INFLUENCE OF IRRIGATED TECHNOLOGICAL SYSTEM IN THE POTATO QUALITY IN LETCA AREA, SALAJ

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Abstract. The study results show a positive influence on the quality of irrigation technology system Potatoes, dangerous periods of drought in recent years, in Transylvania. When dry years 2011 – 2012, the irrigation was a favorable technological solution for achieving significant production increases. The potato crop, application of appropriate technology and global climate change area current irrigated ensure a proper quality of the production of tubers. Under the aspect of quality in irrigated potato, in 2011-2012, it is noted tuber component values concordance with those made in years favorable culture presented in the literature.

Keywords: potato culture, potato quality, irrigation system.

INTRODUCTION

The potato tubers are an almost complete food, having a high content of carbohydrates (15-25% by variety), protein substances (1.5-2.5%) and vitamins (A1, B1, B2, B3, K, vitamin C, amounting to 13-23 mg/100 g dry substance) and minerals (WIRTHS, 1968 cited by DRAICA, 1995).

The starch is used as an ingredient in food products such as: thickening agent, stabilizer, colloidal gelling agent, binding agent, coating agent and in cosmetics, pharmaceuticals.

Potato quality analyzes indicates a composition g/100g fresh material: water from 75.7 - 77.2%, lipids 0.2%, glucides 0.2%, carbohydrates 18.5-20%, cellulose 0.5 -0.6%, proteins 2.5% and ash 1.1%, mineral salts (mg/100 g fresh material) are: Na / 4.5 mg, P / 80-100 mg, Ca / 7.1 -12 mg, Fe / 1.8 - 6.5 mg, K / 340 mg, Mg / 28 mg/100 g fresh material (TARJAN and LINDER, 1974 cited by IANOSI, 2002).

Percentage analysis of the components of potato tuber (g/100g fresh material) by GHERGHI, 1997 cited by IANOSI, 2002 indicates: water 73-80%, lipids 0.11%, mono- and disaccharides from 0.4 - 3.4%, starch 16.4%, cellulose 0.9%, proteins 2.05%, protein substances 0.42%, minerals 1.02% .

Recent analysis made on varieties created at SCDA Târgu Secuiesc (after LUIZA MIKE, 2009) specifies (g/100 g dry material) valuable at qualitative composition: 80.4 g carbohydrates, protides 8.3 g, fat 0.6 g , vitamins: A trace, B1 0.25 mg, B2 0.10 mg, C 26 mg; mineral salts: K 1600 mg, Na 84 mg, P 203 mg, Ca 44 mg, Fe 2.4 mg / 100 g dry matter.

A number of modern quality investigations (MIHAELA ADRIANA PRODAN, 2011), provides vitamins and amino acid composition of potato:

- vitamins (mg/100g) 0.11 mg/100g B1, B2 0.04 mg, B3 = PP 1.20 mg, B5 pantothenic acid 0.30 mg, B6 pyridoxine 0.20 mg, C ascorbic acid 40 mg, carotene 0.02 mg;

- amino acids g/16g N2, essential amino acids: arginine, 5.3; histidine 1.4, isoleucine 4.5, leucine 4.6, lysine 5.0, methionine 1.6, phenylalanine 4.2, tryptophan 1.3, Valina 5,1; amino acids: cysteine 1.3, tyrosine 2.9, aspartic acid 17.1, glutamic acid 23.8, glycine 1.9, serina 2.7.

The literature data specifies quality analyzes of potato tuber components (Table 1.). After DAVIDESCU et al., 1978, cited by IANOSI, 2002, shall be indicated the following values: crude potato: 79.8% moisture and 18% amidon (of which amylose15-25%, amylopectin 75-85%); and a protein content of 21 g / 100g.

MATERIAL AND METHOD

The quality analyzes were made on potato tubers in production years 2011-2012, obtained from two Romanian varieties Redsec and Milenium, created at SCDA Târgu Secuiesc and cultivated in the experimental field at Letca, Salaj, under irrigated and irrigation (50% of active moisture interval).

Qualitative study of potato tuber components was made in the laboratories ICIA Cluj, having attention to the tuber quality parameters for the components: % moisture (g/100 g crude potato), carbohydrates, protides, lipids, (g / 100 g dry material), vitamins A, B1 , B2, C (mg / 100 g dry matter); mineral salts: Na, P, Ca, Fe, K (mg/100 g dry matter), amino acids (g/16g N2) heavy metals, non-metals (mg / kg).

Cellulose was determined by STAS 6240/1991.

For determining humidity of the samples was used in the following mode: the preparation vial with cap by drying at 105 ° C ± 5 ° C, cooling in a desiccator for 45 minutes and weighed to establish mass closed vial (m0), the weighing vial of about 10 g of the sample, weighing the mass of the sample vial closed with mass (m1), dry closed bottle test in oven kept at 105 ° C and cooled in a desiccator and weighed after cooling of the sample (m2). Humidity was calculated using the formula: U = (m1-m2) * 100 / (m1-m0).

Metals have been determined by the method because it provides semi-quantitative information about the sample, without need of calibration of all the elements of interest. Information obtained by semiquantitative method used encompass the entire mass spectrum, from Li to U element except radioactive isotopes and elements that are normally in the gaseous state.

The samples have been used in the preparation of a ball mill Restch RM 100 (Haan, Germany) and digestive system closed vessels microwave PTFE, Berghof MWS-3 + with pressure and temperature control (Eningen, Germany). The quantification of metals was performed using a mass spectrometer with inductively coupled plasma ICP-MS (Sciex - Perkin Elmer ELAN DRC II, ON, Canada).

Determination of amino acids and vitamins was made according to the LC-MS/MS method. Method to identify and quantification of amino acids was done using an LC-MS/MS system consists of a high performance liquid chromatograph (Agilent 1200 series) coupled to a mass spectrometer (3200 Qtrap Applied Byosistems).

The mass spectrometer is made of three quadrupole MRM which enable the development of a method (Multiple Reaction Monitoring), a method generally used for quantitative analysis and enables monitoring of multiple pairs precusor ion → product ion. The development MRM method is scanning the first quadrupole (Q1) of the ions of interest, defragmenting their collision cell (Q2) and precursor ion scanning fragments in the last quadrupole Q3.

RESULTS AND DISCUSSION

The results of research on the influence of the technological system on the quality of the potato crop irrigation in the Letca compared with values registered in the literature are presented in Table 1 and 2.

Table 1

Variation in the potato tuber components illustrated in the literature in different periods

	The components of potato tuber (%)				
Bibliographic mentions:	**Tarjan and Linder, 1974 cited by Ianoşi, 2002**	**Davidescu et al. 1978 cited by Ianoşi, 2002**	**Gherghi, 1997cited by Ianoşi, 2002**	**Baciu et al. 2009 cited by Mihaela Adriana Prodan, 2011**	**Mike Luiza 2009 g / 100 g dry mass**
Water	75,7-77,2 %	79,8%	73-80 %	65-87 %	7,1 g
Lipids	0,2 %		0,11 %	0,04 -1 %	0,6 g
Glucides	0,2 %		0,4-3,4%	0,01-8 %	
Amidon	18.5-20%	18% from which 15-25% amylose 75-85% amylopectin	16,4 %	8-25 %	80,4 g
Cellulose	0,5-0,6%		0,9 %	0,2-3,5 %	
Proteins	**2,5 %**	21 g/100g	2,05 - 2,47%	0,7-4,6%	8,3 g
Mineral salts	1,1 %		1,02%	0,4-1,9 %	

Table 2

The components of potato tuber (%) and the influence of irrigated technological system in the potato quality in Letca area, Salaj

The components of potato tuber (%)						
Variety	**Water (%)**	**Celuloza (%)**	**Amidon (%)**	**Lipide (%)**	**Proteine (%)**	**Minerale (%)**
Redsec not-irrigated	62.94	0,75	18,53	0,2	3,55	1,02
Redsec irigated	67.77	0,73	18,53	0,2	3,55	1,02
Milenium not-irrigated	64.01	0,70	18,53	0,2	3,55	1,02
Milenium irrigated	66.48	0,65	18,53	0,2	3,55	1,02

Average humidity potato tubers (%) in 2011-2012 to Letca 2012 in irrigated system is between 63-64%, which is lower than the values reported by previous works, reaching 65-87% (PRODAN, 2011) or 73-80% (GHERGHI, 1997, cited by IANOSI, 2002).

Average humidity potato tubers (%) in 2011-2012 to Letca 2012 irrigated is slightly higher for both varieties (approx 5% Redsec and 2.5% Milenium) than in non-irrigated system

Compared with values obtained without irrigation system, the Letca, cellulose content (%) is slightly lower in irrigation systems, in both variety, reaching values of 0.75% at Redsec and 0.70% at the Millennium. These values are similar to those in the

literature: 0.5-0.9% (TARJAN and LINDER 1974, respectively GHERGHI, 1997 cited by IANOSI, 2002), resulting from the analysis (STAS 6240/1991).

The amidon content is 18.53% average values compared with the values in literature (8-25%, by PRODAN, 2011). Protein content: 2.5% compared with the values of 0.7-4,6 (IANOSI, 2002, PRODAN, 2011). Mineral salts or ash content: 1.02%.

From data analysis is outstanding the content of vitamins (vitamin C, vitamin B6), which is higher than the variety Milenium (Table 3.).

Table 3

Potato tuber vitamin composition and the influence of irrigated technological system in the potato quality in Letca area, Salaj

Vitamins (mg / kg - fresh material)			
Variant	**Vitamin C**	**Vitamin B6**	**Folic acid**
Redsec not-irrigated	0.002499	0.000089	<0.000125
Redsec irigated	0.002588	0.000082	<0.000125
Milenium not-irrigated	**0.002877**	**0.000112**	<0.000125
Milenium irrigated	0.002673	0.000110	<0.000125

From data analyzes irrigation culture is remarkable influence on the amino acid composition of potato in Letca, Salaj (Table 4.), observing increases in the quantity of tyrosine, alanine, glycine in variety Redsec irrigated, compared with the control not-irrigated. At variety Milenium irrigation is found increasing or doubling the amount of tyrosine, alanine, glycine, aspartic acid, phenylalanine, and histidine.

Table 4

Amino acid composition of potato tubers and the influence of irrigated technological system in the potato quality in Letca area, Salaj

Amino acids (mg / kg - dry material)							
Variant	**Aspartic acid**	**Phenylalanine**	**Glutamic acid**	**Histidine**	**Tyrosine**	**Alanine**	**Glycine**
Redsec not-irrigated	1.065552	1.378151	1.762733	0.829752	1.109033	0.627126	0.059665
Redsec irigated	0.926231	1.389945	1.582863	0.615465	**1.418089**	**0.873406**	**0.084136**
Milenium not-irrigated	1.186814	0.656867	1.241654	0.612529	0.293325	0.481135	0.027358
Milenium irrigated	**1.479647**	**1.230265**	1.082495	**0.898245**	**0.688403**	**0.840399**	**0.062415**

Technological system irrigated and non-irrigated effect on the content of metals, heavy metals, non-metals (mg / kg) of potato tubers (Table 5.) manifests differently. In the irrigation conditions, there is an increase in the content of sodium and magnesium, as a result of the physiological conditions favored by irrigation, but also remarkable increase of the lead content.

Table 5.

The effect of irrigated and non-irrigated technological systems in the metals, heavy metals, metalloid content (mg / kg) of potato tubers

Metals (mg / kg)	Milenium irrigated	Milenium not-irrigated	Redsec irigated	Redsec not-irrigated
B	12,10	1,67	9,38	13,82
Na	**100,5**	**90,00**	**105,4**	**109,8**
Mg	**1014,0**	**648,5**	**1181,0**	**988,1**
Al	37,23	35,30	35,50	44,95
Ca	483,3	763,8	641,8	755,1
Ti	1,11	0,71	0,53	1,18
Cr	0,52	0,41	0,41	0,52
Mn	8,97	6,31	7,62	8,09
Fe	75,77	67,12	46,02	76,91
Co	0,11	<0.10	<0.10	<0.10
Ni	0,87	0,99	0,61	0,82
Cu	**8,30**	**5,77**	**5,53**	**9,48**
Zn	**15,38**	**16,34**	**15,53**	**19,90**
As	0,14	<0.10	<0.10	<0.10
Br	14,82	10,52	12,52	15,92
Rb	14,59	4,79	7,86	4,94
Sr	7,93	7,83	7,43	8,46
Mo	1,19	0,50	0,74	0,87
Cd	0,10	**0,16**	0,04	**0,11**
Sn	0,20	1,87	0,18	0,87
Ba	1,62	1,90	1,67	1,54
Pb	**0,57**	**0,23**	**0,21**	**<0.10**

The content of heavy metals Pb, Cu, Cd, Zn was studied in potato samples of Baia Mare urban area, stating the dangerous concentration in relation to the maximum permissible concentrations of heavy metals in food hygiene as no. 975 of 1998 (MIRELA MICLEAN, 2009) (Table 6.). Pb, B, Na, Mg, Al, Mn, Rb are concentrated in the tubers of the irrigation system. As, Ni, Zn, Cd, Sn (tin) are concentrated in the tubers of irrigated system. Cu and Br are more concentrated in tubers variety Redsec irrigated system.

Table 6.

Values for Pb, Cu, Cd, Zn concentrations in potato samples from Baia Mare ** and Letca

	Pb, mg/kg	Cd, mg/kg	Cu, mg/kg	Zn, mg/kg
CMA*	**0,1**	**0,1**	**3**	**10**
Zona Baia Mare	0,544	0,091	3,035	7,004
Letca area irrigated	0,21-0,57	0,04-0,10	5,53-8,30	15,38-15,53
Letca area not-irrigated	<0.10-0,23	0,11-0,16	5,77-9,48	16,34-19,90

* Maximum permissible concentrations of heavy metals in food hygiene as no. 975 of 1998

** Heavy metals in samples of potato Baia Mare urban area after Mirela Miclean

CONCLUSIONS

This paper brings contributions to optimize technology The of cultivation of irrigated potato in order to improve production and quality in the Letca, County, during the drought of 2011-2012.

Under the aspect of quality in irrigated potato, in 2011-2012, it is noted tuber component values concordance with those made in years favorable culture presented in the literature.

Humidity irrigated tubers was higher in both varieties than in irrigated system (reaching values of 67.8% Redsec and 66.5% at the Millennium).

Cellulose content is slightly lower irrigated, with values of 0.75% Redsec to 0.70% Redsec and the Millennium; the starch content reached average values of 18.53%; protein content: 2.5%; mineral salts or ash content: 1.02%.

From the data analysis is outstanding content in vitamin C and B6, which is higher the variety Milenium. There were increases in quantity of amino acids (tyrosine, alanine, glycine) at the variety Redsec irrigated and tyrosine, alanine, glycine, aspartic acid, phenylalanine, and histidine at Millennium irrigated variety.

In the irrigation conditions, there is an increase in the content of sodium and magnesium.

The heavy metals (Pb, Mn) are more concentrated in tubers of irrigation system, Ni, Zn, Cd, Sn are more concentrated in irrigated system tubers.

The potato crop, application of appropriate technology and global climate change area current irrigated ensure a proper quality of the production of tubers.

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