Corresponding Author: Hafez, M.R., Department of Plant Production, Desert Research Center, Matariya, Cairo, Egypt. E-mail: mohamedraef269@gmail.com

Mulumba and Lal Bhardwaj (2008) determined an optimum mulch rate of 400g/m^2 for increasing porosity and800 g/m^2 to enhance the available water capacity, moisture retention and aggregate stability.

Onion production at newly reclaimed soils have some troubles such as weeds control and high percent of raceme plants and flowering which are due to irregularity in water and fertilizers supply during plant growth stages. Using soil mulch treatments may enhance onion growth, yield, and early yield, minimize weed infestation and reduce discarded bulbs under Siwa Oasis conditions. So, the aim of this study was to investigate the effect of different types of soil mulch on weed infestation, yield and quality of two onion cultivars under Siwa Oasis conditions.

Materials and Methods

An experiment was conducted at the experimental farm of Siwa Oasis Research Station, Desert Research Center (Khimisa farm) during two consecutive winter seasons of 2016-2017 and 2017-2018. Siwa Oasis was located at latitude 29^o 12' N, longitude 25^o 29'E and 18 meters below sea level.

Table A: Physical and chemical properties of the experimental site soil

Soil depth (cm)	Texture class	Soluble anions (me/l)			pH soil paste	E.C dSm^{-1}	Soluble cations (me/l)			
		HCO_3^-	$SO_4^=$	Cl^-			Ca^{++}	Mg^{++}	Na^+	K^+
0 – 25	Sandy loam	0.75	0.85	4.25	6.7	0.58	1.15	0.45	3.92	0.33

pH: Acidity E.C.: Electrical conductivity me/l: milli equivalent per liter.

Table B: Chemical analysis of the irrigation water

Samples	pH	E.C. dSm^{-1}	Soluble cations (me/l)				Soluble anions (me/l)		
			Ca^{++}	Mg^{++}	Na^+	K^+	HCO_3^-	$SO_4^=$	Cl^-
1st season	**7.1**	**5.54**	**10.1**	**13.32**	**39.4**	**1.17**	**9.35**	**15.1**	**39.5**

pH: Acidity, E.C.: Electrical conductivity, dSm^{-1}: Decseime per meter

Table C: Soil temperature at 10 soil depths and air temperature during growing season 2017-2018.

Months	Treatments	8 Am	9 Am	10 Am	11 Am	12 Am	1 Pm	2 Pm	3 Pm	4 Pm	5 Pm	6 Pm	Mean
December	Clear plastic	12.5	16	22.5	25.0	25.0	26.0	25.0	26.0	26.0	24.5	23.0	22.9
	Black plastic	12.5	14.0	17.5	21.0	23.0	24.0	24.5	25.0	24.0	22.5	22.0	20.9
	Straw	11.5	13.0	15.5	18.5	21.0	22.5	22.0	23.5	23.0	22.5	22.0	18.9
	Without mulching	10.5	13.0	17.0	23.5	23.5	24.0	22.0	23.0	22.0	21.0	20.0	20.0
	Air temperature	11.0	11.3	15.0	20.0	21.0	21.0	20.0	20.0	19.0	19.0	18.0	17.8
January	Clear plastic	12.0	15.3	21.3	24.3	25.3	26.0	25.3	25.3	24.7	24.3	23.0	22.5
	Black plastic	12.0	14.7	17.7	20.7	22.7	24.0	24.0	25.0	24.0	23.0	22.0	20.9
	Straw	11.3	13.0	17.7	20.0	20.7	21.3	22.0	21.0	20.3	19.3	19.0	18.7
	Without mulching	13.0	14.7	17.7	20.0	21.7	22.3	22.0	22.0	22.0	21.0	20.3	19.7
	Air temperature	10.7	11.8	14.7	19.7	20.7	21.0	19.7	20.0	19.0	18.7	17.7	17.6
February	Clear plastic	15.3	18.3	24.0	27.3	27.7	28.7	27.7	28.3	28.3	27.0	25.3	25.3
	Black plastic	14.3	17.0	20.3	23.3	25.0	26.3	26.3	27.3	26.3	25.3	24.3	23.3
	Straw	13.7	15.3	20.7	23.0	23.7	23.7	24.3	23.3	22.3	22.0	21.3	21.2
	Without mulching	14.7	15.3	19.7	26.0	25.3	26.3	24.0	25.3	24.3	23.3	22.3	22.4
	Air temperature	13.3	14.3	17.7	22.3	23.3	23.3	22.3	22.3	21.3	21.3	20.3	20.2
March	Clear plastic	24.3	27.0	32.3	36.0	36.3	37.3	36.7	37.3	37.0	36.7	34.3	34.1
	Black plastic	19.3	22.7	26.7	29.7	31.3	32.3	32.7	33.3	32.7	31.7	30.0	29.3
	Straw	17.3	20.3	26.7	28.3	28.3	28.3	29.7	28.3	27.0	27.3	26.3	26.1
	Without mulching	20.0	22.3	26.0	33.7	33.7	33.3	31.7	32.7	31.7	30.7	29.3	29.6
	Air temperature	19.3	20.3	24.3	28.3	29.3	29.3	28.3	28.3	27.3	27.3	26.3	26.2
April	Clear plastic	25.5	28.5	37.5	41.5	41.5	42.5	41.5	42.5	42.5	40.5	38.5	38.4
	Black plastic	24.5	28.0	32.0	35.0	37.0	38.0	38.0	39.0	38.0	37.0	36.0	34.8
	Straw	23.0	25.5	32.0	34.0	34.0	34.5	34.0	33.5	33.0	32.0	31.0	31.3
	Without mulching	25.0	28.0	32.0	39.0	39.0	39.0	37.0	38.0	37.0	36.0	35.0	35.0
	Air temperature	24.0	26.0	29.0	34.0	35.0	35.0	34.0	33.0	32.0	32.0	31.0	31.4

Straw =straw of minced date palm leaves

The aim of this study was to investigated the effect of three different soil mulching treatments (Black plastic poly ethylene 60 Micron thickness, transparent plastic poly ethylene 60 Micron thickness and straw of minced date palm leaves at the rate of 1 kg/m^2) in addition without soil mulch treatment which were assessed directly before transplanting of two onion cultivars (Giza-20 and

Beheri).The Seedlings were planted in the first and second week of December respectively in the two planting seasons. Split-plot design with three replicates was applied, cultivars were arranged in the main plot and soil mulching treatments occupied the subplots. Experimental plots were consisted of one line each of 1 meter wide and 10.5 meter long forming a plot area of 10.5 m^2. Recommended cultural practices, *i.e*., fertilization, irrigation, disease and pest control were applied according to Agric. Ministry recommendations.

Studied traits

Growth parameters.

A random sample of 10 plants of each experimental plot were taken at 60 days after transplanting for measuring vegetative growth parameters(plant number/m^2,Plant height, leaves number and plant fresh weight were recorded.

Soil temperature:

During growth stage (starting from fifteen days after transplanting date until fifteen days before harvest date) soil surface temperature and 10 cm depth were recorded every two weeks from the first of December to the end of April using alcohol thermometers buried in the soil, then average of temperature reading were calculated.

Table D: Soil temperature at 0 soil depths and air temperature during growing season 2017-2018.

Months		8 Am	9 Am	10 Am	11 Am	12 Am	1 Pm	2 Pm	3 Pm	4 Pm	5 Pm	6 Pm	Mean
December	Clear plastic	14.0	15.0	17.0	20.5	22.0	22.5	23.0	24.0	25.0	25.0	24.5	21.1
	Black plastic	14.0	15.0	15.5	17.5	20.0	21.0	21.0	21.0	21.0	20.	20.0	18.7
	Straw	13.0	15.0	17.5	20.0	22.0	22.0	22.0	22.5	22.0	21.0	20.5	19.8
	Without mulching	12.5	15.0	20.0	22.0	24.0	24.0	23.5	22.5	21.5	21.5	21.0	20.7
	Air temperature	11.0	11.3	15.0	20.0	21.0	21.0	20.0	20.0	19.0	19.0	18.0	17.8
January	Clear plastic	14.0	15.0	16.7	19.7	21.7	21.3	22.7	24.0	25.0	24.7	24.7	20.8
	Black plastic	13.7	14.7	15.3	16.7	19.3	21.0	21.0	21.0	21.0	20.0	19.7	18.5
	Straw	13.0	14.7	17.7	20.0	21.7	22.3	22.0	22.0	22.3	21.0	20.3	19.7
	Without mulching	12.7	14.7	19.3	21.7	23.3	23.7	23.7	22.7	21.7	21.0	20.7	20.4
	Air temperature	10.7	11.8	14.7	19.7	20.7	21.0	19.7	20.0	19.0	18.7	17.7	17.6
February	Clear plastic	16.0	17.3	19.3	22.7	24.3	25.0	26.3	26.3	27.3	27.3	26.7	23.5
	Black plastic	15.7	17.0	18.0	19.7	22.0	23.3	23.7	23.3	23.3	22.3	22.3	21.0
	Straw	15.3	17.3	20.0	22.7	24.3	24.7	24.7	24.3	24.3	23.3	23.0	22.2
	Without mulching	15.3	17.3	22.3	24.3	26.3	26.3	26.3	25.3	24.3	24.3	24.0	23.3
	Air temperature	13.3	14.3	17.7	22.3	23.3	23.3	22.3	22.3	21.3	21.3	20.3	20.2
March	Clear plastic	23.7	24.7	26.3	29.7	31.7	32.7	32.0	33.7	34.7	34.0	33.7	30.6
	Black plastic	18.3	22.7	22.7	25.0	27.3	28.0	28.7	28.3	28.7	27.3	27.0	25.8
	Straw	18.7	20.3	23.7	26.3	28.3	28.7	29.0	29.0	28.0	27.7	27.7	26.1
	Without mulching	18.3	23.0	28.3	30.3	32.7	32.3	32.3	31.0	30.3	30.3	30.3	29.0
	Air temperature	19.3	20.3	24.3	28.3	29.3	29.3	28.3	28.3	27.3	27.3	26.3	26.2
April	Clear plastic	24.0	26.0	32.0	35.0	37.0	38.0	38.0	39.0	40.0	40.0	39.0	35.3
	Black plastic	23.5	28.0	28.0	31.0	33.0	34.0	34.0	34.0	34.0	33.0	33.0	31.4
	Straw	24.0	25.5	29.0	32.0	34.0	34.0	34.0	34.0	34.0	33.0	33.0	31.5
	Without mulching	23.5	27.5	33.5	35.5	37.5	37.5	37.5	36.5	35.5	35.5	35.5	34.1
	Air temperature	24.0	26.0	29.0	34.0	35.0	35.0	34.0	33.0	32.0	32.0	31.0	31.4

Straw =straw of minced date palm leaves

Weed measurements:

Total weeds (broad and narrow-leaved) randomly per square meter were taken after 4 weeks from transplanting to determine, average number and total fresh weight of both broad and narrow-leaved.

Yield and its components: At harvest time (mid of April) one square meter was assigned from each plot to estimated total weight of yield per meter, bulb diameter, nick diameter and bulb ratio on-marketable bulbs, flowering, doubled and sprouting, as well as total yield per feddan were calculated. Bulb ratio was calculated as followed equation: nick diameter/bulb diameter.. Also, soluble solid content (TSS) was determined by using digital refractometer (Abbe Leica model).

Chemical analyses: dry matter content (Bulb samples were drayed at 65 Co until constant weight and grinded then bulb dry matter content was determined)

Statistical analysis:

Data were subjected to statistical analysis by M-STAT C (Russell, 1991). The differences among means were performed using least significant difference (LSD) at 5% level.

Results and Discussion

1- Effect of mulching on soil temperature:

Soil temperature data were daily collected every hours during day time (8am to 6 pm) ones every two weeks over four months period at soil depths 0 and 15 cm.Maximum soil temperature at 0 and 15 cm depths for mulching treatments during December 15th to 1April first are presented in Fig. 1 and 2. An increase of average soil temperature at 0 and 15 cm depths were observed up to maximum of 36.3 and 29.9 C^0 at 1pm and 4pm with clear poly ethylene mulching treatment, while the corresponding maximum temperature of 0 and 15 cm depths were (32.8, 26.1 C^0) at 2 pm, (29.2, 26.8 C^0) at 1 and 2 pm, (30.4, 28.8 C^0) at 1 pm for mulching, straw of minced date palm leaves and control treatments respectively. Soil covering with transparent plastic traps raised the average absolute soil temperature at soil surface and 15 cm depth with an increment of (3.5, 7.1, 5.9 C^0) and (3.8, 3.1 and 1.1 C^0) when compared with black mulch, straw of minced date palm leaves and control treatments respectively. Also, we noticed that, soil temperature under transparent plastic remain higher for a long time (about 6 -7 hours) as compared with other treatments (about 2-3 hours) especially at 15 cm depth).These results are agree with those obtained by Moreno and Moreno, (2008), Lal Bhardwaj, (2013) and Wang *et al*. (2016).They decided that, Polyethylene plastic mulches are widely used in agriculture which are cause increasing soil temperature and reduce water evaporation in vegetable production. The higher temperatures could have a disadvantage in certain cases, especially in hot climates.

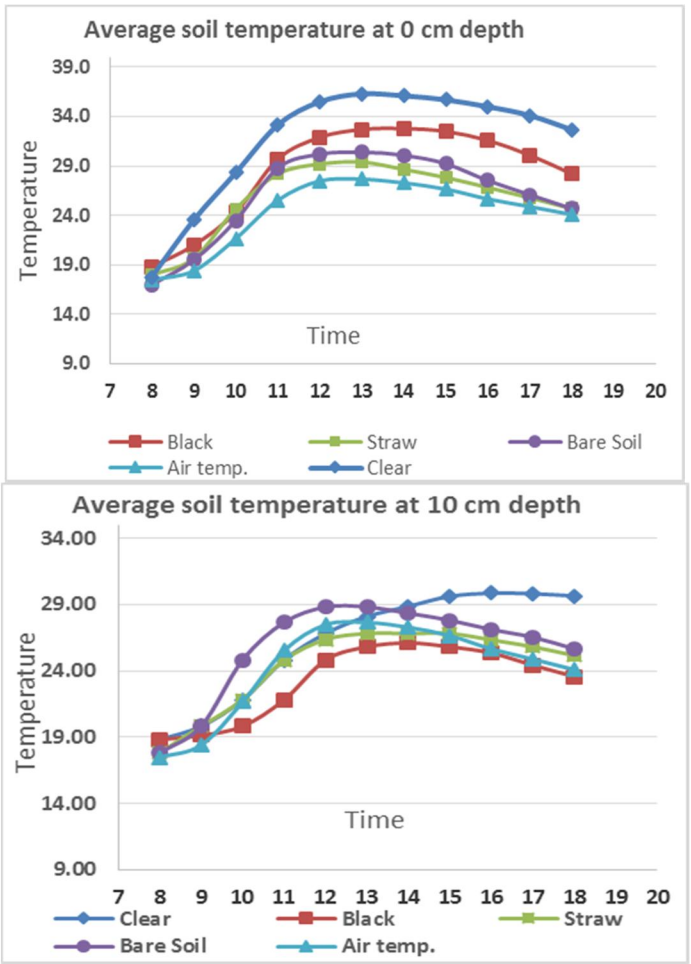

Fig. 1: Effect of soil mulching on soil temperature at 0 and 10 cm depths.

2- Effect of cultivars and soil mulching on weeds count and its fresh weight:

Data presented in Table (1) showed that weeds count and fresh weight of narrow- leaved and broad-leaved significantly affected by soil mulching treatments, while the same characters were not affected significantly by any onion cultivars and all interactions between cultivars and soil mulching. Concerning, soil mulching effects on weed count, straw of minced date palm leaves gave the highest number of narrow-leaved weed, followed by control treatment andtransparent plastic when compared with black plastic which was gave the lowest number. On the contrary, black plastic and straw of minced date palm leaves gave the lowest number of broad-leaved, followed bytransparent plastic compared with control treatment which gave the highest value in this respect. This variance of weed count between narrow and broad-leaved with minced straw of date palm leaves may be due to soil covering by straw of minced date palm leaves, which was enhanced weed seeds germination of both weed types, but narrow-leaved was easier penetration throw mulching in this case when compared with broad-leaves. Also, it is noticed that, data of weeds growing under both clear and black plastic treatments are in disagreement with most research studies, by causingmalty spores in plastic sheet which is allowed weeds growing throw these spores, moreover, mulching treatments enhanced weed growth as onion plants as weeds. Similar results were found by Lamont, (1993) who reported that black plastic reduce light penetration into the soil, consequently weeds generally cannot survive under the mulch. An exception is nut grass, whose provide enough energy for the seedling to puncture the mulch and emerge. Also, with transparent plastic mulch, herbicide or fumigation is needed to prevent weed growth.

Table: 1: Effect of cultivars and soil mulching on weeds count and total fresh weight.

Parameters		**Weeds count**		**Fresh weight(g)**	
Seasons / Cultivars		**Narrow-leaved**	**Broad-leaved**	**Narrow-leaved**	**Broad-leaved**
Giza 20		199.2	92.1	572.9	304.5
Beheri		187.8	93.3	562.8	281.0
LSD at 0.05		N.S	N.S	N.S	N.S
Soil Mulching					
Clear plastic		169.2	64.2	440.0	54.6
Black plastic		44.0	35.7	200.3	178.2
straw		327.8	38.0	822.5	323.5
Without mulching		233.0	232.8	808.5	614.8
LSD at 0.05		24.2	28.7	29.0	53.1
Interaction culti. x mulch.					
Giza 20	Clear plastic	170.0	64.3	459.3	47.3
	Black plastic	47.7	32.7	202.0	166.0
	minced straw of date palm leaves	340.7	35.3	806.7	353.0
	Without mulching	238.3	236.0	823.7	651.7
Beheri	Clear plastic	168.3	64.0	420.7	61.8
	Black plastic	40.3	38.7	198.7	190.3
	straw	315.0	40.7	838.3	294.0
	Without mulching	227.7	229.7	793.3	578.0
LSD at 0.05		N.S	N.S	N.S	N.S

Straw =straw of minced date palm leaves

3- Effect of cultivars and soil mulching on vegetative growth:

Results of onion vegetative growth expressed as plant number per quadratic meter, plant length, plant fresh weight and leave number as shown in Table (2). The results cleared that, cultivars effect on all studied growth characters were insignificant in both growing seasons. Regarding, the effect of soil mulching, data revealed that, black plastic significantly increased plant number per quadratic meter, plant length, plant fresh weight and leaves number per plant followed by straw of minced date palm leaves treatment, while this characters significantly decreased with transparent plastic followed by control treatment in both growing seasons.The superior effect of black plastic treatment cleared when

compared with other treatments refers to the favorable growth conditions such as, temperature moderation, and reduce water evaporation. This results are agree with Lal Bhardwag, (2013); Zribi *et al*. (2015); Prosdocimi *et al*., (2016) and Wang *et al.* (2016). Also, mulching may be prevent the runoff and soil loss, minimizes the weed infestation and reduces water evaporation which are retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil, as well as adds nutrients to the soil and ultimately enhances the growth of crops (Kumar *et al*., 1990).

Table 2: Effect of cultivars and soil mulching on plant number, plant length, plant fresh weight and leave number during the two growing seasons.

Parameters		**No. of plant /m²**		**Plant length (cm)**		**Plant fresh weight (g/plant)**		**Leaves number/plant**	
Seasons / Cultivars		**1St**	**2nd**	**1St**	**2nd**	**1St**	**2nd**	**1St**	**2nd**
Giza 20		85.75	81.01	38.15	40.18	75.40	76.05	7.69	7.81
Beheri		80.07	78.27	38.97	39.30	68.97	71.88	7.29	7.24
LSD at 0.05		**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**
Soil Mulching									
Clear plastic		69.88	64.48	29.73	35.43	48.35	44.83	6.35	6.61
Black plastic		99.07	95.98	43.49	44.36	94.52	100.00	8.55	8.44
Straw		85.24	83.01	41.30	41.18	78.51	85.48	7.78	7.92
Without mulching		77.45	75.09	39.73	37.99	67.35	65.55	7.28	7.13
LSD at 0.05		**3.45**	**3.19**	**1.4**	**2.50**	**3.53**	**6.09**	**0.42**	**0.45**
Interaction culti. x mulch.									
Giza 20	Clear plastic	70.77	68.87	25.33	36.17	43.59	44.52	6.27	6.59
	Black plastic	105.33	96.87	45.73	45.07	101.61	103.77	8.60	8.73
	Straw	85.20	83.10	41.81	41.94	84.41	86.30	8.10	8.41
	Without mulching	81.70	75.20	39.73	37.54	71.98	69.59	7.77	7.53
Beheri	Clear plastic	69.00	60.09	34.13	34.70	53.15	45.13	6.43	6.63
	Black plastic	92.80	95.10	41.25	43.65	87.41	96.23	8.49	8.16
	Straw	85.28	82.91	40.78	40.41	72.62	84.65	7.45	7.43
	Without mulching	73.20	74.99	39.73	38.44	62.71	61.52	6.80	6.73
LSD at 0.05		**4.89**	**4.51**	**2.00**	**N.S**	**4.99**	**N.S**	**N.S**	**N.S**

Straw =straw of minced date palm leaves

4- Effect of cultivars and soil mulching on onion yield and its component:

Data presented in Table (3) revealed that cultivars, soil mulching and their interaction significantly affected on onion yield per feddan. Giza-20 cultivar slightly increased onion yield when compared with Beheri cultivar in both seasons. As for, the effect of soil mulching on onion yield, black plastic mulching gave the highest onion yield followed by straw of minced date palm leaves, while clear mulching gave the lowest yield in both seasons.Regarding, the interaction effect showed Giza-20 cultivar with black plastic treatment produced the highest significant yield followed by Beheri with black plastic in both seasons; while both cultivars produced the lowest significant yield with transparent plastic treatment was used. Onion bulb and neck diameters significantly affected by soil mulching treatments, while cultivars and all interaction treatments had insignificant effect in two growing seasons. Soil mulching with black plastic produced the highest bulb and neck diameters, followed by straw of minced date palm leaves. On the contrary, transparent plastic treatment produced the lowest bulb and neck diameters in both seasons.

Increasing yield per feddan with Giza-20 cultivar may refers to increasing total count of plants per feddan and slightly increment of plant fresh weight when compared with Beheri cultivar, in

addition, Giza-20 cultivar may be more adapted with heat stress conditions specially with mulching at hot climate region like Siwa Oasis . As for, mulching treatments, may be protect the surface of the soil against unfavorable factors, reduces nutrients leaching and improves growing conditions (Acharya and Sharma, 1994; Baumann *et al.*, 2000; Kolota and Sowinska, 2004 and Muhammad *et al.,* 2009). Mulching with natural materials like coconut or rice straw have been beneficial effects on plant growth, early fruiting and increasing N and K concentration in leaves of some vegetable crops (Hassan *et al*., 1994). But natural materials can't be easily spread on growing crops and require considerable human labor, have expense and logistical problems restricted the use of organic mulch in horticultural crop production with only limited use on a large commercial scale (Lal Bhardwaj, 2011).

Table 3: Effect of cultivars and soil mulching on yield, bulb and nick diameter in two growing seasons.

Parameters		**Yield/fed.**		**Bulb diameter (cm)**		**Nick diameter (cm)**	
Seasons / Cultivars		1St	2nd	1St	2nd	1St	2nd
Giza 20		13.707	13.045	7.87	737.	1.88	1.83
Beheri		12.499	12.436	7.67	7.57	1.61	1.71
LSD at 0.05		**0.662**	**0.439**	**N.S**	**N.S**	**N.S**	**N.S**
Soil Mulching							
Clear plastic		8.169	8.194	6.91	6.45	1.40	1.48
Black plastic		17.351	16.548	8.58	8.54	2.05	2.03
Straw		14.038	13.651	8.06	8.18	1.96	1.93
Without mulching		12.854	12.568	7.53	7.44	1.56	1.64
LSD at 0.05		**0.454**	**0.469**	**0.45**	**0.26**	**0.18**	**0.12**
Interaction culti. x mulch.							
Giza 20	Clear plastic	8.227	8.161	6.85	6.46	1.44	1.48
	Black plastic	19.032	17.663	8.56	8.61	2.19	2.14
	Straw	14.095	13.797	8.26	8.37	2.12	2.04
	Without mulching	13.472	12.560	7.80	7.46	1.77	1.67
Beheri	Clear plastic	8.110	8.228	6.97	6.43	1.35	1.49
	Black plastic	15.670	15.433	8.59	8.47	1.92	1.91
	Straw	13.981	13.506	7.85	7.98	1.80	1.81
	Without mulching	12.236	12.576	7.25	7.41	1.36	1.61
LSD at 0.05		**0.642**	**0.663**	**N.S**	**N.S**	**N.S**	**N.S**

Straw =straw of minced date palm leaves

5- Effect of cultivars and soil mulching on premature seeding, doubles and sprouting in two seasons.

As shown in Table (4) cultivars and soil mulching significantly affected on premature seeding, while interaction effect was insignificant in both growing seasons. Beheri cultivars produced the highest number of flowering compared with Giza-20 cultivar. As for, soil mulching treatments, control treatment gave the highest value followed by transparent plastic as compared with straw of minced date palm leaves which gave the lowest value followed by black plastic in both seasons.

Regarding doubles and sprouting characters, obtained data revealed that, soil mulching had significant effect in this respect. On the other hand, cultivars and interaction treatments had in significant effect in both seasons. Doubles bulbs number increased with control treatment followed by transparent plastic in the first season, while transparent plastic had superiority in the second season followed by control as compared with straw of minced date palm leaves or black plastic mulching. Moreover, sprouting plants sharply increased with transparent plastic treatment followed by control as compared with straw of minced date palm leaves or black plastic treatments in both seasons.

It may be worth to mention that, onion yield (kg/fed.) was highly significant positively correlated with number of plants per square meter Fig (2). Linear correlation coefficients (r) of 0.859 and 0.867 were obtained with number of plants in the first and second seasons respectively.

The corresponding coefficients of determination (r^2) were 0.737 and 0.751, which are indicated that 73.7% and 75.1% of variation in onion yield were related to number of plants per square meter. On the other hand, the regression coefficients (b) were 84.02 and 81.83 for onion yield

per feddan and number of plants per square meter, which are indicated that each increase of one plant per square meter, total yield per feddan, correspondingly increased by 84.02 and 81.83 kg in the first and second seasons respectively. Also, onion yield per feddan was significant positively correlated with plant fresh weight Fig (2). A linear correlation coefficients (r) were 0.915 and 0.926 in the first and second seasons, the corresponding coefficients of determination (r^2) were 0.836 and 0.858 which are indicated that, 83.6 %.and 85.8 % of variation in onion yield were related to plant fresh weight. The regression coefficients (b) were 101.3 and 97.7, which are indicated that, for each increase of plant fresh weight by one gram, onion yield per feddan correspondingly increased 101.3 and 97.7 kg in the first and second seasons respectively. Such increment of yield due to increase plant fresh weight, this could be attributed to increase plant height and leaves number per plant Table (3). Increasing number of plant leaves (assimilative plant system) and plant height led to increase plant fresh weight which in turn led to increase of total yield especially with highly increasing of total plant number in square meter. Moreover, increment of onion yield per feddan may be due to the negative correlation between number of both flowering and sprouting plants. A linear correlation coefficients (r) of (-0.560,-0.655) and (-0.925,-0.923) were obtained with numbers of flowering and sprouting plants in the first and second seasons respectively. The regression coefficients (b) were (-359.3, -439.3) and (-605.7, -539.9) which were indicated that, for each increase of one plant discarded even with flowering or sprouting plants, onion yield decreased by (359.3, 439.3) and (605.7, 539.9) kg per feddan in the first and second seasons respectively, Fig (2). Fig.(2)Regression lines, coefficients of determination (r^2) and regression coefficients (b) for number of plants/m^2, plant fresh weight (g), number of flowering plants/plot and number of sprouting plants/plot vs. onion yield (kg/feddan)

Table 4: Effect of cultivars and soil mulching on flowering, doubles and sprouting in two seasons.

Parameters		**Flowering**		**Doubled**		**Sprouting**	
Seasons / Cultivars		**1St**	**2nd**	**1St**	**2nd**	**1St**	**2nd**
Giza 20		6.58	6.25	3.75	5.67	5.42	6.67
Beheri		8.67	7.08	5.00	5.25	6.75	6.25
LSD at 0.05		**0.95**	**0.72**	**N.S**	**N.S**	**N.S**	**N.S**
Soil Mulching							
Clear plastic		6.00	5.00	5.83	8.00	15.50	17.33
Black plastic		3.17	3.67	1.50	4.33	2.00	1.83
Straw		1.83	2.83	2.67	3.33	1.17	1.50
Without mulching		19.50	15.17	7.50	6.17	5.67	5.17
LSD at 0.05		**1.61**	**1.29**	**1.72**	**1.61**	**1.87**	**1.77**
Interaction culti. x mulch.							
Giza 20	Clear plastic	5.00	3.67	4.33	8.67	13.33	19.00
	Black plastic	2.67	3.00	1.33	4.67	2.00	1.33
	Straw	1.33	3.00	2.33	3.00	1.33	1.33
	Without mulching	17.33	15.33	7.00	6.33	5.00	5.00
Beheri	Clear plastic	7.00	6.33	7.33	7.33	17.67	15.67
	Black plastic	3.67	4.33	1.67	4.00	2.00	2.33
	Straw	2.33	2.67	3.00	3.67	1.00	1.67
	Without mulching	21.67	15.00	8.00	6.00	6.33	5.33
LSD at 0.05		**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

Straw =straw of minced date palm leaves

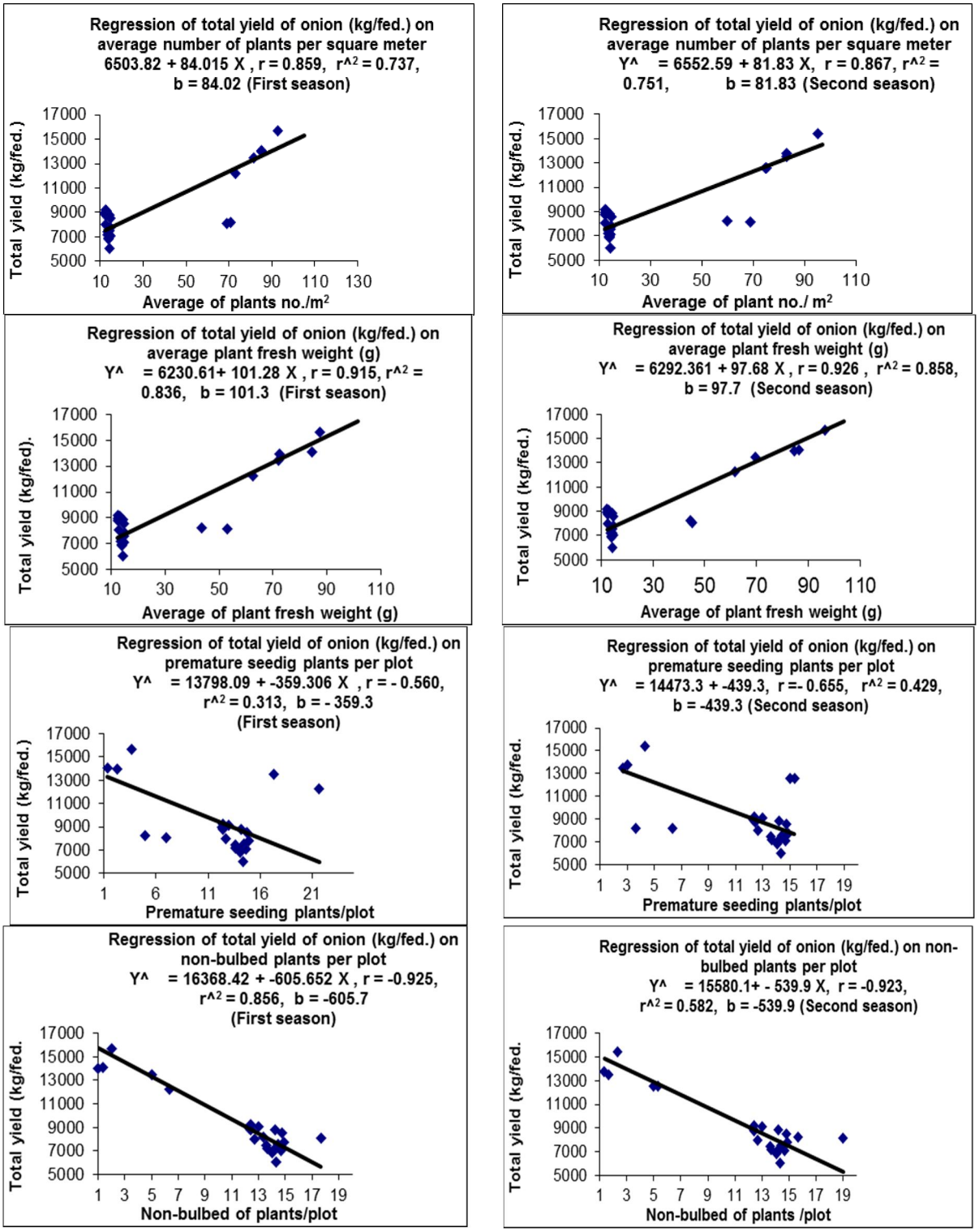

Fig. 2: Regression lines, coefficients of determination (r^2) and regression coefficients (b) for number of plants/m^2, plant fresh weight (g), number of floweringplants/plot and number of non-bulbed plants/plot vs. onion yield (kg/feddan).

Table 5: Effect of cultivars and soil mulching on bulb ratio, dry matter percent and T.S.S in two seasons.

Parameters		Bulb ratio		Dry matter percent		T.S.S	
Seasons / Cultivars		1St	2nd	1St	2nd	1St	2nd
Giza 20		0.24	0.24	15.34	14.90	12.01	11.46
Beheri		0.21	0.23	14.62	14.30	11.46	11.23
LSD at 0.05		**N.S**	**N.S**	**0.28**	**0.30**	**0.19**	**0.18**
Soil Mulching							
Clear plastic		0.20	0.23	15.11	14.83	11.92	11.29
Black plastic		0.24	0.24	14.83	14.54	11.54	11.46
Straw		0.24	0.24	14.86	14.30	11.59	11.04
Without mulching		0.21	0.22	15.12	14.73	11.89	11.58
LSD at 0.05		**0.03**	**N.S**	**0.19**	**0.29**	**0.14**	**0.28**
Interaction culti. x mulch.							
Giza 20	Clear plastic	0.21	0.22	15.42	15.25	12.20	11.50
	Black plastic	0.26	0.26	15.21	14.94	11.86	11.67
	Straw	0.26	0.24	15.26	14.34	11.85	11.00
	Without mulching	0.23	0.22	15.46	15.05	12.14	11.67
Beheri	Clear plastic	0.20	0.25	14.79	14.40	11.64	11.08
	Black plastic	0.22	0.23	14.45	14.14	11.23	11.25
	Straw	0.23	0.23	14.45	14.25	11.33	11.08
	Without mulching	0.19	0.21	14.78	14.41	11.63	11.50
LSD at 0.05		**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

Straw =straw of minced date palm leaves

As shown in Table (5), bulbing ratio has not affected significantly by all experiment studies, except the effect of soil mulching treatment in the first season, where, black plastic and straw of minced date palm leaves treatments increased bulb ratio character compared with clear plastic or control treatment. Concerning, dry matter percent and total soluble solids content, data presented showed that, both cultivars and soil mulching had significant effect in this respect, while all interaction effects were no significant. Giza-20 cultivar gave the highest significant dry matter percent and T.S.S content in onion bulbs compared with Beheri cultivar in both seasons. Clear plastic and control treatments gave the highest dry matter percent and T.S.S. content when compared with black plastic and straw of minced date palm leaves treatments in both seasons, except the effect of mulching treatment on T.S.S. content in the second season, where, straw of minced date palm leaves treatment gave the lowest values, in this respect when compared with all mulching treatments. These results are agree with Moreno and Moreno, (2008) who, decided that, higher temperatures could have a disadvantage in certain cases, especially in hot climates *ie*., decreased soil microbial biomass, organic matter mineralization and supposes an environmental risk. On the contrary, Lal Bhardwaj, (2013) reported that, yield and chemical composition of tomatoes, cucumbers, muskmelons, eggplant, were found to be improved by mulching. Also, yield and quality of early potatoes, cabbage and other vegetables may be improved by straw mulch.

Conclusion

This research may be the beginning of using straw of minced palm leaves which are accumulated in the Siwa Oasis to cover the soil surface to weeds control and reduce the evaporation from the soil surface. Using straw of minced date palm leaves or black plastic poly ethylene 60 Micron gave satisfactory results in improvement of plant growth and total yield of onions crop. In addition to this results may add value to date palm leaves in Siwa Oasis.

References

Acharya, C. L. and P. D. Sharma, 1994. Tillage and mulch effects on soil physical environment, root growth, nutrient uptake and yield of maize and wheat on an Alfisol in north-west India. Soil Tillage Research, 4:291–302.

Baumann, D.T., M.J. Kropff and L. Bastiaans, 2000. Intercropping leeks to suppress weeds. Weed Research, 40: 359-374.

Edwards, L., J.R. Burney, G. Richter and A.H. MacRae, 2000. Evaluation of compost and straw mulching on soil-loss characteristics in erosion plots of potatoes in Prince Edward Island, Canada. Agriculture, Ecosystems & Environment 81, 217-222.

FAO, FAOSTAT/Statistical database, 2016.http://faostat.fao.org/site/535/ desk top Default. aspx? Page ID=535#ancor.

Hassan, S.A., Z.A. Ramlan, and S. Inon, 1994. Influence of K and mulching on growth and yield of chilli. Acta Horticulture, 369: 311-317.

Hooks, C.R.R. and M.W. Johnson, 2003. Impact of agricultural diversification on the insect community of cruciferous crops. Crop Protection, 22: 223-238.

Jordan, A., L.M. Zavala and J. Gil, 2010. Effects of mulching on soil physical properties and runoff under semi-arid conditions in southern Spain. Catena 81, 77–85.

Kolota, E. and K. Adamczewska-Sowinska, 2004. The effects of living mulches on yield, over wintering and biological value of leek. Acta Horticulture, 638: 209-214.

Kumar, D., S. Sachin and R. Kumar, 1990. Importance of mulch in crop production. Indian Journal of Soil Conservation 18, 20-26.

Lal Bhardwaj, R., 1984. Mulch requirements for erosion control with the no-till system in the tropics: a review. Challenges in African Hydrology and Water Resources. Proceedings of the Harare Symposium. IAHS Publ. No. 144.

Lal Bhardwaj, R., 2011. Bench mark survey on effect of mulching material on crop production. Krishi Vigyan Kendrs, Sirohi, MPUAT Udaipur, pp.12-15.

Lal Bhardwaj, R., 2013. Effect of mulching on crop production under rain fed condition-a review. Agricultural Reviews 34.

Lal Bhardwaj, R., C.B. Meena, N. Singh, S.N. Ojha and S.K. Dadhich, 2011. Annual progress report of Krishi Vigyan Kendrs, Sirohi, MPUAT Udaipur, pp.45-46.

Lamont, Jr. W.J., 1993. Plastic mulches for the production of vegetable crops. Hort. Technology, 3:35-39.

Lamont, Jr. W.J., 2005. Plastics: Modifying the microclimate for the production of vegetable crops. HortTechnology, 15: 477- 481.

Lamont, Jr. W.J., 2017. Plastic mulches for the production of vegetable crops. In "A Guide to the Manufacture, Performance, and Potential of Plastics in Agriculture", pp. 45-60. Elsevier.

Lattanzi, A.R., L.D. Meyer and M.F. Baumgardner, 1974. Influences of mulch rate and slope steepness of an interrill erosion. Soil Sci. Soc. Am. Proc. 38 (6), 946–950.

Moreno, M.M., S. González-Mora, J. Villena, J.A. Campos and C. Moreno, 2017. Deterioration pattern of six biodegradable, potentially low-environmental impact mulches in field conditions. Journal of environmental management, 200, 490-501.

Moreno, M., and A. Moreno, 2008. Effect of different biodegradable and polyethylene mulches on soil properties and production in a tomato crop. Scientia Hort. 116, 256-263.

Muhammad, A., P. Muhammad, I. Khuram, U.L. Anwar and S. Hassan, 2009. Effect of mulch on soil physical properties and NPK concentration in Maize (*Zea mays*) shoots under two tillage system, 11 : 120-124.

Mulumba, L.N. and R. Lal, 2008. Mulching effects on selected soil physical properties. Soil Tillage Res. 98, 106–111.

Prosdocimi, M., P. Tarolli and A. Cerda, 2016. Mulching practices for reducing soil water erosion: A review. Earth-Science Reviews 161,191-203.

Russell, D.F., 1991. In "MSTATC, Directory crop soil science Department" Michigan Universty.USA.

Sarolia, D.K. and R.L. Bhardwaj, 2012. Effect of mulching on crop production under rainfed condition: A Review. Int. J. Res. Chem. Environ., 2: 8-20.

Tarara, J. M., 2000. Microclimate modification with plastic mulch. Hort. Science, 35: 169-180. Vos, J. G. M. and Sumarni, N. (1997). Effects of mulch on crop performance and prediction. Journal of Horticultural Sciences, 72: 415-424.

Wang, L., X.G. Li, J. Lv, T. Fu, Q. Ma, W. Song, Y.P. Wang and F.M. Li, 2017. Continuous plastic-film mulching increases soil aggregation but decreases soil pH in semiarid areas of China. Soil and Tillage Research 167, 46-53.

Wang, Y.P., X.G. Li, T. Fu, L. Wang, N.C. Turner, K.H. Siddique and F.M. Li, 2016. Multi-site assessment of the effects of plastic-film mulch on the soil organic carbon balance in semiarid areas of China. Agricultural and Forest Meteorology, 228, 42-51.

Yamaguchi, T. A. Ito and M. Koshioka, 1996. Effect of combination of reflective film mulching and shading treatments on the growth of carnation (Dianthus caryophyllus). Japan Agri. Research Quarterly, 30: 181-188.

Zhang, F., W. Zhang, J. Qi and F. Feng-Min Li, 2018. A regional evaluation of plastic film mulching for improving crop yields on the Loess Plateau of China. Agri. and Forest Meteorology, 248:458-468.

Zribi, W., R. Aragiies, E. Medina and J. Faci, 2015. Efficiency of inorganic and organic mulching materials for soil evaporation control. Soil and Tillage Research 148, 40-45.