Scientific Papers, USAMV Bucharest, Series A, Vol. LII, 2009, ISSN 1222-5339

RESEARCH REGARDING BIOLOGICAL CARROT CROP IN ROMANIA

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Keywords: *carrot culture, biological culture, organic fertilizers*

Abstract

The research is aimed at establishing the optimum doses of organic fertilizers that can be applied to carrot culture in an organic system, correlated with high quality and quantity.

Therefore, in 2007 we carried out an experiment in which the organic doses applied had six degrees (2, 4 and 6 kg cow manure/m^2 and 2, 3 and 4 chicken manure/m^2). The biological material used was the De Nantes carrot.

Harvests were made during two periods, and analyses were also performed to determine the quality and quantity of the carrot crop. Every harvest included carrot measurements, analytic analyses of nitrates that characterize the quality of vegetables. The crop was registered and statistical interpretation of the results was performed.

The results obtained show that cow manure fertilization determined a better carrot development in diameter and length, compared with the chicken manure variants. The highest carrot roots were obtained in variants 2 and 3 fertilized with 6 and 8 kg cow manure/m^2.

Nitrates accumulated with high intensity in the middle phase of harvest; the nitrates content accumulated in carrots were under the maximum admissible limits of 400 ppm mentioned in literature and the Romanian law of vegetable quality [2]. The carrot crop was significantly influenced by the culture fertilization with 6 and 8 cow manure/m^2.

INTRODUCTION

Organic agriculture is an alternative to the usual modern agricultural practices, an intensive one whose main objective is to obtain agro-food products with a high content in biological active substances, so that they do not negatively influence human health and environment. That practice is aimed at increasing soil organic matter by using natural organic fertilizers (manure, compost, green fertilizers), and is an important sector for Romania which provides numerous development opportunities and is a tool in conservation of nature and revival of rural space.

Among the characteristics of agro-food products that must be strictly verified, there are nitrates, phosphorus, potassium, heavy metals and pesticide contents [2, 4, 5].

The aim of this research was to establish the optimum doses of organic fertilizers correlated with establishing the quality and quantity obtained from some vegetables cultivated in an organic system.

MATERIAL AND METHODS

The experience was carried out at the Vegetable Department of USAMV Bucharest, on an unprotected solarium, on a 120 m^2 area. The incorporation of organic fertilizers was made in six doses (4, 6 and 8 kg cow manure/m^2 and 2, 3 and 4 chicken manure/m^2), at the same time with the preparation of soil and at the beginning of the culture. Every variant had 10 m^2 total area.

The De Nantes carrot was sown on 16 March 2007 whereas emergence was on 2 April 2007.

During the vegetation period, nursery practices were applied according to the culture technology; the first weed was recorded on 11 May 2007 and the second on 8 June 2007, when roots recorded a pencil size. Harvest was made 120 days after the emergence, on the 13 July 2007. At harvest biometrical measurements, agrochemical characteristics were made, to characterize the quality and quantity of the crop.

The analyses performed were agrochemical, regarding nitrates, phosphorus and potassium. The methodology used was standard, i.e. STAS 11581-83 for nitrates, phosphorus and potassium. The crop was then registered, and statistical interpretation was made.

RESULTS AND DISCUSSION

At the beginning of the experiment, soil was sampled from the solarium, and the main agrochemical indicators were determined, as follows: pH, soluble salts, macro elements and heavy metals contents as well as pesticides that could affect the crop quality. The results obtained showed that the soil had an average content of nitrogen, and low contents of phosphorus and potassium (table 1).

Table 1

Analysis of soil agrochemical indices before sowing

Specification	pH	Soluble salts (%)	Content (ppm)			
			$N\text{-}NH_4^+$	$N\text{-}NO_3^-$	$P\text{-}PO_4^{3-}$	K^+
Soil	6.20	0.065	2.8	27.3	29.3	102

The heavy metals contents were within normal limits because Romanian soils record Cu element in normal limits of 50 ppm, Zn between 100-300 ppm, Pb-20 ppm and Cd between 3-5 ppm. Pesticide content was low (table 2).The organic fertilizers used in experiment were analyzed (table 3).

The biometric measurements regarding the development of carrot plants show the influence of nutritive element contents of the soil exceeding the carrot size and length (table 4), as well as the quantity of crop g/plant.

Table 2

Analysis of heavy metals at the beginning of culture

Specification	Heavy metals content (ppm)				Pesticides content (µg/kg)	
	Cu	Zn	Pb	Cd	DDT	HCH
Soil	27.3	76.2	5.6	0.13	undetectable	undetectable

Table 3

Analysis of organic fertilizers used in the experiment

No.	Specification	N (%)	P (%)	K (%)
1	Cow manure	0.61	0.17	0.59
2	Chichen manure	1.12	0.87	0.35

In the intermediary phase of vegetable culture, carrot lengths (mm) vary between 115.5 mm in the control and 164.16 mm in variant 3 fertilized with 8 kg cow manure/m^2. The effect of organic fertilizers could be shown on the average carrot length because the value of the control was under the values of the other experimental variants fertilized with cow and chicken manures. The same was also observed in the case of medium size of the carrots, which were between 13.63 mm in the control and 18.10 mm in variant 2 fertilized with 4 kg cow manure/m^2.

From the results, it can be observed that fertilization with cow manure has a more favorable influence upon the development of carrot size and lengths in variants 1, 2, 3.

The average weights of the pencil-sized carrots varied between 6.68 g/roots in the control and 13.43 g/root in variant 2 fertilized with 4 kg cow manure/m^2. It can be noticed that the best carrot weights were obtained in variant 2 and 3 fertilized with 6 and 8 kg cow manure/m^2.

Final harvest was recorded on 13 July 2007. The average root lengths were over the control value (178.3 mm), with the exception of the variant fertilized with 4 kg cow manure/m^2 (178.1 mm); the longest carrots were recorded in the variant fertilized with 8 kg cow manure/m^2 (239.5 mm).The average root diameter at the end of harvest varied between 7.6 mm in the control and 13.02 mm in the variant 4 fertilized with 2 kg chicken manure/m^2. In all variants, the average diameter of carrot roots was over the average diameter of the control variant.

Table 4

Carrot root sizes

Variant		Average values					
		L (mm)		Φ (mm)		Weight (g/plants)	
Harvest in intermediary vegetation stage (pencil-sized carrots) – 08.06.2007							
		L (mm)	**Dif. +/-**	**Φ (mm)**	**Dif. +/-**	**g/plant**	**Relative values (%)**
1	Ct	115.50	-	13.63	-	6.68	100.00
2	V1-4 kg cm*/m^2	152.66	+37.16	15.16	+1.53	6.88	102.99
3	V2-6 kg cm*/m^2	147.33	+31.83	18.10	+4.47	13.43	201.04
4	V3-8 kg cm*/m^2	164.16	+48.66	17.38	+3.75	10.17	152.24
5	V4 -2 kg chm**/m^2	130.33	+14.83	15.08	+1.45	7.31	109.43
6	V5-3 kg chm **/m^2	131.50	+16.0	16.46	+2.83	9.81	146.85
7	V6-4 kg chm **/m^2	142,66	+27,16	15,33	+1,70	7,95	119,01
Final harvest – 13.07.2007 -							
		L (mm)	**Dif. +/-**	**Φ (mm)**	**Dif. +/-**	**g/plant**	**Relative values (%)**
1	Ct	178.3	-	7.60	-	15.48	100.00
2	V1-4 kg cm*/m^2	178.1	-0.2	8.59	+0.99	14.95	96.57
3	V2-6 kg cm*/m^2	212.5	+34.2	10.25	+2.65	24.27	156.78
4	V3-8 kg cm*/m^2	239.5	+61.2	12.84	+5.24	33.19	214.40
5	V4 -2 kg chm **/m^2	232.1	+53.8	13.02	+5.42	21.96	141.86
6	V5-3 kg chm **/m^2	234.5	+56.2	10.90	+3.3	28.80	186.04
7	V6-4 kg chm **/m^2	233.6	+55.3	10.50	+2.9	31.19	201.48

*cow manure-cm, **chicken manure - chm

The average weight carrot varied between 14.95 g/root in the variant 2 fertilized with 4 kg cow manure/m^2 and 13.19 mm in the variant 3 fertilized with 8 kg cow manure/m^2.

Analyses regarding the carrot quality for consumption are presented in the table below (table 5). Nitrates present a restricting factor for quality, as carrot is a species that accumulates nitrates in its root; in humans, the accumulation of high quantities of nitrates can cause health problems, especially in children and old persons.

Nitrates absorption had a high intensity from the intermediary phase of analysis, the contents in nitrates varied between 115 ppm in the control to 173 ppm in V6 fertilized with 4 kg chicken manure/m^2. The level of nitrates in carrots was under the admissible limits presented in literature, i.e. 400 ppm content [1].

During the final harvest, the nitrates content in carrots had values between 107 ppm in variant 1 fertilized with 4 kg cow manure/m^2 and 308 ppm in variant 6 fertilized with 4 chicken manure/m^2. In that phase, the content was high but fertilization with organic fertilizers determined the metabolization of nitrates into proteins, and thus the nitrate contents were under the admissible value presented by the „Ordonanța Autorității Naționale pentru Protecția Consumatorilor nr. 1 din 3 ianuarie 2002 pentru legume şi fructe proaspete"[3], i.e. 400 ppm, respectively.

Table 5

Contents in unmethabolised nutrients in carrots

Variant		Content (ppm)		
		NO_3^-	**$P\text{-}PO_4^{3-}$**	**K^+**
Harvest in intermediary vegetation phase (pencil-sized carrots) – 08.06.2007				
1	Ct	115	64.4	2020
2	V1-4 kg cm */m^2	117	108.0	2300
3	V2-6 kg cm */m^2	151	110.0	2220
4	V3-8 kg cm */m^2	126	92.8	2140
5	V4 -2 kg chm **/m^2	154	86.8	1860
6	V5-3 kg chm **/m^2	158	71.2	2060
7	V6-4 kg chm **/m^2	173	64.8	2100
Final harvest – 13.07.2007				
1	Ct	141	313.6	2340
2	V1-4 kg cm */m^2	107	385.2	2980
3	V2-6 kg cm */m^2	167	387.6	3440
4	V3-8 kg cm */m^2	187	312.8	2220
5	V4 -2 kg chm **/m^2	183	292.4	2660
6	V5-3 kg chm **/m^2	166	298.8	1880
7	V6-4 kg chm **/m^2	308	176.8	1600

*cow manure-cm, **chicken manure - chm

The phosphorus content of carrot in the intermediary phase of harvest varied between 64.4 ppm (control) and 110.0 ppm in variant 2 fertilized with 6 kg cow manure/m^2. Until the final harvest, phosphorus absorption was intense, varying between 176.8 ppm in variant 6 and 387.6 ppm in variant 2.

Potassium content was high in the two stages of harvest, which influenced the period of carrot maintenance.

Carrot crop was very significantly influences by fertilization with 6 and 8 kg cow manure/m^2.

Table 8

Statistical interpretation of carrots crop

Variant	Average crop/variant (kg/m^2)	Differences +/-	Crop increase (%)	Significance
Mt	2.301	Mt	100	-
V1	2.582	0.281	112.21	ns
V2	2.987	0.686	129.81	***
V3	3.021	0.720	131.29	***
V4	2.564	0.263	111.43	ns
V5	2.651	0.350	115.21	ns
V6	2.321	0.020	100.87	ns

DL 5%=0.39 kg/m2 DL 1% =0. 53 kg/m2 DL 0.1%=0.62 kg/m2

CONCLUSIONS

1. The highest average roots length was registered in variant 3 fertilized with 8 kg cow manure/m^2 (239.4 mm). In all variants, the average roots diameter of the variants exceeded the average diameter of the control.
2. The nitrates contents in carrots in all variants was under the maximum admissible limits of 400 ppm presented by the" Ordonanța Autorității Naționale pentru Protecția Consumatorilor nr. 1 din 3 ianuarie 2002"[3].
3. The carrot yields were significantly influenced by the culture fertilization with 6 and 8 kg cow manure/m^2.

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