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Research Article

Investigation of the effects of non-living mulches and metribuzin on redroot pigweed and lamb'squarters in tomato

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ABSTRACT- A field study was conducted to determine the influences of six mulch materials (organic and inorganic), including black plastic, transparent plastic, wheat straw, peat moss, coco peat, and sawdust, and besides, metribuzin on the vegetative and reproductive growth cycles of two weed species in a tomato field using a randomized complete block design with three replications at the Research Station of the Agricultural School, Shiraz University, Shiraz, Iran. According to the results of the analysis of variance, all evaluated traits of both weed species, and also tomato, were significantly influenced by treatments at $p < 0.01$. The longest and shortest time of redroot pigweed (*Amaranthus retroflexus* L.) emergence were recorded under the plastic mulch treatment at 28 days after transplanting (DAT) and organic mulches as well as metribuzin at 21 DAT, respectively. Plastic mulches deferred the time of lamb's quarters (*Chenopodium album* L.) emergence more than organic mulches up to 28.0%. Additionally, the longest time of lamb'squarters emergence was observed with coco peat at 29 DAT and the shortest time of its emergence was recorded under the application of clear plastic and sawdust mulches at 23.3 DAT. Results showed that, the highest marketable tomato yield (up to 19.2 kg m⁻²) was assessed in covered plots with black plastic mulch, while the lowest marketable yield was detected by 3.02 kg m⁻² in the plots under the application of the sawdust. In general, results demonstrated that the plastic mulches, particularly the black plastic sheet, could be reliable alternatives for metribuzin to control weed infestations in tomato fields.

INTRODUCTION

In recent years, the application of non-chemical weed management methods has been increased to reduce the utilization of synthetic herbicides. Environmental concerns and herbicide resistance could be some main reasons why non-chemical weed control approaches have been attracting more nowadays (Alebrahim et al., 2017; Mohammadi, 2012; KhodamKahangi et al., 2014; Zangouinejad et al. 2019a, b, c, d). Although herbicide-tolerant/resistant crops have been enhanced the productivity in agricultural production systems, there are serious issues regarding the developing cost of these kinds of crops, and besides, social concerns regarding their safety for consumers as well as environment. Therefore, scientists are required to seek some practical alternatives for weed chemical practices worldwide (Fagliari et al., 2005; Marple et al., 2007; Lovelace et al., 2007; Lovelace et al., 2009; Zangouinejad et al., 2016; Zangouinejad et al., 2018).

The application of non-living mulches is one of the non-chemical weed management practices to diminish weed infestations in organic agricultural systems. There is a variety of non-chemical weed management practices that are used in organic agricultural systems of

which non-living mulches is one. Non-living mulches act as physical barriers to block some resources such as sunlight that weed depends on for germination, growth, and development (Read, 2013; Green et al., 2003; Scarascia-Mugnozza et al., 2006; Cirujeda et al., 2012; Bond and Grundy, 2001; Suojala, 2003). Also, mulches make it difficult for weed species to early establish and compete with crops, due to a delayed emergence time (Rask and Andreasen, 2007).

Rice (*Oryza sativa* L.) straw, barley (*Hordeum vulgare* L.) straw, maize (*Zea mays* L.) residue, absinth wormwood (*Artemisia absinthium*), black biodegradable plastic, and brown paper were compared with black polyethylene mulch and some herbicide options in terms of their effects on the weed infestations in tomato field during 2005-2007 (Anzalone et al., 2010). In 2005, the least percentage of the weed cover was statistically recorded in treated plots with paper, polyethylene, and biodegradable plastic mulches which were up to 14.3, 28.4, and 31.3%, respectively. However, paper by indicating 3.1 and 0.9% weed cover represented the lowest weed cover in 2006 and 2007, respectively. Moreover, paper reduced the total weed dry biomass up

to 94.7, 74.7, and 94.9% compared to herbicide treatments in 2005 (rimsulfuron), 2006 (rimsulfuron + metribuzin), and 2007 (rimsulfuron + metribuzin), respectively (Anzalone et al., 2010). In general, it was concluded that paper, biodegradable plastic, and rice straw are potential alternatives for black polyethylene mulch and herbicides (Anzalone et al., 2010).

The weed density and dry biomass were evaluated under application of the black, white/black, gray, infrared transmitting brown, infrared transmitting green, and white plastic mulches under field condition in 2001 and 2002 (Ngouajio and Ernest, 2004). The white plastic mulch showed the highest weed density up to approximately 39.6 and 155.9 seedlings m^{-2} in 2001 and 2002, respectively (Ngouajio and Ernest, 2004).

In another study, the effects of clear, black, and seven colored mulches were investigated in California organic and conventional strawberry production systems to assess their ability in diminishing the weed invasions. The recorded weed germination percentages were 46.0, 19.0, 27.0, 23.0, 32.0, 13.0, 22.0, and 28.0% in treated plots by clear, blue, red, brown, yellow, green, white, and black plastic mulch, respectively. Finally, the highest weed control percentage was observed in black plastic mulch up to 100.0%, while it was by 99.4 and 98.7% in treated plots with green and brown plastic mulches, respectively (Johnson and Fennimore, 2005).

The aims of current study were to compare the effects of non-living (organic and inorganic) mulches and metribuzin on vegetative and reproductive properties of *Amaranthus retroflexus* and *Chenopodium album*. Also, the influence of the mentioned treatments was examined on the marketable tomato yield.

MATERIALS AND METHODS

A field experiment was conducted in 2016 to compare the effect of six types of non-living mulches (black plastic, transparent plastic, wheat straw, peat moss, coco peat, and sawdust) with metribuzin using a randomized complete block design (RCBD) with three replications. The experiment was run at the Research Station of the School of Agriculture, Shiraz University (35° 52' E, 40° 29' N, altitude 1810 m a. s. l), Shiraz, Iran. No weed control and a weed-free treatment were included.

Land preparation, including plowing, disking, ridging was done, and also, fertigation was performed using 166 $kg\ ha^{-1}$ of a synthetic fertilizer containing 20% (w/w) N, P_2O_5 , and K_2O . Plots were irrigated twice a week by a drip irrigation system. Each plot consisted of four 3 m long rows spaced 50 cm apart. Twenty-four tomato (cv. CH) seedlings (six-week-old) were transplanted into each plot on June 30, 2018. This tomato variety is an early ripening, dwarf and high-yielding variety that produces round and firm fruits. The fruit of this variety is very durable on the plant and remains firm for some time after harvesting. Meanwhile, this is resistant to root rot (*Verticillium* wilt).

The treatments consisted of four organic non-living mulches, including wheat straw, sawdust, coco peat, and peat moss so that applied at 8, 7, 6, 6 cm thickness, respectively, and two inorganic mulches, inclusive of black and clear plastic mulches with a thickness of 15

and 20 μm , respectively. Metribuzin was applied at the rate of 0.75 $kg\ ha^{-1}$, at five weeks after transplanting. Tomatoes were harvested thirteen weeks after transplanting to determine the marketable yield ($kg\ m^{-2}$). The firm and free of any visual damage tomatoes were defined as marketable tomato yield.

The most abundant weed species in the field were redroot pigweed (*Amaranthus retroflexus* L.) and lamb's quarters (*Chenopodium album* L.). The weed density (WD), weed dry weight (WDW), time of weed emergence (TWE), time of weed flowering (TWF), time of weed seed shattering (TWSS) were measured for both weed species. The appearance of the plumule was taken as the time of emergence. The field was visited once a week from the time of the tomato seedlings transplanting until the harvesting time. The number of weeds was counted in four randomly fixed 0.25 m \times 0.25 m quadrats in each plot, and then expressed as the number of weeds m^{-2} . All weed seedlings were carefully uprooted by hand, stored in polythene bags, and dried at 72°C for 48 h. The dried weed seedlings were weighed to calculate WDW.

Data was tested to evaluate the normality using plotting QQ [quantile-quantile] plots for residuals in JMP v. 13 (SAS Institute, SAS Campus Drive, Cary, NC 27513). All data were subjected to ANOVA using GLM SAS 9.4 (SAS Institute, Cary, NC, USA) and means were separated using Tukey's test at 5% level. The drawing of graphs was carried out using Excel 2010.

RESULTS AND DISCUSSION

Time of Weed Emergence

The results showed that TWE was influenced by treatments (Table 1). Regarding redroot pigweed, the longest TWE was recorded in plastic mulch at 28 DAT, while the organic mulches and metribuzin were less effective to delay TWE (21 DAT). In contrast, the lamb's quarters seed germinated at 29 DAT in treated plots by coco peat. In other words, this raw material indicated the most performance to postpone the lamb's quarters seed germination. Clear plastic and sawdust showed the least effect on the lamb's quarters weed emergence time so that it was recorded at 23.3 DAT (Table 2). Jodaugiene et al. (2006) reported that various organic mulches reduced weed germination. Moreover, it was revealed that black plastic mulch inhibited the germination of annual bluegrass (*Poa annua* L.), common chickweed (*Stellaria media* L.), corn spurry (*Spergularia arvensis* L.), and Persian speedwell (*Veronica persica* L.) approximately up to 53.6 and 28.0% under greenhouse and field condition, respectively (Johnson and Fennimore, 2005).

Time of Weed Flowering

The effect of different treatments on TWF was significant ($P < 0.01$) (Table 1). The flowering time of redroot pigweed was delayed more by metribuzin (86.3 DAT) than by any of other the treatments. The redroot pigweed flowering time was at 49.0 DAT after the application of peat moss and wheat straw, as the least

effective treatments (Table 2). Furthermore, metribuzin was the most effective treatment to delay the lamb's quarters flowering time, since it was observed at 88.7 DAT. Besides, the shortest interval between the transplanting date and flowering time for lamb's quarters was assessed under the utilization of wheat straw treatment at 42 DAT (Table 2).

Time of Weed Seed Shattering

The analysis of variance showed a significant effect of treatments ($P < 0.01$) on TWSS (Table 1). Remarkably, wheat straw delayed the redroot pigweed seed shattering until 77 DAT, while metribuzin prevented its seed shattering by 135.3 DAT. No statistical significant difference was observed between two plastic mulches, and also, among all four organic mulches (Table 2). Plastic mulches were significantly more effective than the organic mulches to prevent the lamb's quarters seed shattering. The longest and shortest time of its seed shattering was recognized after the usage of metribuzin and organic mulches at 126 and 77.0 DAT, respectively. Plastic mulches were significantly less effective than metribuzin to postpone the lamb's quarters seed shattering time (Table 2).

Weed Density

The treatments significantly affected ($P < 0.01$) WD (Table 1). Clear plastic, black plastic, and metribuzin reduced the redroot pigweed density up to 1.60, 3.45 and 5.02 seedling m^{-2} , which had no significant differences (Fig. 1).

Besides, the highest WD was recorded in peat moss (17.50 seedling m^{-2}) and coco peat (16.79 seedling m^{-2}). Generally, the organic mulches showed a lower impact than the plastic mulches as well as herbicide in lessening the redroot pigweed density (Fig. 1). Moreover, the lowest lamb's quarters density was discerned in the treated plots with clear plastic (1.37 seedling m^{-2}). Likewise, the lamb's quarters density was 3.3 and 4.6 seedling m^{-2} in black plastic and metribuzin, respectively (Fig. 1). Meanwhile, the highest lamb's quarters density was recorded in coco peat (14.0 seedling m^{-2}) and peat moss (12.9 seedling m^{-2}) (Fig. 1).

Ashrafuzzaman et al. (2011) reported that the lowest WD (52.2 seedling m^{-2}) was detected after application of

the black plastic mulch in chili processing. This mulch sheet significantly reduced the WD up to 56.1 and 70.9% more than blue and transparent plastic mulches, respectively. Also, Johnson and Fennimore (2005) suggested that the black plastic mulch controls weed abundance by approximately 100% in the strawberry farm; however, often the black plastic mulch does not warm the soil as same as clear plastic mulch. It was emphasized that the effect of the mulch color on the transmittance of the photosynthetically active light (PAR; 400 to 700 nm) through the mulch sheets is the key factor for germinating weed seeds. The recorded PAR value was 180.5, 61.1, 19.3, 10.9, 10.6, 10.2, 2.6, and 0.1 $W\ m^{-2}$ for clear, blue, red, brown, green, yellow, white/black, and black plastic mulches, respectively. Thus, black plastic passed lower the PAR quantity up to 99.9% compared with clear plastic mulch. In fact, the black plastic mulch diminishes weed infestations due to this fact that weed could not be able to grow in the absence of PAR (Olson, 2002; Teasdale and Mohler, 2000).

Weed Dry Weight

Clear plastic was the most effective mulch in reducing both redroot pigweed and lamb's quarters dry biomass which were up to 21.03 and 19.13 $g\ m^{-2}$, respectively (Fig. 1). Importantly, there was no statistically significant difference between the impact of black plastic, and besides, metribuzin on the both WDW compared to clear plastic. The redroot pigweed dry biomass was 23.6 and 24.1 $g\ m^{-2}$, respectively, in black plastic mulch and metribuzin. Additionally, it was 21.32 and 23.2 for lamb's quarters in treated plots with black plastic and metribuzin, respectively (Fig. 1). The highest redroot pigweed and lamb's quarters dry weights were up to 39.8 and 39.7 $g\ m^{-2}$, respectively, in peat moss. Ahmad et al. (2011) displayed that the recorded weed dry biomass in black plastic mulch was lower than those in transparent and blue plastic mulches which were up to 79.9 and 90.5%, respectively, in chili processing.

Rajablariani et al. (2012) also demonstrated that the plastic mulches could reduce the weed biomass by 84-98%, so that silver/black plastic mulch decreased the total weed dry biomass up to 98.2%, as the best performance among all evaluated mulches.

Table 1. Analysis of variance (ANOVA), degrees of freedom, and significance levels for some vegetative/reproductive traits of *A. retroflexus* and *C. album* and tomato marketable yield.

	Sources of variations	df	Mean-square					
			TWE	TWF	TWSS	WD	WDW	MTY
<i>A. retroflexus</i>	Block	2	5.44 ^{ns}	7.25 ^{ns}	12.70 ^{ns}	5.69 ^{ns}	0.72 ^{ns}	-
	Treatment	8	200.08 ^{**}	1514.00 ^{**}	3657.75 ^{**}	278.37 ^{**}	581.77 ^{**}	-
	Error	16	5.44	5.21	10.66	2.87	13.96	-
	CV		11.53	4.49	4.14	16.46	13.00	-
<i>C. album</i>	Block	2	23.59 ^{ns}	12.70 ^{ns}	7.25 ^{ns}	1.81 ^{ns}	3.70 ^{ns}	-
	Treatment	8	216.87 ^{**}	1557.56 ^{**}	3249.42 ^{**}	218.92 ^{**}	563.03 ^{**}	-
	Error	16	33.80	14.74	9.30	2.80	17.98	-
	CV		26.38	8.18	3.98	19.24	15.51	-
Tomato	Block	2	-	-	-	-	-	0.01 ^{ns}
	Treatment	8	-	-	-	-	-	88.41 ^{**}
	Error	16	-	-	-	-	-	0.24
	CV		-	-	-	-	-	6.99

** : Significant at $P < 0.01$ and ns refers to non-significant. TWE, TWF, TWSS, WD, and WDW refer to the time of weed emergence, time of weed flowering, time of weed seed shattering, weed density, and weed dry weight, respectively.

Table 2. Response of some vegetative/reproductive characteristics of *A. retroflexus* and *C. album* to different treatments at harvest time

	Treatment	TWSS	TWF	TWE
		TWSS	TWF	TWE
<i>A. retroflexus</i>	Black plastic	28.00a	56.00c	86.33bc
	Peat moss	21.00b	49.00d	84.00bc
	weedy	21.00b	49.00d	72.33d
	Clear plastic	28.00a	63.00b	93.33b
	Sawdust	21.00b	51.33cd	81.66cd
	Metribuzin	21.00b	86.33a	135.33a
	Coco peat	21.00b	53.66cd	79.33cd
	Weed-free	0.00c	0.00e	0.00e
	Wheat straw	21.00b	49.00d	77.00cd
<i>C. album</i>	Black plastic	25.66a	53.67b	91.00b
	Peat moss	25.66a	44.33c	77.00c
	weedy	21.00a	42.00c	74.66c
	Clear plastic	23.33a	56.00b	88.66b
	Sawdust	23.33a	44.33c	77.00c
	Metribuzin	25.66a	88.66a	126.00a
	Coco peat	29.00a	51.33b	77.00c
	Weed-free	0.00b	0.00d	0.00d
	Wheat straw	25.66a	42.00c	77.00c

The quantities in each column for each weed species followed by the same letter are not significantly different (Tukey's test 5%). TWSS, TWF, and TWE refer to the time of weed seed shattering, time of weed flowering, and time of weed emergence, respectively.

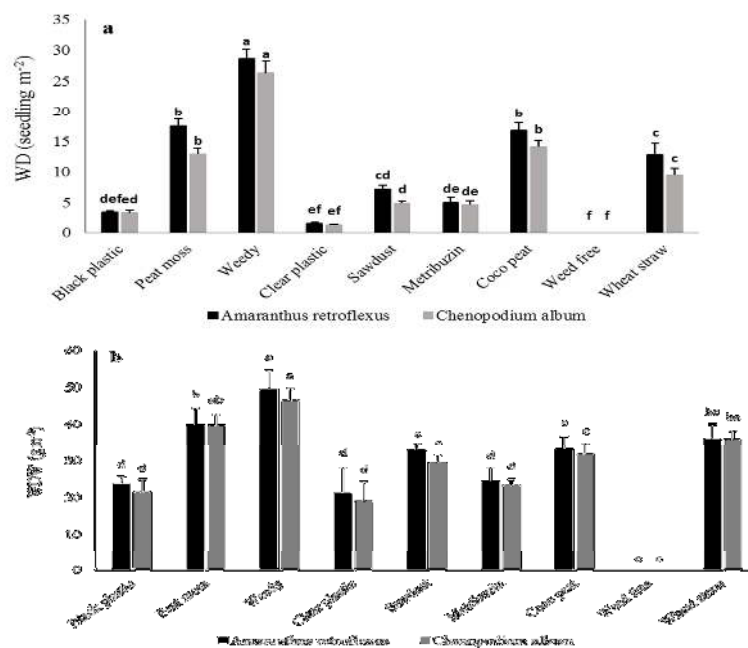


Fig. 1. Response of weed density (a) and (b) weed dry weight to different treatments at the harvest time (Tukey's test 5%). The means followed by the same letter are not significantly different (Tukey's test 5%). WD and WDW refer to weed density and weed dry weight, respectively.

In agreement, Grassbaugh et al. (2004) uncovered that the black plastic mulch resulted in a 66.7, 42.8, 63.6, and 83.3% reduction in the weed biomass compared to newspaper, wheat straw, bark mulches, and bareground, respectively. Moreover, Ngouajio and Ernest (2004) observed the lowest weed biomass (0-10 g m⁻²) in black plastic mulch when the light transmission was around 2%.

Marketable Tomato Yield

MTYs were 19.2, 7.3, and 5.7 kg m⁻² in treated plots with black plastic mulch, clear plastic mulch, and metribuzin, respectively, which were significantly higher than those of the control plots (0.98 kg m⁻²) as well as organic mulches (Fig. 2). This suggests that MTY would be increased higher by using the plasticulture (Zegbe-

Dominguez et al., 2003, 2006). Garry et al. (2010) concluded that the highest marketable okra yield (15.4 t ha^{-1}) was obtained under the black plastic mulch compared to blue (13.5 t ha^{-1}), red (12.6 t ha^{-1}), silver (12.5 t ha^{-1}), and white (12.8 t ha^{-1}) plastic mulches. Meanwhile, Rajablariani et al. (2012) indicated that the application of the colored plastic mulch significantly increased the marketable tomato yield up to 24-65% compared to bare soil. Also, silver/black, black, and blue plastic mulches recorded 40.0, 38.0, and 35.0 t ha^{-1} MTY, respectively, which had no significant differences. Besides, red and clear plastic mulches showed 32 and 31 t ha^{-1} MTY, respectively.

The authors proposed that increasing in yield as well as the weed control level is probably associated with the conservation of moisture and improved microclimate in the above and under the soil surface. In other words, one

of the benefits of the black plastic mulch is to enhance the soil temperature, which promotes the crop development (Hochmuth, 2008). Kumara and Dey (2011) reported higher root growth and nutrient uptake after the application of various mulching treatments, which resulted in significant yield rocket in strawberry. The maximum root length density (9.6 km m^{-3}) was found with black plastic, and followed by rye mulch (5.0 km m^{-3}), while the minimum growth was observed in control plots (3.2 km m^{-3}) under rainfed irrigation condition. Besides, the black plastic enhanced the N, P, and K uptake up to 14.2, 24.1, 20.7%, respectively, compared to hay mulch. Consequently, the berry yield was higher in the treated plots with black plastic mulch up to 33.3% than treated ones by hay mulch (Kumara and Dey, 2011).

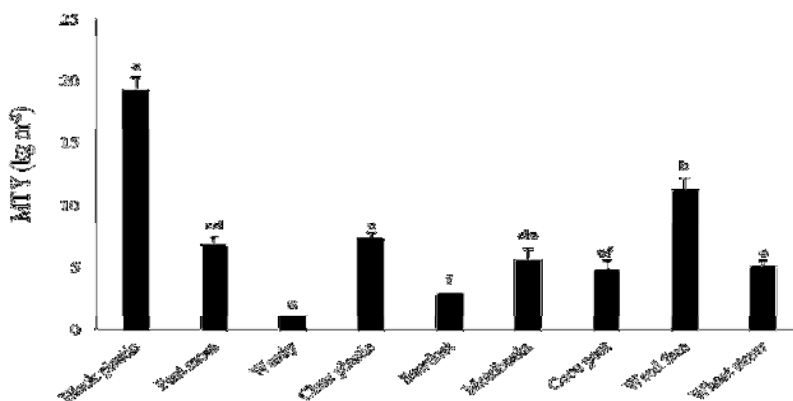


Fig. 2. Comparison of MTY under different treatments. The means followed by the same letter are not significantly different (Tukey's test 5%). MTY refer to the marketable tomato yield.

In support of the mentioned results, it was emphasized that the black polyethylene plastic mulch is the standard plastic mulch in vegetable production (Gordon et al., 2010). It was revealed that the black plastic altered the plant growing environment by increasing the soil temperature (Díaz-Pérez et al., 2000; Hanna et al., 2003) so that by utilizing this kind of mulch sheet the crop yield production would be improved significantly (Leib et al., 2002; Summers and Stapleton, 2002). More importantly, the harvest time could take place earlier after using the black plastic mulch (Ibarra et al., 2001; Brown and Channell-Butcher, 2001; Loughrin and Kasperbauer, 2002).

The Correlation Between Traits

According to the results, the redroot pigweed emergence time was correlated with TWF ($r=0.80$, $p < 0.01$), and also, the TWSS ($r=0.79$, $p < 0.05$).

Moreover, the positive correlation was observed between the redroot pigweed flowering time and TWSS ($r=0.99$, $p < 0.01$) (Table 3). Also, the positive correlation was recorded between the time of redroot pigweed flowering and TWSS ($r=0.99$, $p < 0.01$) (Table 3). Meanwhile, the significant correlation was

distinguished between the redroot pigweed dry weight and its density ($r=0.85$, $p < 0.01$) (Table 3).

Regarding lamb's quarters, the time of weed emergence represented the positive correlation with TWF ($r=0.78$, $p < 0.05$), TWSS ($r=0.85$, $p < 0.01$), and weed dry weight ($r=0.69$, $p < 0.05$). Likewise, the correlation was assessed between TWF and TWSS ($r=0.97$, $p < 0.01$) (Table 4). Importantly, the weed density was related to the weed dry weight ($r=0.83$, $p < 0.01$) (Table 4).

CONCLUSIONS

Overall, all treatments tested in this study, including six various mulches and metribuzin, controlled the density of lamb's quarters better than that of redroot pigweed. Although the clear plastic lessened the density of both weed species more than all other treatments, it had no significant difference compared with the black plastic mulch as well as metribuzin. All treatments, except wheat straw and peat moss mulches, decreased the dry weight of lamb's quarters more than that of redroot pigweed. Furthermore, the clear plastic mulch, black plastic mulch, and metribuzin had no significant

differences in diminishing the weed species dry weight. Taking everything into consideration, the positive effects of plastic mulches to increase MTY along with their remarkable role to suppress the vegetative and reproductive redroot pigweed and lamb's quarters

growth demonstrated that these mulches could be reliable alternatives, as the non-chemical weed control approaches, for the metribuzin in tomato production industry.

Table 3. Correlation coefficient (r) between the time of weed emergence, flowering, seed shattering, density, and dry weight of *A. retroflexus*.

	TWE	TWF	TWSS	WD	WDW
TWE	1				
TWF	0.80**	1			
TWSS	0.79*	0.99**	1		
WD	0.17 ^{ns}	0.09 ^{ns}	0.08 ^{ns}	1	
WDW	0.56 ^{ns}	0.44 ^{ns}	0.45 ^{ns}	0.85**	1

* and **: Significant at $P < 0.05$ and 0.01 , respectively, and also, ns refers to non-significant. TWE, TWF, TWSS, WD, and WDW refer to the time of weed emergence, time of weed flowering, time of weed seed shattering, weed density, and weed dry weight, respectively

Table 4. Correlation coefficient (r) between the time of weed emergence, flowering, seed shattering, density, and dry weight of *C. album*.

	TWE	TWF	TWSS	WD	WDW
TWE	1				
TWF	0.78*	1			
TWSS	0.85**	0.97**	1		
WD	0.30 ^{ns}	0.02 ^{ns}	0.10 ^{ns}	1	
WDW	0.69*	0.33 ^{ns}	0.46 ^{ns}	0.83**	1

* and **: Significant at $P < 0.05$ and 0.01 , respectively, and also, ns refers to non-significant. TWE, TWF, TWSS, WD, and WDW refer to the time of weed emergence, time of weed flowering, time of weed seed shattering, weed density, and weed dry weight, respectively.

REFERENCES

- Ashrafuzzaman, M., Halim, M. A., Ismail, M. R., Shahidullah, S. M., & Hossain, M. A. (2011). Effect of plastic mulch on growth and yield of chilli (*Capsicum annuum* L.). *Brazilian archives of biology and technology*, 54(2), 321-330.
- Albrahim, M. T., Zangouinejad, R., & Tseng, T. M. (2017). Biochemical and molecular knowledge about developing herbicide-resistant weeds. In Pacanoski, Z. (Ed.), *Herbicide resistance in weeds and crops* (pp. 101-132). London: IntechOpen.
- Anzalone, A., Cirujeda, A., Aibar, J., Pardo, G., & Zaragoza, C. (2010). Effect of biodegradable mulch materials on weed control in processing tomatoes. *Weed Technology*, 24(3), 369-377.
- Ashrafuzzaman, M., Abdul Halim, M., Ismail, M. R., Shahidullah, S.M., & Hossain, M.A. (2011). Effect of plastic mulch on growth and yield of chilli (*Capsicum annuum* L.). *Brazilian Archives of Biology and Technology*, 54(2), 321-330.
- Bond, B., & Grundy, A. C. (2001). Non-chemical weed management in organic farming systems. *Weed Research*, 41, 383-405.
- Brown, J. E., & Channell-Butcher, C. (2001). Black plastic mulch and drip irrigation affect growth and performance of bell pepper. *Journal of Vegetable Crop Production*, 7, 109-112.
- Cirujeda, A., Aibar, J., Anzalone, Á., Martín-Closas, L., Meco, R., María Moreno, M., Pardo, A., María Pelacho, A., et al. (2012). Biodegradable mulch instead of polyethylene for weed control of processing tomato production. *Agronomy for Sustainable Development*, 32(4), 889-897.
- Di'az-Pe'rez, J. C., & Batal, D. (2002). Colored plastic film mulches affect tomato growth and yield via changes in root-zone temperature. *Journal of the American Society for Horticultural Science*, 127, 127-136.
- Fagliari, J. R., Oliveira, Jr R. S. D., & Constantin, J. (2005). Impact of sublethal doses of 2, 4-D, simulating drift, on tomato yield. *Journal of Environmental Science and Health, Part B*, 40(1), 201-206
- Gliessman, S. R. (2007). *Agroecology: The ecology of sustainable food systems* (2nd ed). Boca Raton, FL, USA: CRC Press.
- Gordon, G. G., Foshee, G. W., Reed, S. T., Brown, J. E., & Vinson, E. L. (2010). The effects of colored plastic mulches and row covers on the growth and yield of okra. *HortTechnology*, 20, 224-233.
- Grassbaugh, E. M., Regnier, E. E., & Bennett, M. A. (2004). Comparison of organic and inorganic mulches for heirloom tomato production. *Acta Horticulturae*, 638, ISHS, 171-176.
- Green, D. S., Kruger, E. L., & Stanosz, G. R., (2003). Effects of polyethylene mulch in a short-rotation, poplar plantation vary with weed-control strategies, site quality and clone. *Forest Ecology Management*, 73, 251-260.
- Hanna, H. Y., Parish, R. L., & Bracy, R. P. (2003). Reusing black polyethylene mulch saves money in the vegetable business. *Louisiana Agriculture*, Winter, 21-22.
- Hochmuth, G. J., Hochmuth, R. C., & Olson, S. M. (2008). *Polyethylene mulching for early vegetable production in*

- north Florida (1sted). Gainesville, Florida, USA: University of Florida IFAS Extension Publication.
- Ibarra, L., Flores, J., & Di'az-Pe'rez, J. C. (2001). Grow and yield of muskmelon in response to plastic mulch and row covers. *Scientia Horticulturae*, 87, 139-145.
- Jodaugiene, D., Pupaliene, R., Urboniene, M., Pranckietis, V., & Pranckietiene, I. (2006). The impact of different types of organic mulches on weed emergence. *Agronomy Research*, 4 (Special issue), 197-201.
- Johnson, M. S., & Fennimore, S. A. (2005). Weed and crop response to colored plastic mulches in strawberry production. *HortScience*, 40(5), 1371-1375.
- Karkanis, A., Bilalis, D., Efthimiadou, A., & Katsenios, N. (2012). Comparison between conventional and organic weed management: Growth and yield of leek (*Allium porrum* L.). *Horticultural Science (Prague)*, 39(2), 81-88.
- KhodamKahangi, H., Rajablarjani, H. R., & Nasri, M. (2014). Effect of mung bean living mulch, plastic mulch and herbicides on for age maize yield and weed control. *International Journal of Agriculture and Crop Sciences*, 7(14), 1452-1456.
- Kumara, S., & Dey, P. (2011). Effects of different mulches and irrigation methods on root growth, nutrient uptake, water-use efficiency and yield of strawberry. *Scientia Horticulturae*, 127(2011), 318-324.
- Leib, B. G., Jarrett, A. R., Orzolek, M. D., & Mumma, R. O. (2002). Drip chemigation of imidacloprid under plastic mulch increased yield and decreased leaching caused by rainfall. *Trans. American Society of Agricultural Engineers*, 43, 615-622.
- Lemma, D. (2002). Research experience and production projects- Addis Ababa, Ethiopia: Ethiopian Agriculture Research Organization (EARO).
- Loughrin, J. H., & Kasperbauer, M. J. (2002). Aroma of fresh strawberries is enhanced by ripening over red versus black mulch. *Journal of Agricultural and Food Chemistry*, 50, 161-165.
- Lovelace, M. L., Hoagland, R. E., Talbert, R. E., & Scherder, E. F. (2009). Influence of simulated quinclorac drift on the accumulation and movement of herbicide in tomato (*Lycopersicon esculentum*) plants. *Journal of Agricultural and Food Chemistry*, 57, 6349-6355.
- Lovelace, M. L., Talbert, R. E., Scherder, E. F., Hoagland, R. E. (2007). Effects of multiple applications of simulated quinclorac drift rates on tomato. *Weed Science*, 55, 169-177.
- Marple, M. E., Al-Khatib, K., Shoup, D., Peterson, D. E., & Claassen, M. (2007). Cotton response to simulated drift of seven hormonal-type herbicides. *Weed Technology*, 21(4), 987-992.
- Mohammadi, G. R. (2012). Living mulch as a tool to control weeds in agroecosystems: A review. In Price, A. J. (Ed.), *Weed Control* (pp. 75-100). London: IntechOpen.
- Ngouajio, M., & Ernest, J. (2004). Light transmission through colored polyethylene mulches affects weed populations. *HortScience*, 39(6), 1302-1304.
- Olson, S. M. (2002). Mulching. In Olsen, S. M., & Maynard, D. N. (Eds.), *Vegetable production guide for Florida*. (pp. 25-28). Gainesville, Florida, USA: University of Florida IFAS Extension Publication.
- Rajablarjani, H. R., Hassankhan, F., & Rafezi, R. (2012). Effect of colored plastic mulches on yield of tomato and weed biomass. *International Journal of Environmental Science*, 3, 590-593.
- Rask, M., & Andreasen, C. (2007). Influence of mechanical rhizome cutting, rhizome drying and burial at different developmental stages on the regrowth of *Calystegia sepium*. *Weed Research*, 47, 84-93.
- Read, N. A. (2013). *Plant residues and newspaper mulch effects on weed emergence and collard performance*. (B.Sc. thesis, Ohio State University, Columbus, United States).
- Scarascia-Mugnozza, G., Schettini, E., Vox, G., Malinconico, M., Immirzi, B., & Pagliara, S. (2006). Mechanical properties decay and morphological behavior of biodegradable films for agricultural mulching in real scale experiment. *Polymer Degradation and Stability*, 91, 2801-2808.
- Suojala, T. (2003). Yield potential of chive: effects of cultivar, plastic mulch and fertilisation. *Agricultural and Food Science Finland*, 12, 95-105.
- Summers, C. G., & Stapleton, J. J. (2002). Use of UV reflective mulch to delay the colonization and reduce severity of *Bemisia argentifolii* (Homoptera: Aleyrodidae) infestations in cucurbits. *Crop Protection*, 21, 921-928.
- Teasdale, J., & Mohler, C. L. (2000). The quantitative relationship between weed emergence and the physical properties of mulches. *Weed Science*, 48, 385-392.
- Zangouinejad, R. (2019a). Study the mechanism(s) of tolerance to herbicides in selected tomato lines [Doctoral dissertation, University of Mohaghegh Ardabili, Ardabil, Iran. (In Persian)].
- Zangouinejad, R., Alebrahim, M. T., & Tseng, T. M. (2019b). Evaluation of auxin tolerance in selected tomato germplasm under greenhouse and field conditions. *Weed Technology*, 33(6), 815-822.
- Zangouinejad, R., Alebrahim, M. T., & Tseng, T. M. (2019c). Investigating dicamba uptake and translocation in dicamba-tolerant tomato using HPLC, The Annual Meeting of the Weed Science Society of America. New Orleans, Louisiana State, February 11-14. USA: Weed Science Society of America.
- Zangouinejad, R., Alebrahim, M. T., Shrestha, S., & Tseng, T. M. (2019d). Dose response study to evaluate dicamba tolerance of wild tomato germplasm, 72nd Annual Meeting of Southern Weed Science Society. Oklahoma City, Oklahoma State, February 03-06. USA: Southern Weed Science Society.
- Zangouinejad, R., Alebrahim, M. T., Snyder, R., & Tseng, T. M. (2018). Greenhouse screening to detect dicamba, 2,4-D, and quinclorac tolerant selected tomato accessions, 2nd Annual Summer Student Science Symposium, Mississippi Academy of Sciences. Starkville, Mississippi State, July 26. USA: Mississippi Academy of Sciences.
- Zangouinejad, R., Ghadiri, H., & Alebrahim, M. T. (2016). Comparison of some vegetative and reproductive traits of dominant weeds in cultivated tomato as influence by metribuzin and nonliving mulches, 7th International Weed Science Congress, Prague, June 19-25. Czech Republic: International Weed Science Society.
- Zegbe-Dominguez, J. A., Behboudian, M. H., & Clothier, B. E. (2006). Responses of "Petopride" processing tomato to partial root zone drying at different phenological stages. *Irrigation Science*, 24, 203-210.
- Zegbe-Dominguez, J. A., Behboudian, M. H., Lang, A., & Clothier, B. E. (2003). Deficit irrigation and partial rootzone drying maintain fruit dry mass and enhance fruit quality in "Petopride" processing tomato (*Lycopersicon esculentum* Mill.). *Scientia Horticulturae*, 8, 505-510.



بررسی اثرات مالچ‌های غیرزنده و علف‌کش متریبوزین بر علف- های هرز تاج‌خروس و سلمه‌تره در مزرعه گوجه‌فرنگی

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همبستگی

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چکیده-مطالعه‌ای به منظور تعیین اثرات شش نوع مالچ (ارگانیک و غیرارگانیک) و علف‌کش متریبوزین بر چرخه رشد رویشی و زایشی علف‌های هرز در مزرعه گوجه‌فرنگی در قالب طرح بلوک کامل تصادفی با سه تکرار در ایستگاه تحقیقاتی دانشکده کشاورزی دانشگاه شیراز انجام شد. براساس نتایج تجزیه واریانس، همه صفات موردبررسی گونه‌های علف‌هرز و همچنین گوجه‌فرنگی به طورمعنی-داری درسطح احتمال یک درصد تحت تاثیر تیمارهای اعمال شده قرارگرفتند. طولانی‌ترین و کوتاه-ترین زمان ظهور بذرهای علف هرز تاج خروس (*Amaranthus retroflexus* L.) به ترتیب تحت تاثیر تیمارهای مالچ پلاستیکی مشکی (۲۸ روز پس از انتقال گیاهچه‌های گوجه‌فرنگی به زمین اصلی) و مالچ‌های ارگانیک و علف‌کش متریبوزین (۲۱ روز پس از انتقال گیاهچه‌های گوجه‌فرنگی به زمین اصلی) ثبت شد. مالچ‌های پلاستیکی زمان ظهور بذر علف هرز سلمه‌تره (*Chenopodium album* L.) را در مقایسه با مالچ‌های ارگانیک به میزان ۲۸ درصد به تاخیر انداختند. همچنین، طولانی‌ترین زمان ظهور بذر علف‌هرز سلمه‌تره تحت تاثیر تیمار کوکوپیت (۲۹ روز پس از انتقال گیاهچه‌های گوجه‌فرنگی به زمین اصلی) و کوتاه‌ترین زمان ظهور در کرت‌های تیمار شده با مالچ پلاستیکی مشکی (۲۳/۵ روز پس از انتقال گیاهچه‌های گوجه‌فرنگی به زمین اصلی) مشاهده شد. بر اساس نتایج آزمایش، بیشترین مقدار عملکرد قابل فروش گوجه‌فرنگی در کرت‌های تحت تیمار مالچ پلاستیکی مشکی (۱۹/۲۱ کیلوگرم در مترمربع) و کمترین مقدار عملکرد قابل فروش (۳/۰۲ کیلوگرم در مترمربع) در کرت‌های تیمار شده با خاک‌اره ثبت شد. به طور کلی، نتایج آزمایش نشان دادند که مالچ‌های پلاستیکی، به‌ویژه مالچ پلاستیکی مشکی، می‌توانند جایگزین‌های قابل اطمینانی برای علف‌کش متریبوزین به منظور کنترل علف‌های هرز در مزارع گوجه‌فرنگی باشند.