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BEHAVIOR OF SOME CARROT CULTIVARS (*Daucus carota* L.) DURING 2016, IN VIDRA AREA

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Abstract
The experimental material was represented by five carrot cultivars: 3 varieties (Berlikum, Flakkee and Chantenay Red Cored) and two hybrids (Warmia F1and Fidra F1). Depending of the cultivar, the root length varied between 10.8 cm (Flakkee) and 14.1 cm (Chantenay Red Cored), the root diameter between 2.4 cm (Flakkee) and 3.9 cm (Chantenay Red Cored) and the average weight of roots between 84.5 g (Flakkee) and 130.2 g (Chantenay Red Cored). The yield was between 38.8 t/ha (Flakkee) and 60.2 t/ha (Chantenay Red Cored). Also, Berlikum carrot variety had a high yield (57.6 t / ha). In the climate conditions of Vidra area, variety Chantenay Red Cored recorded the highest values for all studied parameters (root length, root diameter, average root weight and yield). In comparative crops with carrot cultivars, it was manifested the attack of pathogens Alternaria solani (early blight) and Erysiphe umbelliferarum (powdery mildew) starting with third decade of August. There were observed differences regarding the behavior of the studied cultivars to the pathogens attack.

Keywords: cultivars, Daucus carota, pathogens, yield

1. INTRODUCTION

Carrot is one of the most important vegetable species, which is the first place as surface from the roots vegetables group. Worldwide, the largest areas grown with carrot are in China, Oman, Russia, Ukraine, India and USA. In Europe, Romania ranks 4th as the surface cultivated with carrots, with an area of 16,047 ha, after Russia, Ukraine and Poland. The highest yield was obtained in Iceland, UK, Belgium, Austria and Sweden (FAO, 2014).

Carrot roots are rich in carbohydrates (9g/100g fresh substance), water (88%) mineral salts (35mg calcium, 40mg phosphorus, 332mg potassium, 0.6mg iron, 41mg sodium, 19mg magnesium/ 100g fresh substance), vitamins (9mg vitamin C, 0.35mg vitamin B1, 0.06mg vitamin B2/ 100g fresh substance) and low in protein, fat and fiber (Rubatzky et al., 1999).

2. MATERIAL AND METHOD

Five carrot cultivars were studied: Berlikum, Flakkee, Warmia F1, Fidra F1 and Chantenay Red Cored. The experience was placed in randomized blocks in 4 replicates with the following experimental variants: 1. Berlikum (figure 1), 2. Flakkee (figure 2), 3. Warmia F1 (figure 3), 4. Fidra F1 (figure 4) and 5. Chantenay Red Cored (figure 5).

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Fig. 1 Berlikum cultivar

Fig. 2. Flakkee cultivar

Fig. 3. Warmia F1 hybrid

The Fidra F1 cultivar is earlier, Warmia F1 and Chantenay Red Cored demy-late, Berlikum and Flakkee late, for fresh consumption, industry and long-term storage.

Fig. 4 Fidra F1hybrid

Fig. 5 Chantenay red cored cultivar

The sowing was done on May 30, 2016. There were sown two bands with two rows each, according with the following scheme: 100 cm - 10 cm - 30 cm - 10 cm - 100 cm (fig. 6). The depth of sowing was 1-1.5cm, and the distance between seed on a row, 2-3cm. Five days after sowing, there was applied Stomp 330EC in a rate of 5 l / ha.

During 2017 year, the average temperature between June - October was higher than the multiannual average for the period 1981 - 2010 (Tables 1 and 2), with 1.2 - 2^0C. Atmospheric humidity was lower than the multiannual average compared with the reference period, except the month of June, which had values close to the multiannual average.

In the year 2016, characterized by a droughty

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summer, with only very few rainfalls, in July only 2 mm, pathogens attack occurred due to abundant precipitation in the last part of August (only on 23 August fall down 58 l / sq m).

Table 1. Climatic data in the field (Vidra 2016)

Month	Temperature (^{0}C)			Atmospheric humidity (%)			The precipitations amounth (mm)
	average	minimum	maximum	average	minimum	maximum	
June	21.9	16.1	28.4	71.3	56.8	89.5	33.5
July	23.7	17.0	31.0	59.7	48.1	78.3	2.0
August	23.4	17.5	30.6	60.6	49.5	77.2	110.0
September	18.9	13.1	26.3	62.8	51.9	80.2	43.5
October	12.3	6.9	13.8	78.7	71.2	87.1	85.0

Table 2. Multi-annual average of climatic data, Bucharest (1981 - 2010)

Month	Temperature (^{0}C)			Atmospheric humidity (%)	The precipitations amounth (mm)
	average	minimum	maximum		
June	20.6	13.6	27.7	70	83
July	22.5	15.4	29.8	68	70
August	22.0	14.9	29.8	68	56
September	16.9	10.5	24.6	73	64
October	11.0	5.4	17.9	79	59

In September, there were applied two treatments for controlling *Alternaria dauci* and *Erysiphe umbelliferarum* pathogens with Sygnum 33.4WG 1 kg / ha and Flint Max 75 WG 0.3 kg / ha.
During the vegetation period there were made observations regarding the occurrence and evolution of *Erysiphe umbelliferarum* (powdery mildew) pathogen attack and *Alternaria dauci* (alternaria leaf blight), and during storage time for *Sclerotinia sclerotiorum* (white rot) attack.
At harvest (4 October), there were made the following determinations at carrot roots: length, root diameter, average root weight and yield (t/ha).
The total K, Na, Ca, P, and Fe content in the roots was determined on fresh substance with an inductively coupled plasma optical spectrometer (Optima 8000 - Perkin Elmer spectrometer). Water and dry matter content was determined after drying of fresh material at 105^{0}C.

3. RESULT AND DISCUTIONS

Analyzing the behavior of carrot cultivars, compared to the average of the experience, we can see that in 2016, at Vidra, the best results were obtained with the Berlikum and Chantenay red cored varieties with a very positive production (Table 3).

Table 3. The main characteristics of carrot cultivars

Cultivar	Root type	Root color	Root length (cm)	Root diameter (cm)	Average weight of roots (g)	Yield (t/ha)	Relative yield compared with average (%)
Berlikum	Berlikum	orange red	11.2	2.8	110.2	57.6^{xxx}	116.3
Flakkee	Flakkee	orange	10.8	2.4	84.5	38.8^{000}	78.3
Warmia F1	Flakkee	dark orange	11.7	3.2	90.3	48.5	97.9
Fidra F1	Nantes	dark orange	12.2	2.8	89.6	42.3^{000}	85.5

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Chantenay Red Cored	***Chantenay***	***orange red***	***14.1***	***3.9***	***130.2***	***60.2^{xxx}***	***121.6***
Experience average(Mt)	***-***	***-***	***12.0***	***2.4***	***100.9***	***49.5***	***100.0***
					LD 5%	***1.52***	
					LD 1%	***2.14***	
					LD0.1%	***3.02***	

The Flakke and Fidra F1 varieties gave the worst results with a significantly negative production difference compared to the average of the experience (Table 3).

Table 4. The chemical composition of cultivars carrot roots

Cultivar	***Water content (%)***	***Dry substance (%)***	***Composition in mineral elements (mg/ 100 g dry substance)***					
			Na	***K***	***Mg***	***Ca***	***P***	***Fe***
Berlikum	***88.55***	***11.45***	***204.4***	***145.7***	***7.1***	***31.5***	***9.0***	***1.3***
Flakkee	***87.88***	***12.12***	***129.0***	***168.1***	***8.1***	***40.1***	***10.5***	***1.0***
Warmia F1	***84.51***	***15.49***	***165.7***	***210.5***	***2.2***	***59.2***	***21.3***	***2.7***
Fidra F1	***87.04***	***12.96***	***143.3***	***202.7***	***9.6***	***34.0***	***9.5***	***2.3***
Chantenay Red Cored	***88.44***	***11.56***	***93.3***	***257.6***	***13.1***	***31.7***	***12.0***	***3.6***

Because the pathogen attack has starting with third decade of September, it has not influenced significantly the yield.

Fig. 7 Attack of *Alernaria dauci* on carrot leaves

Fig. 8 Attack by *Erysiphe umbelliferarum* on carrot leaves

Table 5. Behavior of carrot cultivars to the pathogens attack

Cultivar	***Attack rate (%) on the leaves***		***Frequency of roots attacked (%)***
	Alternaria dauci	***Erysiphe umbelliferarum***	***Sclerotinia sclerotiorum***
Berlikum	***23.4***	***2.7***	***0***
Flakkee	***7.3***	***30.8***	***0***
Warmia F1	***25.3***	***1.2***	***0***

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Fidra F1	***11.8***	***15.9***	***0***
Chantenay Red Cored	***18.5***	***13.6***	***1.3***

Flakkee and Fidra F1 cultivars were less sensible to the *Alternaria dauci* attack. At the same time Warmia F1 and Berlicum F1 were less sensible to *Erysiphe umbelliferarum*.

4. CONCLUSION

1. Depending of the cultivars , the rooth lenght varied between 10.8 cm (Flakkee) and 14.1 cm (Chantenay Red Cored).
2. The root diameter was between 2.4 cm (Flakkee) and 3.9 cm (Chantenay Red Cored) and the average weight of roots between 84.5 g (Flakkee) and 130.2 g (Chantenay Red Cored)
3. The yield ranged between 38.8 t/ha (Flakkee) and 60.2 t/ha (Chantenay Red Cored). Also, Berlikum carrot variety had a high yield (57.6 t/ha).
4. in the climate conditions of Vidra Ilfov area, variety Chantenay Red Cored recorded the highest values for all studied parameters.
5. There were observed differences regarding the behaviour of studied cultivars to the pathogens attack *Alternaria dauci* and *Erysiphe umbelliferarum*. Flakkee and Fidra F1 varieties are less sensible to *Alternaria dauci* attack. At the same time Warmia F1 and Berlikum F1 are less sensible to *Erysiphe umbelliferarum.*

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