

TESTING ECOLOGICAL BEHAVIOUR OF SOME SPECIES AND CULTIVARS OF VEGETABLES IN THE CONDITIONS FROM NORTH-WESTERN PART OF ROMANIA

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Abstract

Testing ecological cultivars in different climatic conditions is very important for achieving optimum crop technologies. On luvisol from Oradea and sands from Valea lui Mihai, cultivars of peppers, tomatoes, fall cabbage and watermelons were studied. Out of the twelve peppers cultivars tested in Oradea, the highest yield was obtained at cultivar Mureş 23.3 t / ha. These cultivars (Arădean and Galben superior) have the highest percentage of first quality. On the sands from Valea lui Mihai out of the six cultivars of peppers, the highest yield was obtained for cultivar Uriş de California (27.39 t / ha). Out of the four long peppers cultivars tested, the highest yield was obtained for cultivar Lung românesc (26.2 t / ha) and out of the five cultivars of sweet pepper, the cultivar Timpuriu de Bucureşti had the highest yield (15.9 t / ha); for paprika pepper, the cultivar Arad 6 yield obtained was higher than in cultivar Arad 5. In the conditions of sands from Valea lui Mihai, out of the twelve earlier tomato cultivars tested, the highest yield was obtained in cultivar Nr.10 x Bizon and out of the seventeen cultivars of tomatoes for industrialization, the highest yield was obtained for cultivar Arges 411 (99.7 t / ha). Testing the eight cultivars of autumn cabbage in the conditions from Oradea showed that cultivar De Socodor obtained the highest yield, 56.7 t / ha and (beside cultivar Mocira) the highest percentage of first quality bulbs, 90 %. Regarding the watermelons crop, out of the eight cultivars tested in Oradea, for cultivar Roxana the highest yield of first quality were obtained. On the sands from Valea lui Mihai, among the ten studied species, the highest yield was obtained for Dr. Mauch cultivar.

Keywords: ecological testing, cultivar, pepper, tomato, autumn cabbage, watermelon

INTRODUCTION

Testing ecological behavior of species and cultivars in different pedoclimatic zones is necessary, in the conditions that in the same climatic conditions the water requirements depend on the stage of vegetation, root system development, the leaf area etc. (Domuta C., 2003, 2008, 2009, 2012, Domuta Cr., 2010, 2011, 2012), Grumeza et al. (1987), in view of the consumption of water and absorption capacity, put vegetables into the following four groups: group I - tomato, carrot, parsley, melons; group II: cabbage, cauliflower, cucumber, lettuce, spinach, pepper, garden beans, group III: beet, early potato, group IV: onions, garlic.

Both in Oradea and Valea lui Mihai, the paper studied cultivars of melons and vegetables from group I characterized by low consumption of water and a well developed root system both laterally and in depth and pepper has been studied in both localities; this culture is part of group-II characterized through plants with poorly developed root system and a reduced capacity of water absorption. In group-II the behavior of autumn cabbage cultivars has been studied in Oradea. From group I at Valea lui Mihai cultivars of early tomatoes and tomato for industrialization were studied.

MATERIAL AND METHOD

Soil from Oradea

The research from Oradea were made in the luvisoil conditions at Agricultural Research and Development Station Oradea. Domuța Cr. (2010, 2011, 2012) describes the luvisoil profile from the research field: Ap = 0-24 cm, El = 24-34 cm; BT₁ = 34-54 cm; Bt₂ = 54-78 cm; Bt / c = 78-95 cm, C = 95-145 cm. It is noted that the migration of colloidal clay causes the appearance of horizon El with 31.6% colloidal clay and two horizons of colloidal clay accumulation with BT₁ and Bt₂ with 39.8% and 39.3% colloidal clay.

Luvosoil from the research field is characterized by a very high hydrostability of soil aggregates more than 0.25 mm, 47.5% of layer at 0-20 cm. Bulk density - 1.41 g/cm³ - characterizes a poorly compacted soil on depth 0-20 cm; on other depths studied, the apparent weight highlights a moderately and strongly compacted soil (Brejea, 2010). On watering depth (0-50 cm) and on 0-150 cm the soil is strongly compacted. Total porosity values decrease on the soil profile from the surface to depth. Hydraulic conductivity is high on the depth 0-20 cm, medium on depth 20-40 cm and 40 cm, low and very low on the following depths studied.

Field capacity had a middle value throughout the soil profile and the wilting coefficient is also worth to middle depth of 80 cm and higher below this depth (Borza, 2011). Active humidity interval (IUA) or useful water capacity had a high value in the depth 0-80 cm and the middle on depth 80-150 cm. On watering depth used on the research field the active humidity range had a great value (Domuța, 2009, 2012). Depending on soil easily available water content was set at 2/3 IUA.

The soil in the research field has a slightly acid reaction throughout the studied depth, with increasing values from surface to depth. Humus supply is poor, and the total nitrogen, low – medium on the entire studied depth. C/N ratio has a value higher on depth 0-20 cm (8.01) and decreases with depth determination.

Mobile phosphorus is of 22.0 ppm and mobile potassium is of 124.5 ppm.

The soil content in exchangeable magnesium on soil profile has a similar pattern with potassium content, the soil being middle supplied with this item's full profile. Manganese characterizes the soil from research field as a soil with medium content at depth 0-20 cm and 20-40 cm and low content at next depths. The soil is moderately submezobasic on the entire studied depth.

Sands and sandy soils in North-Western part of Romania occupy an area of about 30.000 ha. The first research regarding the cultivation sands and sandy soils were made to the current Agricultural Research and Development Station from Oradea (Stepănescu E., Bunea A., 1971). Trif Gh. studied the behavior of cultivars of early tomato, industrialization tomatoes, peppers, watermelons on interdune during 1980-1984 and on land leveled during 1985-1987. In the natural state, sand from dunes had acidic reaction (pH = 5.9), are moderately saturated base (V = 60%) and provided with humus is low (0.20-0.25%), mobile phosphorous (5.75 mg/100 g soil) and mobile potassium (6.15 mg/100 g soil) (Șandor, 2008).

Climate conditions

In the three years of research at Oradea, rainfall registered during the period from April to September were close to the multiannual value (367.0 mm) in 2010, (357.0 mm) or below its value (275.7 mm in 2011 and 298.5 mm in 2012). The average temperature was equal to multiannual averages (17.1 °C) and had higher values in 2011 (19.0 °C), especially in 2012 (19.8 °C). Air humidity was higher than the multiannual average in 2010 (76% compared with 72%) and had lower values (64% and 63%) in 2011 and 2012 (Table 1).

In Valea lui Mihai during February – December, the amount of temperature degrees was 3800-4000 °C. Temperatures over 5 ° C amounts 3600-3800 ° C, over 10 ° C 3200-3400 ° C and over 15 °C 2600-2800 °C (Table 2).

In the period from April to September, rainfalls registered 340.7 mm, air humidity averaged 72% and the duration of sunshine is 1498.2 hours. Winds with the highest speed 2-3 m / s (Table 3, 4).

Table 1

Elements of climate in Oradea, 2010-2012

Year	Month						Sum Average
	April	May	June	July	August	September	
Rainfalls, mm							
2010	46.1	61.1	84.9	70.9	58.7	45.3	357.0
2011	19.0	56.5	35.2	125.3	8.9	30.8	275.7
2012	40.7	65.0	94.1	70.8	6.5	21.4	298.5
Average*)	46.1	61.1	84.9	70.9	58.7	45.3	367.0
Air temperature ° C							
2010	10.5	15.8	19.1	20.8	20.0	16.2	17.1
2011	12.4	16.8	21.2	21.8	22.6	19.3	19.0
2012	12.5	17.2	21.8	24.6	23.4	19.5	19.8
Average	10.5	15.8	19.1	20.8	20.0	16.2	17.1
Air humidity %							
2010	77	76	73	75	77	78	76
2011	60	64	62	69	64	64	64
2012	66	69	68	62	52	59	63
Average **)	72	72	73	69	71	75	72

*) 1931 – 2009

**) 1947 – 2009

Table 2

Thermal potential of sands area in North - Western part of Romania

Specification	Start	Finish	Duration days	Sum of the temperature
Temperature >° C	11-21 II	21 XII – 1 I	310-323	3800-4000
Temperature >5° C	11-21 III	21 I – 1 XII	240-264	3600-3800
Temperature >10° C	1-11 IV	21 IX – 1 XI	200-214	3200-3400
Temperature >15° C	21 IV – 1 V	21 IX – 1 X	150-163	2600-2800

Table 3

Elements of climate in sands area from North-Western part of Romania
during April-September

Specification	Month						Sum Average
	April	May	June	July	August	September	
Rainfalls, mm	42.0	57.5	79.1	62.7	62.2	39.0	340.7
Sunlight, hours	193.3	246.9	263.2	288.5	267.7	208.6	1468.2
Air humidity %	72	72	73	69	71	75	72

Table 4

Wind parameters in the sands from North-Western part of Romania

Directions	Frequency		Speed m/s	
	Value %	%	m/s	%
S;S-V	12-14	100	2-3	100
N	102	83-71	2-2.5	100-83
E	5-8	42-57	1.5-2.0	75-67

RESULTS AND DISCUSSION

Research regarding the pepper cultivars

Research from Oradea were performed in an experiment placed after the block method in four replications; experimental plot area was of 50 m². To maintain the water supply on the depth of 0-50 cm between easily available water content and field capacity to irrigate 600 m³/ha in 2010 to 3700 m³/ha in 2011 and 2900 m³/ha in 2012. Watering method: Sprinkler with device adapted rectangular shape of the plot.

In Oradea, the control variant used was De Siria cultivar which registered a yield of 17.62 t / ha over the three years. Regarding this cultivar, statistically significant increases at cultivars Ceres (7%), Aroma (9%) and Miniş (10%) were obtained. Statistically significant spore were obtained at cultivars Cristal (13%), Arădean (14 %), Galben superior (16%), Şimnic (18%), Opal (19%) and Mihaela (19%). Only at cultivars Uriaş de California (24%) and Mureş (33%), highly statistically significant production increases were achieved. The percentage of first quality yield was 90% at cultivars Siria, Ceres and Şimnic, the percentage of 91% was recorded at Miniş, Aroma, Cristal, Mihaela, Opal and Uriaş de California cultivars and percentage of 92% was recorded in Arădean, Galben superior and Mureş cultivars (table 5).

Table 5

The yields analysis on different cultivars of pepper obtained in the luvosoil condition from Oradea

No. crt.	Cultivar	Yield		Difference		Statistical Significance	Yield of I quality %
		t/ha	%	t/ha	%		
1.	De Siria	17.620	100	-	-	x	90
2.	Miniş	19.300	110	1.68	10	x	91
3.	Ceres	18.760	107	1.14	7	x	90
4.	Aroma	19.250	109	1.63	9	x	91
5.	Arădean	20.150	114	2.53	14	xx	92
6.	Cristal	19.900	113	2.28	13	xx	91
7.	Galben Superior	20.350	116	2.73	16	xx	92
8.	Mureş	23.300	133	5.68	33	xxx	92
9.	Şimnic	20.750	118	3.13	18	xx	90
10.	Mihaela	21.200	120	3.58	20	xx	91
11.	Opal	20.900	119	3.28	19	xx	91
12.	Uriaş de California	21.800	124	4.18	24	xxx	91

LSD 5% = 0.95 LSD 1% = 2.15 LSD 0.1% = 3.95

At Valea lui Mihai during 1981-1986 four types of peppers were studied: green pepper, long pepper, chili pepper and cayenne pepper. Compared with the cultivar of sweet pepper Export II at cultivar Galben superior, a small yield was registered, but the difference is not statistically significant; negative differences were obtained at cultivars Aroma, statistically significant at cultivar Muntenia 84, respectively Mihaela and Progres (differences statistically significant); at cultivar Uriaş de California the difference of 4.33 t / ha was highly statistically significant. At long pepper compared to control Kapia de Kurtova, at all other three cultivars, a highly statistically significant production increases were registered; the higher yield increase of 10.3 t / ha was registered at cultivar Lung Românesc. Five cultivars of peppers were studied and compared to control variant. In all the other cultivars, the yield was significant statistically assured; at cultivar Timpuriu de Bucureşti it was registered the largest increase of the yield compared to control cultivar Splendid. Cultivar of paprika Arad 6 determined a yield increase of 4.35 t / ha, statistically significantly assured (Table 6).

Table 6

Yields analysis of different cultivars of peppers obtained on sands from Valea lui Mihai

Cultivar	Yield		Difference	Statistically Semnif.	Fruits Quality 1 st of total%
	t/ha	%	t/ha		
Pepper					
Export II	23.06	100.0	Mt	Mt	72.1
Miniș 27	24.03	104.2	+0.97	-	93.5
Muntenia 84	10.85	46.0	-12.21	000	90.4
Progres	19.15	83.0	-3.91	000	78.5
Uriș de California	27.39	118.8	+4.33	xxx	110.1
Aroma	20.17	87.5	-2.89	00	70.1
Galben superior	22.0	95.4	-1.06	-	44.0
Mihaela	16.6	72.0	-6.46	000	36.0
LSD 5% = 1.1 LSD 1% = 1.9 LSD 0.1% = 3.2					
Long pepper					
Kapia de Kurtova	15.9	100.0	Mt.	Mt.	39.0
Cosmin	21.5	135.22	+5.6	xxx	52.0
Zlaten Medal	24.2	152.20	+8.3	xxx	32.0
Lung românesc	26.2	164.78	+10.3	xxx	38.0
DI 5% = 1.3 DI 1% = 2.2 DI 0.1% = 4.8					
Chili pepper					
Splendid	9.2	100.0	Mt.	Mt	49.0
Superb	10.5	114.13	+1.2	x	48.0
Rubin	10.9	118.48	+1.7	x	64.0
Titan	13.7	144.21	+4.5	xxx	88.0
Timpurii de București	15.9	167.37	+6.7	xxx	50.0
LSD 5% = 0.9 LSD 1% = 1.9 LSD 0.1% = 3.7					
Paprika pepper					
Arad 5	19.2	100.0	-	-	18.9
Arad 6	23.5	120.51	+4.35	xx	18.8
LSD 5% = 3.84 LSD 1% = 5.41 LSD 0.1% = 7.76					

The behavior of tomato cultivars on the sands from Valea lui Mihai.

Twelve cultivars of early tomato were studied in the period 1981-1986. Compared with the control Export at tomato cultivars Delicatese, Ranii 83 and Termokrasnii, statistically significant differences were registered. At cultivars IH - 15, Argeș I, Someș, Argeș 401, H14 the registered yields are lower than the control yield, the differences being statistically assured. Positive differences were obtained at cultivar Argeș 405 (+ 5.1 t / ha, distinct significantly) and No.10xBizon (7.7 t / ha highly statistically significant). The highest percentage of early yield 64.5% was registered at cultivar Export II and the lowest percentage of 10.7% was recorded at cultivar Argeș 405 (Table 7).

Table 7

Analysis of yield of different cultivars of early tomato obtained on sands from Valea lui Mihai

No. crt.	Cultivar	Yield		Differ. t/ha	Statistic. Signif.	Early yield at 20VII, % of total	Yield, quality 1 st % of total
		t/ha	%				
1.	Export II	52.7	100	-	-	64.5	80.5
2.	Arges I	48.5	92	-4.2	00	52.7	69.7
3.	Delicatese	55.2	105	+2.4	-	53.3	50.1
4.	H-14	49.6	94	-3.1	0	20.3	81.3
5.	Argeș 401	47.9	91	-4.8	00	14.6	75.6
6.	Someșan	49.8	95	-2.8	0	20.2	71.6
7.	Ranii 83	50.8	96	-1.9	-	25.6	82.6
8.	Termokrasnii	54.5	104	+1.8	-	13.3	78.8
9.	Argeș 405 *)	57.8	110	+5.1	xx	10.7	74.8
10.	Nr. 10xBizon *)	60.4	115	+7.7	xxx	16.5	64.7
11.	IH - 15 *)	43.7	83	-9.0	000	32.7	78.0
12.	IH - 50 *)	56.9	108	+4.2	x	17.6	80.0

Average X	52.3					
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*) 1985-1986

LSD 5% = 2.5 LSD 1% = 3.9 LSD 0.1% = 6.2

In the same period, seventeen cultivars for industrialization were studied. Compared with the control cultivar Cluj 80, at cultivars Argeş 428 and Ace Royale and Monor the differences are not statistically significant; at cultivars Heintz 1370, Urbana, Fakel, Early and Carolina lower yield was recorded compared with the control one, the differences being statistically assured. Highly statistically significant differences compared with control were obtained at Novinka cultivars, Ace, Argeş 411, 405, Braila, Buzau 22 and Campbel. The highest percentage of early yield was registered at Early cultivars (33.7%) and Monor (22.4%) and the highest percentage of first quality fruit were obtained at cultivar Ace (Table 8).

Behavior of autumn cabbage cultivars in the conditions from Oradea

The research realized in 2010-2012 shows that in comparison with the cultivar Braushweigh at two cultivars (Buzau, Gloria) lower yields were obtained, the differences being statistically significantly assured.

At cultivars Amager and Licurişcă, the yield obtained was higher than the control, the differences (4.7 t / ha and 5.6 t / ha) were statistically significant. At cultivars Mocira , De Işalniţa and De Socodor, the differences were highly statistically significant (6.6 t / ha, 6.9 t / ha and 9.1 t / ha). Compared with the control, in all the studied cultivars the first quality yield was higher. The highest percentage of first quality yield (90%), was registered at cultivars Amager and Mocira (Table 9).

Table 8

Yield analysis of different cultivars of tomatoes for industrialization obtained on sands from Valea lui Mihai

No. crt.	Cultivar	Yield		Diff. t/ha	Statistic Semnific.	Early yield at 20VII, % from total	Yield, 1 st quality % from total
		t/ha	%				
1.	Cluj 80	49.0	100	-	-	12.5	69.3
2.	Monor	49.4	101	0.4	-	22.4	69.1
3.	Novinka	58.5	119	9.5	xxx	2.8	74.8
4.	Argeş 428	47.6	97	-1.4	-	-	92.9
5.	Ace	68.0	139	19.0	xxx	0.2	95.8
6.	Ace Royale	46.5	95	-2.5	-	0.05	63.9
7.	Argeş 411	99.7	204	50.7	xxx	1.4	61.2
8.	Brăila 405	68.8	140	19.8	xxx	0.03	66.2
9.	Buzău 22	71.4	146	22.4	xxx	0.4	90.0
10.	Campbel	60.5	124	11.5	xxx	1.5	87.4
11.	Carolina	36.4	74	-12.5	000	-	83.8
12.	Early	44.6	91	-4.4	00	33.7	68.8
13.	Northon	85.5	175	36.5	xxx	2.7	67.6
14.	Fakel	43.9	90	-5.1	00	0.9	79.1
15.	Florida	64.2	131	15.2	xxx	1.3	81.0
16.	Heintz 1370	45.8	94	-4.2	0	2.5	76.3
17.	Urbana VF	45.3	93	-4.7	00	2.2	78.0

LSD 5% = 2.8 LSD 1% = 4.2 LSD 0.1% = 7.1

The yields of cabbage were obtained using irrigation in order to maintain the water supply between the minimal limit and the field capacity. Irrigation rules used were 400 m³ in 2010, 3100 m³ in 2011 and 2500 m³/ha in 2012.

Table 9

Yield analysis of different cultivars of autumn cabbage obtained on the luvosoil from Oradea

No. crt.	Cultivar	Yield		Difference		Statistically significant	Yield 1 st quality %
		t/ha	%	t/ha	%		
1.	Braunshweigh	47.600	100	-	-	Mt.	87
2.	De Buzău	42.500	89	-5.1	-11	00	89
3.	Gloria	43.700	92	-3.9	-8	00	89
4.	Amager	52.300	110	+4.7	10	xx	90
5.	Licurișcă	53.100	112	+5.5	12	xx	89
6.	Mocira	54.200	114	+6.6	14	xxx	90
7.	De Ișalnița	54.500	115	+6.9	15	xxx	89
8.	De Socodor	56.700	119	+9.1	19	xxx	90

LSD 5% = 1.20 LSD 1% = 2.9 LSD 0.1% = 5.6

Behavior of watermelons cultivars in the North Western Romania

Eight cultivars were studied in Oradea; the control is considered Charleston Gray variety. In all the other seven studied species, higher yields were obtained in comparison with the control, the differences being statistically assured as follows: at cultivar Miniș statistically significant, statistically significant at Dăbuleni and Lovrin 532 and highly statistically significant at cultivars Crina, Dunărea, Festiv and Roxana. Compared to the control in all the other seven species, a higher percentage of first quality fruits was obtained (table 10).

Table 10

Yields analysis of some cultivars of watermelons obtained on luvosoil from Oradea

No. crt.	Cultivar	Yield		Difference		Statistically significant	Yield 1 st quality %
		t/ha	%	t/ha	%		
1.	Charleston Gray	29.200	100	-	-	Mt.	83
2.	De Miniș	31.700	109	2.500	9	x	86
3.	De Dăbuleni	33.700	116	4.500	16	xx	85
4.	Lovrin 532	34.500	118	5.300	18	xx	87
5.	Crina	37.100	127	7.900	27	xxx	88
6.	Dunărea	38.300	131	9.100	31	xxx	89
7.	Festiv	37.700	129	8.500	29	xxx	88
8.	Roxana	39.300	135	10.100	35	xxx	89

LSD 5% = 1.700 LSD 1% = 3.100 LSD 0.1% = 5.700

The research from Oradea were conducted in 2010-2012, and to maintain water reserve between the minimum ceiling and field capacity on 0-50 cm depth, the following irrigation rates were used: 400 m³/ha in 2010 2200m³/ha, 2900 m³/ha in 2011 and 2012.

At Valea lui Mihai, cultivars of watermelons were studied with the control cultivar Baby sugar. Compared to this, in all cultivars the yield obtained was higher and statistically significant (Malali), statistically significant (New Hampshire, Charleston Gray) and highly statistically significant in the other cultivars. Cultivars Baby sugar and New Hampshire were the earliest (first harvest 1-3.08.) (Table 11).

Table 11

The yields analysis on different cultivars of watermelons obtained on the sands from Valea lui Mihai

No crt.	Cultivar	Yield		Difference	Statistically significant	First harvest
		t/ha	%			
1.	Baby sugar	27.7	100	-	Mt	1-3.08
2.	Dr.Mauch	46.1	167	18.4	xxx	4-5.08
3.	Minis I	39.0	141	11.3	xx	4-5.08
4.	Vidra 6	42.2	152	14.5	xxx	4-5.08
5.	Charleston Gray	48.6	175	20.9	xxx	4-5.08
6.	New Hampshire	54.0	195	26.3	xxx	4-5.08

9.	Timpuriu de Canada	40.2	145	12,5	xxx	3-5.08
LSD 5% = 3.3 LSD 1% = 6.1 LSD 0.1% = 11.9						

CONCLUSIONS

Research realized on the luvisol from Oradea and on the sands from Valea lui Mihai regarding the behavior of cultivars of peppers, tomatoes, fall cabbage and watermelons caused the following conclusions:

- out of the twelve peppers cultivars tested in Oradea, the highest yield was obtained at cultivar Mureş 23.3 t / ha. These cultivars (Arădean and Galben superior) have the highest percentage of first quality products. On the sands from Valea lui Mihai, out of the six cultivars of peppers, the highest yield was obtained at cultivar Uriaş de California (27.39 t / ha). Out of the four long peppers cultivars tested, the highest yield was obtained at cultivar Lung românesc (26.2 t / ha) and out of the five cultivars of sweet pepper, the cultivar Timpuriu de Bucureşti had the highest yield (15.9 t / ha); for paprika pepper, the cultivar Arad 6, the yield obtained was higher than for cultivar Arad 5.

- In the conditions of sands from Valea lui Mihai, out of the twelve earlier tomato cultivars tested, the highest yield was obtained in cultivar No.10 x Bizon and out of the seventeen cultivars of tomatoes for industrialization, the highest yield was obtained at cultivar Arges 411 (99.7 t / ha).

- Testing the eight cultivars of autumn cabbage in the conditions from Oradea showed that cultivar De Socodor obtained the highest yield of 56.7 t / ha and (beside cultivar Mocira) the highest percentage of first quality bulbs (90 %).

- Regarding the watermelons crop, out of the eight cultivars tested in Oradea, the highest first quality yield was obtained for cultivar Roxana. On the sands from Valea lui Mihai, among the ten studied species, the highest yield was obtained for Dr. Mauch cultivar.

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