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SUNFLOWER RESIDUES FOR WEED MANAGEMENT IN RADISH AND CARROTS

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Abstract: Radish *(Raphanus sativus* L.) and carrot (*Daucus caraota* L.) are two crops of food and commercial interest in the world and in Mexico. The presence of weeds affects crop production and quality, so it is necessary to know the species, management and control of weeds. In general, this is done through the application of herbicides that can contaminate the products and the soil. The objective of the study was to determine the effect of the application of sunflower receptacle on weeds in radish and carrots, as well as on the production and agronomic characteristics of these crops. The study was carried out in field conditions under rainfall regime in Montecillo, Texcoco, Mexico, (19° N and 98° W and 2250 masl) of temperate climate. Carrot (cultivar Nantes) and radish (ball) were planted in beds of0.80 metros by 2.0 m, in a frame of 20 cm X 20 cm. The treatments consisted of: 1) incorporation of 3.5 kg of dried and ground sunflower receptacle to the soil and 2) no incorporation of sunflower receptacle (control), with a total of 30 plants per bed. The application of sunflower residues on radish and carrot reduced the weed population. The weed species found in the crops were grasses, *Galinsoga, Brassica, Urocarpidium, Chenopodium, Simsia, Portulaca, Salvia and Amaranthus.* The application of sunflower residues caused increases in fresh weight, diameter and length of radish and carrot.
Keywords: weed species, fresh weight, number of leaves, diameter and length.

INTRODUCTION

Radish *(Raphanus sativus* L.) and carrot (*Daucus caraota* L.) are two crops of food and commercial interest in the world and in Mexico. The presence of weeds affects crop production and quality, so it is necessary to know the species, management and control of weeds. In general, this is done through the application of herbicides that can generate contamination in the products and soil. To avoid this, an alternative is the use of products derived from plants containing allelochemicals (Rodriguez *et al.* 1994 and Weston, 1996). In this regard, some studies in beet *(Beta vulgaris L.*) have shown control of weeds occurring in the crop (Rodriguez *et al.,* 2021). Residues (husk) have also been used as a substrate for edible mushroom production (Super campo,2019). The incorporated sunflower receptacle improves soil structure and nutrients. This practice can be applied in particular by smallholder farmers. The objective of the study was to determine the effect of sunflower receptacle application on weeds occurring in radish and carrot crops, as well as on the yield and agronomic characteristics of these crops.

MATERIALS AND METHOD

LOCATION AND SOIL TYPE

The study was conducted in field conditions under rainfall conditions in Montecillo, municipality of Texcoco, State of Mexico, Mexico, (19° 29' N and 98° 53' W and 2250 masl) with a temperate climate (Garcia, 2005). The soil is silty-clay, with pH 7.6, EC of 1.9 dS $m^{-1}$and MO of 3.5%.

SOWING, TREATMENTS AND EXPERIMENTAL DESIGN

Carrot (cultivar Nantes) and radish (ball) were planted in beds of0.80 metros by 2.0 m, in a frame of 20 cm X 20 cm. The treatments consisted of: 1) incorporation to the soil of 3.5 kg of dry and ground sunflower receptacle (CR) and 2) without incorporation of sunflower receptacle (control). 30 plants per bed were planted in total.

VARIABLES UNDER STUDY

Weeds

To count the number of species, number of individuals (NI) per weed species 45 days after planting, a 50 * 50 cm quadrat was used. The percentage of control (PC) was calculated for the sunflower residue, using the following approach: PC (%) = [1- ((DMT - DMG)/ DMT)]*100.where DMT= is the total density of weeds; DMG = is the density of weeds with sunflower receptacle incorporation.

RADISH AND CARROT

In the crop, both in radish (thickened hypocotyl) and carrot (napiform root), 20 plants were taken from the plot to record on average per plant: fresh weight (g), number of leaves, diameter and length of the subway structure.

RESULTS AND DISCUSSION

WEEDS

When counting the species and NI by species, no differences were found between crops. Table 1 shows that grasses had the highest NI, followed by *Galinsoga, Brassica, Urocarpidium, Chenopodium, Simsia, Portulaca, Salvia and Amaranthus*. The incorporation of dried and ground sunflower receptacle (RG) controlled the NI in the weed species present in the crops. Those that showed the greatest reduction (86 to 43%) in NI were, in order of control: *Salvia, Chenopodium, Galinsoga, Brassica*, grasses, *Simsia, Urocarpidium*. *Portulaca* was not affected by GR. In contrast, *Amaranthus* did not appear in the sunflower plots.

RADISH AND CARROT

The growth of radish and carrot was higher where sunflower was incorporated. Due to the lower weed population and improved soil structure, which presents less physical restriction for the growth of radish and carrot. In addition, the sunflower receptacle decomposing in the soil increases its fertility, which has also been indicated in sugarcane by Toledo *et al.* (2008). Thus, Table 1 shows that in addition to the 20% increase in FP, NH was not affected, diameter and length increased by 33% and 30%, respectively. Similar trends have been reported in beets by Rodriguez *et al.* (2021). In the case of carrot, the data in Table 2 indicate that FP increased by 54%, NH by 9%, diameter by 40% and length by 28%,

Treatment	PF (g)	NH	Diameter (cm)	Length (cm)
SR	95 b	8 a	6 b	**7 b**
CR	120 a	8 a	9 a	**10 a**
Tukey 0.05	**12**	**2**	**2**	**2**

Table 1. Fresh weight (g, FP), number of leaves (NH), equatorial diameter and length of subway structure of radish. Average data per plant at 45 days after sowing. Montecillo, Mex. 2018.

SR = without receptacle; CR = with receptacle; FP = fresh weight; NH = number of leaves. In columns values with similar letters are statistically equal.

Carrot treatment	PF (g)	NH	Diameter (cm)	Length (cm)
SR	32 b	11a	3b	**10 b**
CR	70 a	12 a	5 a	**14 a**
Tukey 0.05	**20**	**2**	**1**	**2**

Table 2. Fresh weight (g, FP), Number of leaves (NH), equatorial diameter and length of the subway structure of carrot .Average data per plant at 45 days after sowing. Montecillo, Mex. 2018-

SR = without receptacle; CR = with receptacle; FP = fresh weight; NH = number of leaves; in columns values with similar letters are statistically equal.

No. of weeds	SR weed species Witness	No. of weeds	Weed species CR	% of control
147	*Gramineas*	39	*Grasses*	73 %
11	*Simsia amplexicaulis*	4	*Simsia amplexicaulis*	63 %
42	*Galinsoga parviflora*	9	*Galinsoga parviflora*	78 %
7	*Salvia tilifolia*	1	*Salvia tilifolia*	86 %
15	*Urocarpidium jacens*	8	*Urocarpidium jacens*	47 %
12	*Chenopodium murale*	2	*Chenopodium murale*	83 %
9	*Portulaca oleracea*	11	*Portulaca oleracea*	0 %
17	*Brasica campestris*	4	*Brasica campestris*	76 %
7	*Amaranthus hybridus*			

Table 1. Species and number of individuals per weed species in the radish and carrot planting beds. Average data 45 days after sowing. Montecillo Méx. 2018

These results confirm the weed control of the sunflower receptacle, by means of its allelochemicals, as previously indicated by Rodriguez *et al.*(1994), Fuentes (1998) and Rodriguez *et al.* (2021), which in addition to reducing the number of individuals per species causes less competition for inputs for crop growth, together with the improvement of the structure, fertility and water retention of the soil leads to greater growth and fresh weight of radish and carrot. Crops such as amaranth can also present allelopathic compounds that reduce the weed population and even inhibit the growth of amaranth itself (Tejeda *et al.*, 2001).

CONCLUSIONS

The application of sunflower residues on radish and carrot reduced the weed population.

The weed species found in the crops were grasses, *Galinsoga, Brassica, Urocarpidium, Chenopodium, Simsia, Portulaca, Salvia and Amaranthus.*

The application of sunflower residues caused increases in fresh weight, diameter and length of radish and carrot.

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