

The Establishment of Technological Sequences for the Culture of Carrot

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Abstract. The carrot is a species belonging to the group of root vegetables, important for the use in human nutrition. The emergence of a diverse variety of carrots characterized by new cultivars (hybrids and varieties), with different growing seasons, requires an appropriate technology for each region of the country. The experience was set up in 2011, in Cluj County, on an experimental group in three randomized repetitions. The following experimental factors were taken into consideration: the cultivar ('Nantes' and 'Flakker'), the sowing period (March and May) and the mode of fertilization (organic and chemical). The procedure for the determination of the production was by weighing, and expressed in tones/hectare. It can be noted that chemical fertilization had a positive influence on the production. Moreover, it appears that 'Flakker' variety, sown in March and chemically fertilized recorded the highest production of 35.07 t/ha, obtaining a distinctively significant production increase of 5.72% as compared to the 'Nantes' variety, sown in March and chemically fertilized. The sowing period had a negative impact upon production as the crops sown in March had a yield of 29.25 t/ha as compared to the crops sown in May that recorded a difference of -1.75% which is significant.

Keywords: carrot, production, fertilization, cultivar

INTRODUCTION

The carrot is one of the vegetables that enter in the daily diet of human. Cultivation of carrots in different parts of our country requires knowledge of cultivars, application of more performing technology, so that maximum efficiency is achieved with low efforts. The length of vegetation period directly influences the production especially for hybrids (Anagnoste, 2012). Changing the assortment of cultivars has increased the productivity by 15-20%, new varieties of plants created accumulates soil nutrients better and are more receptive to agrotechnical measures (Gaučienė, Viškelis 2001, Karklelienė *et al.*, 2007), as well as to environmental factors. Rubatzky *et al.* (1999) shows that there is no defined stage of maturity of carrots harvested compared to other vegetable. Determining the appropriate harvest maturity will be variable depending on the varieties, the use, market conditions and other factors.

Carrot crop fertilization can affect production especially in heavy soils, where supply is difficult because heavier elements decompose, roots will be deformed and poorly colored (Guiu, 2009). For one tonne of roots, the plants extract from soil 2.2-7 kg N, 0.9-1.5 kg P₂O₅, 6.2-8 kg K₂O, 1.5-2 kg CaO and MgO (Apahidean, 2003).

MATERIALS AND METHODS

Carrot cultivars used in this experience were 'Nantes' and 'Flakker'. 'Nantes' variety was approved in Romania on November 1952. It has a less developed leaves rosette, 6-8 leaves

with thin petiole. Thickened root is cylindrical, with prominent neck and rounded top, typical for 'Nantes' variety.

Root length is about 15-19 cm long, red-orange colored, with small central cylinder which is about 1/3 from diameter of the root. 'Flakker' is a Dutch cultivar, obtained in 1937 and breed continuously. Leaves rosette is well developed. Thickened root is conical, 18-22 cm long, with large neck of 5-6 cm, slightly rounded on top. Root has orange color, medium-sized central cylinder slightly lighter than the rest of the root. 'Flakker' is a late variety, very productive and resistant to winter keeping.

Experience was placed by subdivided blocks method in three repetitions and the experimental plot area was of 16 m². First carrot culture was sown on March 30, 2011 and the second crop on May 28, 2011. Crop fertilization was performed with two types of fertilizers, respectively organic (cattle urine) and chemical (N:P:K 16:16:16). Fertilizers were applied four times every two weeks after the plants had four to five true leaves.

Production was obtained by weighing each repetition, for each variant being considered the average of variant, expressed in tonnes/ha. Statistical data processing was performed by analysis of variance and Duncan test.

RESULTS AND DISCUSSIONS

Referring to cultivars used it can be said that the two varieties registered good yields (Tab. 1), of 25.52 t/ha at 'Nantes' and 31.23 t/ha at 'Flakker'.

Analyzing the unilateral influence of cultivar used in the experiment, it can be observed that 'Flakker' variety registered a distinct significantly production increase (5.72 t/ha) compared to 'Nantes' variety taken as control.

Tab. 1

The influence of cultivar on carrot production

Cultivar	Total average yield		Difference	Significance
	t/ha	%		
'Nantes' (Control)	25.52	100	-	-
'Flakker'	31.23	122.4	5.72	**
LSD (p 5%)			1.23	
LSD (p 1%)			2.85	
LSD (p 0.1%)			9.06	

In 2011, the delay in seeding time had a negative influence on the carrots culture. It can be seen a decrease in average production of lots seeded in May (late seeded) with 4.12 t/ha from the average total production obtained in plots seeded in March (early seeded), the difference being distinctly significant negative (Tab. 2). The average yield recorded in plots seeded early was 30.43 t/ha and in those seeded late was 26.32 t/ha, maintaining the same technology (except seeding period).

Production in the experimental plots was differently influenced by the two types of fertilizers used during the vegetation period (Tab. 3). Average production obtained in chemically fertilized plots was 29.25 t/ha. Organic fertilization influenced significantly the production (-1.75 t/ha) compared to chemically fertilization.

Tab. 2

The influence of seeding period on carrots production

Seeding period	Total average yield		Difference	Significance
	t/ha	%		
Early (Control)	30.43	100	-	-
Late	26.32	86.5	- 4.12	00
LSD (p 5%)			1.27	
LSD (p 1%)			2.11	
LSD (p 0.1%)			3.94	

Tab. 3

The influence of fertilization on carrots production

Fertilizer	Total average yield		Difference	Significance
	t/ha	%		
Chemical (Control)	29.25	100	-	-
Organic	27.50	94.0	- 1.75	0
LSD (p 5%)			2.11	
LSD (p 1%)			3.06	
LSD (p 0.1%)			4.60	

Table 4 includes results of the combined influence of two factors studied: cultivar and sowing period. The highest average total production (33.65 t/ha) was recorded by 'Flakker' variety, sown in the early period (March).

Tab. 4

The influence of cultivar and sowing time on carrots production

Cultivar	Seeding dates	Total yield		Difference ± (t/ha)	Significance
		t/ha	%		
'Nantes' (Control)	Early	27.22	100	-	
'Flakker'	Early	33.65	123,6	6,43	**
'Nantes'	Late	23.82	100	-	
'Flakker'	Late	28.82	121,0	5,00	**
LSD (p 5%)					2.38
LSD (p 1%)					3.78
LSD (p 0.1%)					7.10

'Flakker' variety sown early provides an increased production that is significantly distinct compared with the production of 'Nantes' variety, sown early, taken as control variant. Even the lately period of sowing of the variety 'Flakker', provides a statistically significant increase of production (6.43 t/ha) compared to control.

The combined influence of factors: cultivar and fertilizer on total production of carrots is presented in Tab. 5.

Regardless of the fertilizer used, 'Flakker' variety has higher production, respectively 33.08 t/ha in chemical fertilization, and 29.38 t/ha in the organic fertilization compared to 'Nantes' variety. On chemical fertilization at 'Flakker' variety was obtained a statistically very significant yield increase (7.67 t/ha) than yields from 'Nantes' variety, chemically fertilized,

considered as control. Organic fertilization of ‘Flakker’ variety has ensured a distinct yield increase (3.77 t/ha) in comparison with chemically fertilization of ‘Nantes’ variety.

Tab. 5

Influence of cultivar and fertilization on carrots production

Cultivar	Fertilizer	Total yield		Difference ± (t/ha)	Significance
		t/ha	%		
‘Nantes’ (Control)	Chemical	25.42	100	-	
‘Flakker’	Chemical	33.08	130.2	7.67	**
‘Nantes’	Organic	25.62	100	-	
‘Flakker’	Organic	29.38	114.7	3.77	**
LSD (p 5%)				1.73	
LSD (p 1%)				3.30	
LSD (p 0.1%)				8.15	

Analyzing the combined influence of the three factors studied on the carrots production (Tab. 6.), it can be appreciated that ‘Flakker’ variety, seeded in March and chemical fertilized, recorded the highest production (35.07 t/ha).

‘Flakker’ (35.07 t/ha and 32.23 t/ha) and ‘Nantes’ (27.90 t/ha and 26.53 t/ha) varieties sown in March, as it can be seen in Tab. 6, registered high yields on both organic and chemical fertilization. It can be said that a positive influence on production was sowing period.

Tab. 6

The influence of combined factors on carrots production

Cultivar	Seeding period	Fertilizer	Production (t/ha)	Significance*
‘Nantes’	May	Organic	23.33	A
‘Nantes’	May	chemical	24.30	AB
‘Flakker’	May	Organic	26.53	AB
‘Nantes’	March	chemical	26.53	AB
‘Nantes’	March	organic	27.90	BC
‘Flakker’	May	chemical	31.10	CD
‘Flakker’	March	organic	32.23	CD
‘Flakker’	March	chemical	35.07	D

SD 4.12-4-62 * Values marked with different letters are significant

CONCLUSION

The genotype had a major role in influencing carrots production. The most valuable variety, as regard of carrot production, proved to be ‘Flakker’, which recorded a yield of 35.07 t/ha. The late period of sowing of the variety ‘Flakker’, provides a statistically significant increase of production (6.43 t/ha) compared to control. ‘Flakker’ variety has higher production, respectively 33.08 t/ha in chemical fertilization, and 29.38 t/ha in organic fertilization compared to ‘Nantes’ variety.

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