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Research Article

The Use of Different Waste Mulch Materials Against Weeds Which are Problems in Tomato (*Solanum lycopersicum* L.) Cultivation

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ABSTRACT

This study was carried out in two different locations (L1: Yüzbaşılar village and L2: TUAM (Iğdır University Agricultural Application and Research Center) in 2020 to determine the effect of different waste mulch materials on weed control and tomato yield. In the study, five different mulch materials (tree of heaven leaves, fine sawdust, wood chips, shredded paper and sheep wool) were used. Each plot has weedy and weed-free control plots. The effects of mulching on weeding suppression, weed dry weight, yield (kg/da), fruit weight (gr) and number of fruit per plant were investigated. Three counts were made to determine the weed density in the plots. As a result of the study, a total of 17 weed species belonging to 9 families were determined in the experimental areas. As a result of the counts, it was observed that *Sorghum halepense* L., *Convolvulus arvensis* L. and *Xanthium strumarium* L. weeds emerged the most in the plots where the mulch materials were applied. Depending on the location, the lowest density among the weed density counts was obtained from the paper plots. In the study, the lowest average weed dry weight among the mulch materials was shredded paper (L1: 97.63; L2: 73.12 gr/m^2), the highest average was tree of heaven (L1: 191.87; L2: 165.27 gr/m^2) plots. As a result of the study, the best results in tomato yield (L1: 6.078.50; L2: 6.807.87 kg/da) and fruit weight (L1: 142.67; L2: 147.35 gr)) were obtained in the shredded paper mulch applied plots. The highest number of fruits per plant was obtained in the use of wood chips (L1: 45.774.83 pieces) and tree of heaven leaves (L2: 46.627.41 pieces). The fact that mulch applications give better results than control groups suggests that mulches will be much more beneficial for controlling weeds and improving fruit yield and quality.

1. Introduction

Turkey is one of the most important crop producer country in the world with its geopolitical position, climatic characteristics and ecological differences. It is one of the rare countries where fruits and vegetables are grown in good and quality conditions with its wide agricultural lands, fertile soils and suitable climate zone crop production. In Turkey, fruits and vegetables are produced in almost every season and in every region. Tomato, is one of the most important vegetables grown, is consumed in different forms as tomato paste, puree, ketchup, tomato juice, dried and fresh tomatoes. The homeland of tomatoes, which ranks first among the most consumed vegetables in the world, is South America.

The first arrival of tomatoes in Turkey was realized through France and Syria in the 19th century (Kaya et al 2018). Turkey ranks 3rd after China and India in world tomato production according to 2020 data (FAO 2020). Amoung the vegetables produced in Turkey tomato is seen the most common one. It comes first in terms of both production area (1.744.372 decares) and production amount (13. 204.015 tons). Tomato production is mostly in Antalya, Bursa and Mersin provinces. In addition, 33.666 tons of tomatoes were produced in Igdir in 2020 (TUIK 2020).

Increasing the amount of product obtained from a unit area in order to meet the food needs of the increasing world population has gained great importance in recent years. With the increase in agricultural production, the amounts of both plant harvest wastes and agricultural industry wastes increase from year to year. These plant-based wastes; In addition to being a good source of organic matter, they also have an important potential in terms of plant nutrients they contain. These wastes are an important source of organic matter, especially for our soils, which are poor in organic matter. Today, these

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wastes can also be used as a plant growing medium by preparing suitable mixtures. Knowing the characteristics of the wastes used will also be useful in increasing the success rate in agricultural production (Citak et al 2007).

Weed species, diseases and pests are the leading plant protection factors that cause yield losses in vegetable production. Weed species compete with vegatablesfor nutrients, water, light, etc. and significantly reducing the yield and quality of vegatables. In addition to this primary damage, it can cause secondary damage by being an intermediate host to many fungal and viral diseases (Uygur et al 1984; Üstüner 2018; Üstüner and Öztürk 2018).

Weeds are one of the biggest problems that cause yields and quality reductions in agricultural areas. It is known that weeds cause great yield losses in tomato, which is widely grown in Turkey in recent years (Tepe 1998). The loss rate of field dodder (*Cuscuta campestris* Yunck.) alone in the yield of Dila pepper (*Capsicum annum* L.); it was calculated as 100% in the seedling stage, 34.22% in the flower stage and 17.02% in the fruit stage (Üstüner 2020). In order to increase yield and quality in tomato cultivation, it is necessary to determine effective, economical, harmless to humans and environment control methods against weeds. One of the methods that can be used to control weeds in tomato production is mulching.

Mulching is covering the soil surface with an opaque material. The aim is to prevent the growing of weeds and to prevent them from photosynthesizing. Although mostly black nylon (polyethylene) covers are used for mulching today, many organic and inorganic materials are also being used. Mulching; preventing weed emergence, preserving moisture in the soil, increasing soil temperature, increasing the amount of nutrients and organic matter in the soil, increasing the number of microorganisms and worms in the soil, providing earliness and yield increase, protecting the soil against erosion, protecting fruits against diseases, increasing fruit quality, dripping irrigation is used which reduces the consumption of water its use in different colors and its positive effect on the fight against insects (Yüksel et al 1992; Buchanan 1999; Edward et al 2000; Koçer & Eltez 2004; Radics et al 2004; Ünlü et al 2006; Koçar 2007).

Compared to the polyethylene covers of various colors, which are widely used in mulching, the demand for organic and inorganic mulching materials has increased today. Among the organic mulches, straw is the most well known. In addition to these, compost, tree bark, husk, leaves, sawdust, paper, etc. obtained from plant residues are used. There are many organic materials that are opaque, abundant and cheap (Kitiş 2011). Organic mulches have both advantages and disadvantages. Advantages; all organic mulches decompose over time, increasing the amount of organic matter in the soil. By creating an environment and a source of food for many living things, they increase the biodiversity. They also have allelopathic effects properties against weeds. Disadvantages; organic mulches can lose their mulch properties in a short period of time because they decompose quickly. In addition, most of them are dispersed by the wind as they are of light structure (Kitiş 2011). One of the organic mulches used for commercial purposes is mulching paper. Mulching paper is an environmentally non-toxic and recyclable organic material containing some vegetable oils and acids. This mulch is cheaper and can be mixed into the soil. However, its sensitivity to tearing and perforation, and rapid disintegration are the major disadvantages of the material (Harrington & Bedford 2004).

In this study; the effects of some organic waste mulch materials were use to control weeds, which are a serious problem in tomato fields, were investigated and it was aimed to present alternative suggestions of herbicides with the results obtained.

2. Materials and Methods

The study was conducted in Igdir University Agricultural Application and Research Center (TUAM) (39°55'45.6"N 44°05'42.3"E) and Yüzbaşılar village of Igdir center (40°00'07.3"N 44°04'10.2"E) at two different locations in 2020. Glacier tomato variety was used in the study. The application amounts and general properties of the mulch materials used in the research are given in Table 1. Soil characteristics of the study area are given in Table 2. The climate data of 2020 and mean of long years (MLY) of the months in which the study was carried out are given in Table 3.

Table 1
Mulch materials used in the experiments, application rates and general characteristic

Treatmets	Application rates	General characteristics
Fine sawdust	4.000 kg/da	Poplar wood dust
Wood chips	3.000 kg/da	Poplar wood sawdust waste
Sheep wool	2.500 kg/da	6 and 12 months old morkaraman lamb's wool
Shredded paper	2.000 kg/da	1 cm vertically cut sheets of paper
Leaves of tree of heaven	2. 000 kg/da	Tree of heaven freshly plucked leaves

Table 2
Soil characteristics of the experimental areas

Soil Properties	Units	L1	L2
Profile Depth	cm	0-30	0-30
Constituent Class	-	Clay-Loam	Clay-Loam
Lime ($CaCo_3$)	%	11.32	11.05
Total Salt	mmhos/cm	2	2.01
pH	-	7.9	8.1
Phosphorus (P_2O_5)	kg da^{-1}	0.8	0.85
Potassium (K_2O)	kg da^{-1}	9.28	9.06
Organic Matter	%	1.8	1.85

Table 3
Climate data of the year 2020 and MLY (1941-2020) for the months in which the study was carried out (MGM 2020)

	Average Temperature (°C)		Total Precipitation (mm)		Average Relative Humidity (%)	
Months	2020	MLY(1941-2020)	2020	MLY(1941-2020)	2020	MLY(1941-2020)
March	10.44	6.2	18.1	22.1	65.6	52.2
April	11.49	13	83.6	33.8	76.6	49.9
May	18.8	17.7	76.1	46.5	63.1	51.5
June	24.19	22.1	15.7	32	48.3	47.3
July	26.7	25.9	30.2	13.7	48.4	45.3
August	24.2	25.3	15.3	9.7	47.6	47.1
September	23.5	20.4	1.4	11.5	47.7	46.2
October	14.5	13.1	7.3	26.3	49.6	48.53

Tomato Planting, Care and Experimental Set up

Tomato seedlings were planted on 17.05.2020 with a 80x80 cm inter and intra row spacing. The seedlings were planted along the furrow with 2/3 of their height under the ground and 1/3 above the ground when the soil was annealed. Before planting, 35 kg/da of NPK fertilizer was applied by mixing it into the soil. After planting the seedlings, the first irrigation was done with the drip irrigation system. Afterwards, tomato irrigation was done once a week. In both locations, the study was set up in a randomized complete block design with 4 replications and 7 characters. The size of the plots (4x1.5) was 6 m^2, the distance between plots were 0.5 m, and the distance between replications were 1.5 m, and the total experimental area was 325.5 m^2. Stake were fixed to the ground for parcellization and rope was used in the strips. The mulch materials in the study were laid on 25.06.2020 with 12 tomato seedlings in each plots. Care was taken not to cover the tomato plants while covering the mulch materials on the inter and intra rows.

Effect of Mulching on Weed Control

Weed densities in m^2 were asssessed three times in three months (25.07.2020, 25.08.2020, 25.09.2020) in order to determine the effect of different mulch materials (fine sawdust (wood dust), wood chips, sheep wool, shredded paper, tree of heaven leaves) used in tomato cultivation on weed emergence. Hoeing and hand weeding were done together with the emergence of weeds in the weed-free (hoe) plots. In order to determine the density of weeds in the applications, frames of 1 m^2 (1x1 m) were used. Weed density values determined for each assessment date were calculated using the following formulas belonging to Odum (1971). According to this; the densities in the applications were determined by dividing the total number of plants determined by the total area counted.

Density = T.Y. / n

T.Y. : Total density of each species in the counted areas (pieces)

n: Counted total area (m^2)

As suggested by Üstüner and Güncan (2002), density scale used as follows; Density scale,

A. High dense (average more than 10 weeds / m^2)

B. Dense (average 1-10 weeds / m^2)

C. Middle dense (average 0.1-1 weeds / m^2)

D. Low dense (average of 0.01 to 0.1 weeds / m^2)

E. Rare (average of less than 0.01 weeds / m^2)

The Effect of Mulching on Weed Dry Weights

In both locations, weeds were first assessed on the species basis in order to determine the weed species in the experimental area before the last harvest. Before the last harvest of tomatoes, weeds in all plots were cut from the soil base separately, put in paper bags and brought to the Igdir University Agriculture Faculty of Herbology Laboratory. After being kept in an oven at 70 °C for 24 hours in the laboratory, they were taken and their dry weights were weighed one by one and numerical data were recorded.

The Effect of Mulching on Tomato Yield and Yield Components

Tomato harvest were done between 23.07.2020-01.10.2020. Taking into account the market situation at harvest, tomato fruits were picked by hand pulling from the part where the fruit stem meets the branch, and properly plucked. The collected tomato fruits were taken to the Herbology Laboratory of the Faculty of Agriculture of the Sehit Bülent Yurtseven campus of Iğdır University; Fruit weight (g), fruit number per plant (piece/da) and yield (kg/da) values of tomato fruits collected in each plot were determined. The obtained values were compared with the weedy and weed-free (hoe) control plots.

Data analysis

As a result of the study, in order to determine the effects of mulching on weed control, weeds dry weight and tomato yield components, Duncan test was applied in SPSS 17.0 Package program and statistical analysis was done and the differences between the applications were evaluated.

3. Results and Discussion

Weed Species Detected in Experimental Areas

In the experimental areas (L1 and L2), a total of 17 weed species belonging to 9 families, including 1 narrow-leaved, 6 broad-leaved and 1 parasite, were determined. Of the detected weed species, 7 perennial, 9 annual and 1 parasite were determined. In addition,

Brassicaceae (4), Poaceae (3) and Amaranthaceae (3) come first in terms of the number of weeds among the 9 families identified, and least weeds in the families Asteraceae (2), Portulacaceae (2), Polygonaceae (1) and Convolvulaceae (1) has been identified. The distribution of the detected species according to the locations are given in Table 4.

It is seen that the weed species we detected in the results of the experiment are similar to a study conducted with weeds that were a problem in vegetable planting fields and overlap with *C. arvensis*, *C. album*, *Cuscuta* spp, *P. oleracea* and *S. halepense* species (Tepe 1998).

Table 4
Weed species detected in experiment areas

Family	Scientific Name	Common Name	Life Cycle	L1	L2
Narrow-leaved					
Poaceae	*Sorghum halepense* (L.) Pers.	Johnsongrass	P	×	×
	Setaria verticillata (L.) P.B.	Bristlegrass	A	×	×
	Cynodon dactylon (L.) Pers.	Bermuda grass	P	×	
Broad-leaved					
Amaranthaceae	*Chenopodium album* L.	Lambs quarters	A	×	×
	Atriplex nitens Schkuhr.	Garden orache	A	×	
	Suaeda altissima (L.) PALL	Seablite	A	×	×
Asteraceae	*Cirsium arvense* (L.) Scop.	Californian thistle	P	×	×
	Xanthium strumarium L.	Rough cocklebur	A	×	×
Brassicaceae	*Sinapis arvensis* L.	Wild mustard	A	×	×
	Descurainia sophia (L.) Webb. Ex Prant.	Flixweed	A		×
	Cardaria draba (L.) Desv.	Hoary cress	P	×	×
	Myagrum perfoliatum L.	Birdseye cress	A	×	×
Convolvulaceae	*Convolvulus arvensis* L.	Field bindweed	P	×	×
Fabaceae	*Alhagi pseudalhagi* (BIEB.) DESV.	Camel-thorn	P	×	×
Portulacaceae	*Portulaca oleracea* L.	Common purslane	A	×	×
Polygonaceae	*Polygonum aviculare* L.	Common knotgrass	A	×	
Parasite					
Cuscutaceae	*Cuscuta* spp.	Dodder	Parasite	×	×

Life Cycles; P: Perennial and A: Annual

The Effect of Applications on Coverage and Weed Density

In the first assessment made on 25.03.2020 in the plots different mulch materials were applied, it was determined that the highest weed density was in the weed control area (L1: 27.75; L2: 19.25 plant/m^2). In the L1 counts, this order is followed by sheep wool (7.25 plant/m^2), tree of heaven leaves (7.00 plant/m^2), wood chips (5.00 plant/m^2), fine sawdust (4.75 plant/m^2) and shredded paper (3.00 plant/m^2). Differences were observed in the counts in the L2 trial area, and the order was tree of heaven leaves (9.00 plant/m^2), fine sawdust (4.75 plant/m^2), sheep wool (3.25 plant/m^2), shredded paper (2.00 plant/m^2) and wood chips (1.50 plant/m^2). It was determined that the weed density in the weed-free plot was (L1: 0.00; L2: 0.00 plant/m^2). It is seen that the best mulch material is paper in the L1 and wood chips in the L2. (Table 5).

In the 2nd count held on 25.08.2020 in the trial areas; the highest weed density was determined in the weed control plots (L1: 42.00; L2: 38.25 plant/m^2). It was seen that sheep wool was mostly (11.00 plant/m^2) and shredded paper (4.25 plant/m^2) was the least effective mulch in the counts in the L1 plots. In L2 trials; tree of heaven leaves mostly (13.00 plant/m^2) and shredded paper (4.50 plant/m^2) was least effective mulch.

In the 3rd count held on 25.09.2020 in the L1 and L2, it was determined that the weed density was the highest in tree of heaven leaves plots (L1: 14.00; L2: 16.00 plant/m^2). Likewise, it was seen that shredded paper mulch (L1: 8.00; L2: 6.50 plant/m^2) was the least effective in the counts. As in both counts, weed density was not observed in the controlled plots without weeds in the 3rd count. It can be said that the results of all counts and waste mulch materials are statistically different from each other. (Table 5). Especially in the 2nd and 3rd counts where the results of weed coating densities were discussed; it is seen that the mulch that suppresses the weeds the most in L1 and L2 plots is the paper material. In a study carried out with tomatoes for 3 consecutive years; rice straw, barley straw, corn harvest residue, wormwood dried, black biodegradable plastic, brown kraft paper, polyethylene and brown kraft paper were used. It has been reported that the most resistant material against weeds is brown Kraft plot (Anzalone et al. 2010). In a study where organic tomatoes were grown and eight different mulch materials were applied, they stated that the best weed control was achieved with paper mulch material (Radics et al 2004). When the findings are compared with the previous studies, it is seen that the results are similar and paper is the best mulch material in weed control.

Table 5
The general covering areas of weeds detected in the plots in the counts

Treatmets	1st count (plant/m^2)		2nd count (plant/m^2)		3rd count (plant/m^2)	
	L1	L2	L1	L2	L1	L2
Tree of heaven leaves	7.00b	9.00b	10.75b	13.00b	14.00b	16.00b
Fine sawdust	4.75b	4.00c	9.00bc	5.75c	11.75bc	11.00c
Wood chips	5.00b	1.50cd	7.75bc	6.25c	10.00bc	12.00c
Shredded paper	3.00bc	2.00cd	4.25cd	4.50c	8.00c	6.50d
Sheep wool	7.25b	3.25cd	11.00b	8.75bc	13.00b	13.50bc
Weedy Control	27.75a	19.25a	42.00a	38.25a	48.50a	46.75a
Weed free Control	0.00c	0.00d	0.00d	0.00d	0.00d	0.00e
Mean	7.82b	5.57	12.10	10.92	15.03	15.10
F	91.7	59.82	152.23	177.75	224.12	307.30
P	0.00	0.00	0.00	0.00	0.00	0.00

*The values in each row and column are statistically different from each other (P≤0.01).

Table 6
Average densities of weed species in L1 and L2 mulch areas

	Density (plant/m^2)	
Scientific Name	L1	L2
Sorghum halepense (L.) Pers.	34.15	30.3
Setaria verticillata (L.) P.B.	2.25	1.75
Cynodon dactylon (L.) Pers.	3.05	0
Chenopodium album L.	0.8	0.5
Atriplex nitens Schkuhr.	0.5	0
Suaeda altissima (L.) PALL	0.2	0.4
Cirsium arvense (L.) Scop.	1.05	0.86
Xanthium strumarium L.	6.25	4.55
Sinapis arvensis L.	2.15	1.25
Descurainia sophia (L.) Webb. Ex Prant.	0	0.5
Cardaria draba (L.) Desv.	0.25	0.5
Myagrum perfoliatum L.	0.75	0.8
Convolvulus arvensis L.	4.25	3.75
Alhagi pseudalhagi (BIEB.) DESV.	0.75	0.5
Portulaca oleracea L.	0.5	0.5
Polygonum aviculare L.	0.2	0.2
Cuscuta spp.	0.5	0.2

When the effect of different mulch materials in tomato against weeding was examined, it was seen that *S. halepense* (L1: 34.15; L2: 30.3 plants/m^2) weed species emerged the most as a result of the censuses made in L1 and L2 areas. It has been determined that the least common weeds were *Atriplex nitens*, *Descurainia sophia* and *Polygonum aviculare* and very low emergence in other weeds (Table 6). Jodaugiene et al (2006) investigated the effect on the emergence of weeds using peat, turf, wheat straw, wood chips and wood shavings mulch materials. In the results of their study; they stated that mulching has more effects on annual weed emergence than perennial weeds. In the study conducted with wheat, barley, vetch, clover and canola as mulch plants, they stated that mulch applications in tomato significantly reduced weed density (Kaya and Kadıoğlu 2013). In our study, it is seen that the one-year weed density is less and our results are similar to the studies done.

Effect of Mulching on Weed Dry Weight

Duncan multiple comparison test was applied to determine the effect of different waste mulch (tree of heaven leaves, fine sawdust, wood chips, shredded paper and sheep wool) materials used in two different locations (L1 and L2) in tomato cultivation on weed dry weights. According to the results of the analysis, there was a statistical difference of P≤0.01 in terms of weed dry weights between mulch applications (Table 7).

When the effect of different waste mulch materials on weed dry weights in tomato was examined, the highest dry weight was obtained from the weed control plot (L1: 309.40 g/m^2 and L2: 254.55 g/m^2) in both locations. Among the mulch materials, the lowest weed dry weight is found in paper (L1: 97.63 g/m^2 and L2: 73.12 g/m^2) and the highest is found in tree of heaven leaves (L1: 191.87 g/m^2 and L2: 165.27 g/m^2) determined parcels (Table 7). Gurbuz et al. (2021), in the study in which 4 different weed wastes were used as mulch material in eggplant production; it was stated that the lowest weed dry weights were 72.50 g/m^2 in *Sorghum halepense* mulch and the highest value was obtained from 525.00 g/m^2 weedy control plots. In another study using paper, wheat straw and grass waste mulch materials in tomato production areas; the minimum weed dry weight was obtained from the paper (22 g/m^2) plot, and the

maximum weed dry weight were obtained from the weedy check plot (Tülek 2021). Alptekin and Gurbuz (2022) who found the lowest cucumber yield in weedy check plots reported similar results. The results of the study are in agreement with our results and proves that paper mulch is the most effective waste mulch material.

Table 7
Effect of mulching on weed dry weight (g/m^2)

Treatments	L1	L2
Tree of heaven leaves	191.87b	165.27b
Fine sawdust	150.70c	130.55c
Wood chips	127.15c	145.27bc
Shredded paper	97.63e	73.12d
Sheep wool	180.55b	152.47bc
Weedy Control	309.40a	254.55a
Weed Free Control	0.00f	0.00e
Mean	151.04	131.60
F	402.53	217.66
P	0.00	0.00

*The values in each row and column are statistically different from each other (P≤0.01).

Effect of Waste Mulch Materials on Tomato Yield

In order to determine the effect of different waste mulch materials on yield in tomato; the number of fruits per plant (pieces), fruit weight (gr), and yield (kg/da) parameters were evaluated. As a result of the measurements and analysis, it was observed that there was a statistically significant difference of 1% (P≤0.01) on the parameters (Table 8).

Compared to the control plots, in the study where different waste mulch materials were used in tomato yield; in both locations, the highest yield was obtained from shredded paper mulch (L1: 6.078.50 and L2: 6.807.87 kg/da). Afterwards, the average yield per plant was taken from wood chips, weed-free control, fine sawdust, sheep wool, tree of heaven leaves and weed control plots, respectively. Yield in L2 trial areas; wood chips, fine sawdust, weed-free control, tree of heaven leaves, wool and weed control plots (Table 8). Karaer (2020), stated that the highest yield was obtained from mulched plots in a 2 year study on tomatoes. Awodoyin et al. (2010) reported that they provided 52-88% yield in tomato yield by using different mulch materials. In a different mulch study, 44% yield was achieved in tomato (Biswas et al. 2015). In the production of tomatoes in India (dried sugarcane leaves, dried poplar leaves, rice straw and wild sugarcane) mulch materials were used to provide yield in tomatoes (Singh 1994). In the studies, it is seen that mulch materials are effective in increasing the yield in tomatoes and the results are similar to our study.

Table 8
The effect of mulching on tomato yield

	Yield (kg/da)		Fruit Weight (g)		Number of Fruits (Number/da)	
Treatments	L1	L2	L1	L2	L1	L2
Tree of heaven leaves	5.229.00c	5.548.30d	119.45cd	119.06de	43.893.78a	46.627.41a
Fine sawdust	5.710.27b	6.131.75c	127.60bc	132.32bc	44.799.48a	46.447.25a
Wood chips	5.875.20ab	6.421.70b	128.35bc	140.35ab	45.774.83a	45.779.56a
Shredded paper	6.078.50a	6.807.87a	142.67a	147.35a	42.627.89a	46.206.70a
Sheep Wool	5.567.92bc	5.431.90d	122.60c	118.15de	45.466.28a	46.015.86a
Weedy Control	3.817.25d	4.022.65e	107.80d	111.80e	35.430.94b	35.978.41b
Weed Free Control	5.826.20ab	5.917.87c	135.38ab	128.33cd	43.029.59a	46.110.20a
Mean	5.443.47	5.754.57	126.26	128.19	43.003.26	44.737.91
F	96.40	260.20	19.42	30.05	18.437	39.177
P	0.00	0.00	0.00	0.00	0.00	0.00

*The values in each row and column are statistically different from each other (P≤0.01).

The highest tomato fruit weights were obtained from shredded paper mulch plot (L1: 142.67 g and L2: 147.35 g). In L1 plots, this yield was followed by weed-free, wood chips, fine sawdust, sheep wool, tree of heaven leaves and weedy plots, respectively. In the L2, after the paper mulch, the most effective mulches in fruit weight are; wood chips, fine sawdust, weed-free, tree of heaven leaves, sheep wool and weedy control parcels (Table 8). In tomato production (rice straw, kans grass and dencha husk), it increased the fruit yield of organic materials by 21.5-28.8 t/ha (Agarwal 2022). The effects of different soil mulches on field performance, yield and fruit quality of greenhouse tomato (*L. esculentum*) were investigated. The highest yield and large fruits were obtained from compost mulch (Abubaker 2016). The highest effect on the number of tomato fruits in L1 conditions was obtained from rough sawdust (45.774.83 number/da) mulch. In L2 parcels; the best results were obtained from tree of heaven leaves (46.627.41 number/da). The lowest results were obtained from the weed control plots (L1: 35.430.94; L2: 35.978.41 number/da) in both locations. In the study, three different mulches were used in cherry tomato cultivation; the highest fruit yield was obtained from rice straw mulch (Rodríguez Rodríguez 2007). In a different study; it has been reported that organic straw mulch has significant effects on the yield and quality of tomatoes (Ozer 2017). When our results are compared with our control groups; the use of paper mulch in fruit yield and weight; in the number of fruits, it is seen that sawdust and tree of heaven leaves mulches provide a high effect. It can be said that our study findings are similar to other studies results

4. Conclusion

In the current study, the most effective waste mulch material in tomato weed control was shredded paper in both locations (L1 and L2). The shredded paper material inhibits photosynthesis by blocking light and slows water uptake, allowing proper penetration of water into

the soil, preventing the emergence and growth of weeds. Shredded paper and other waste mulch materials are cheaper and easier to obtain products for farmers and producers than chemical control and polyethylene mulch. The fact that these products are easily decomposed in the soil and are not harmful to the environment, people and products reveals a good alternative weed control methods. It is thought that these waste products can be used as mulch materials especially in the transplanted tomato crop and in organic agriculture and will contribute to the country's economy.

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