

IRRIGATED POTATO CROP IN TRADITIONAL FARMS IN LETCA AREA SALAJ COUNTY

Malschi Florian Bianca Cecilia, E. Luca

University of Agricultural Sciences and Veterinary Medicine, 3-5 Manastur St., Cluj-Napoca, 400372, Romania; emil.luca@yahoo.com

Abstract. The potato is one of the most important plant food, forage and industrial. In the industry potato is an important raw material for spirits, starch, dextrin and glucose. The potato ensure high quantity of protein (310 kg / ha) and energy (12 896 Mcal / ha), situated in second place after barley and breweries. Given the importance of potato in food and feed, in Romania between 1998 - 2001 he ensured the largest quantity of dry substance, protein and energy per hectare, in favorable climatic conditions for this crop. In the context of sustainable agriculture, potato is more valuable talking about the agronomic, economic and ecological indicators: the environment, consumer health protection, landscape quality. This study presents researches about technology in irrigated potato crop, adapted at the global warming and aridisation in traditional farms in central Transylvania, Someș Plateau, the Letca zone. The results of this study shows the dangerous periods of severe drought in recent years, which may endanger potato and they are justifying the irrigation technology development on zone small and medium farms. Analyzing the results obtained in dry years 2011-2012, for the two studied Romanian varieties (Redsec and Milenium), we founded provided production increases by applying irrigation, higher production was achieved in 2011, compared with yields of 2012 disaster situations frequently recorded in the country.

Keywords: potato culture, Someș Plateau, climate change-drought, irrigation system.

INTRODUCTION

This study brings contributions to technology research of potato cultivation, irrigation and non-irrigation under in order to improve the production and quality in traditional farms in central Transylvania, Someș Plateau, the Letca zone.

In the context of sustainable agriculture, potato is more valuable talking about the agronomic, economic and ecological indicators: the environment, consumer health protection, landscape quality.

Scientific concerns in mentioned research directions polarize the research at global scale, especially in Western Europe and developed countries on other continents.

The consumption ranges are between 30 and 150 kg/person/year in Europe with an average of 80 kg of potato/person/year. In Romania, in the scripts of the Ministry of Agriculture and Food, the annual consumption of potato ranged from 80.8 kg/person in 1991 and 129.6 kg/person in 1994, taking into account an average of 100 kg / capita (MORAR, 2008; MORAR and Marin, 2004; MIKE LUIZA et al., 2009; MIKE Luiza, 2009).

The quantity of dry matter of potato produced per area unit is approximately 7-8 t / ha. The production of protein per hectare for potatoes is 2 times higher than in grain, barley than 1.3 times and 1.1 times than corn. The content of quality protein makes that a consumption of 200 g of boiled potato a day to provide 16-18% of human proteins. The

presence of aminoacids from potato makes it comparable to meat or egg. Potato contains all the major vitamins in quantities larger than rice or white bread (DRAICA, 2000).

The tubers of potato is 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 (100 grams boiled tubers contain 0.5 to 2 mg assimilable iron, 25-50 mg assimilable phosphor and 6-17 mg calcium assimilable) (Wirths, 1968 cited by DRAICA, 1995). In general the early potato varieties have a higher content of vitamin C than those almost belated and late.

Now the potato is considered to have great potential for use in new pharmaceutical, cosmetic and in some dietetic products promotion. Potato starch, besides its use in products become classics (food, pharmaceutical, cosmetics), gets new valences of biodegradable plastics industry recommended especially for the packaging industry.

The starch is used as an ingredient in foodstuffs is only to produce products with high sensory qualities, not for nutritional purposes. Its primary functions are: - thickening agent (sauces, cream soups), - colloidal stabilizer (salad dressing), - humidity retention agent (cake type products), - gelling agent (gummy products, sweet), - binding agent (waffles), - covering agent (sugar products).

Agricultural irrigation is one of the most effective steps to improve production. Irrigation is applied globally, irrigation is applied globally not only in arid and semi-arid areas of the world, with annual precipitations of 300-500 mm but also in humid regions with annual precipitations of 700-800 mm (BOTZAN, 1972).

In Romania, the drought affects almost a half of the country's agricultural area (more than 7 million hectares), which impose irrigation both in the steppe, silvosteppe and in the more humid, of the old oak forests of plains and hills regions, where the precipitations, though it would be sufficient, are equally inadequate. Such is the case of the Carpathian foothills and plains of Transylvania, where, although the average of precipitations exceeds 600 mm, there are perimeters where irrigation is efficient (NAGY Z., LUCA E., 1994; LUCA et al., 2005; 2007; LUCA, BUDIU, ANA CIOTLĂUȘ, 2008).

MATERIAL AND METHOD

The location chosen for the experimental field, respectively Letca village, Sălaj county, covers an area of 6050 hectares. From morphologically falls within the Plateau Purcăreț - Boiu Mare - Jugastreni it happens only within Salaj county to the south (Plateau Purcăreț), as a elongated area right Somes between the Ileanda Valley and the region Ciocmani-Poienița. Meadows of the Somes river floodplains land is the highest technological suitability, because they are flat or easy inclined, with alluvial soils, rich in humus and medium texture and they are usually occupied by cultures with higher water consume.

The experimental field was situated in the village Letca, in the northeast Salaj county, on Somes River, to a distance of 50 km from the city Zalău (Figure 1 si 2).

In the experience has been studied two Romanian varieties of potato, that have been created to Station Research and Development for Potato Târgu Secuiesc: Redsec and Milenium varieties (Table 1).



Fig. 1. The physical-geographical units Salaj county and village Letca



Fig. 2. Pictures from the experimental field with potato Letca (2012)

Table 1

Characteristics of the Redsec and Milenium varieties (after Mike Luiza et al., 2004)

<p>Redsec variety was homologated in 1999 and patented in 2005.</p> <p>Morphological characters. The tubers are oval form, color of sheel is red and the pulp is yellow. The stem is medium to large. The leaf is compactly with high folio green. The inflorescence is simple, with big white-violet flowers.</p> <p>Resistance to diseases and pests: the variety is resistant to virus Y and tolerant to attack of manna (<i>Phytophthora infestans</i>).</p> <p>The vegetation period: the variety belongs to the group of varieties little late, with a period of vegetation of 87 days.</p> <p>The production capacity. The variety has high production capacity, the potential of 44.3 t / ha.</p> <p>The quality properties: good culinary quality, the variety fits in anywhere use class B, the content of starch is 18.53%. It is recommended for autumn-winter use and storage.</p>
<p>Milenium variety was homologated in 2004 and patented in 2005.</p> <p>Morphological characters. The tubers are rounded-oval form, with superficial eyes. The color of shell and pulp is yellow. The stem is high, with unpigmented internodes. the leaf is medium with green folio. The flower has white corola.</p> <p>Resistance to diseases and pests: the variety is resistant to virus Y and sensible to attack of manna (<i>Phytophthora infestans</i>). It is resistant to potato Cyst.</p> <p>The vegetation period: the variety belongs to the group of varieties late, with a period of vegetation of 100-110 days.</p> <p>The production capacity. The variety has high production capacity, the potential of 58.1 t / ha.</p> <p>The quality properties: good culinary quality, the variety fits in anywhere use class C, the content of starch is 18.53%. It is recommended for autumn-winter use and processing.</p>

The experiments were placed on a land fertility and microrelief uniformly in three repetitions (n = 3), was respected the technology for the potatoes culture of variety studied, recommended by the Research Station - Development for Potato Târgu Secuiesc, where they have been created.

The soil of the experimental field, is part of the alluvial soil, of class protosoils, occupying plane surfaces in the floodplain Someș, having a texture from the coarse to fine, with profiles Ao-C.

Table 2.

Summary of the experimental factors studied in experiences carried in 2011-2012, in the Letca - Salaj

Analyzed factors	Graduations
Factor A	A1 – year 2011
	A2 – year 2012
Factor B Irrigation regime	B1 – non-irrigated
	B2 – irrigated at 50% of active humidity interval
Factorul C Fertilization	C1 – unfertilized
	C2 – fertilization with natural fertilizer
	C3 – fertilization with natural fertilizer and chemical
Factorul D Variety	D1 – Redsec variety
	D2 – Milenium variety

For chemical fertilization have been administered every year 60 kg / ha N, 30 kg/ha P₂O₅ and 30 kg/ha K₂O. The organic fertilization was achieved by following over 30 tones of manure in autumn, in a prepared for the culture of potato.

The irrigation was done by tapping on the surface the furrows, the soil humidity to 50% humidity interval Active.

The harvest of potatoes was done manually and individually for each experimental parcel, the production processing was obtained by the method of variance analysis: the potato production determination in relation to the technological factors experienced, irrigation and fertilization regime as well as with the biologic material in the two variety, in each of the two years of research, 2011 and 2012.

RESULTS AND DISCUSSION

In present, in Romania is growing over 60 variety of potato with vegetation period and different purposes usage. In the last years has started the potato production management in purpose of use only and even some farmers were specialised in certain varieties of potato cultivation. For use in household and industrial level, the starch extract from the potato is preferred to be obtained from other vegetable sources. Starch potato in the form of pasta provides much consistency to the aliments, their viscosity and retrogradation stability are higher compared to other types of starch.

Irrigation is a high efficiency measure, with which it can influence the level, consistency and quality of crops. By irrigation watering distribution is done according the requirements of to the crop. In the areas subhumid and humid, to a deficit of 100 -150 mm water the culture needs 2-4 waterings, with an interval between waterings of 12 -14 days with a norm of irrigation 35 -45 mm water (NAGY and TURDEANU, 1990; LUCA and al., 2005, 2007, LUCA, BUDIU, ANA CIOTLĂUȘ, 2008).

The potato is one of the plants with higher humidity requirements, although the coefficient of transpiration is lower than to cereals. Novikov (1947) cited by Velican (1965) establishes this coefficient between 242-265 is influenced by the anatomical and biological characteristics of varieties, especially the development of foliar mass to flowering and low relative humidity of the air (SALONTAI, 1976).

The potato total water consumption after different authors, is between 320 and 850 mm (3200 to 8500 mc / ha) (GRUMEZA, MERCULIEV, KLEPS, 1989).

The water consumption differs depending on the stage of development of potato plants. In the period planted - rise (25 - 33 days) of potato water needs are minimal. The daily consumption is 0.5 - 2 mm, which is 10 -18% of total consumption (NAGY M. and NAGY Z., 1976). After the research conducted over a period of 25 years from Cluj-Napoca (NAGY and TURDEANU, 1990), daily water consumption of potato between planted - rise is by 1.6 to 1.8 mm / day / ha.

In the period of rise - buds (12-35 days) in which the runners growth and tuberization, the potato going through a critical stage for water. The daily consumption of potato plants is of 1.8 to 3.5 mm / day / ha, which represents 24% of total water consumption (ȘIPOȘ and PĂLTINEANU, 1976).

In the period buds - flowering (7-28 days) potato plant touch maximum foliar development, is in a period of intensive growth of tubers. In this phase the water consumption is 3 - 3.5 mm / day / ha depending on the variety (Sipos, 1976).

In the period flowering - maturity the water consumption touches the highest daily values by 5-7 mm / day / ha, which is 37-38% of total water consumption.

In the period maturity – harvest, for ensuring optimal working conditions, is recommended that the soil humidity should be between 16 to 24% depending on soil texture (TUȘA and colab., 1978), (Table 3).

Table 3.

The study of phenological evolution at potato correlated with water requirements (by Nagy and Turdeanu, 1990 ¹; Șipoș and Păltineanu, 1976 ²; Șipoș, 1976 ³; Tușa and al., 1978 ⁴)

Phenological period	Duration (days)	Water requirement (mm/ day / ha)	The importance of phenophase
planted-rise emergence	25-33	1,6 - 1,8 ¹	rise
rise-buds	12-35	1,8-3,5 ²	increase stolons, tuberization
buds- flowering	7-28	3- 3,5 ³	foliar development of, tubers growth
flowering-maturation		5 – 7 ⁴	37-38% of total water consumption
maturation -harvest			soil humidity: 16 to 24

Given the importance of the potato culture, it requires a technological system suitable for practicing this time, characterized by effects of climate change, drought and aridization. In this purpose in the traditional farms, small and medium enterprises in the center of Transylvania, Somes Plateau, are recorded dangerous periods of high drought which may endanger potato and justifying elaboration of irrigation technology for potato (Figure 3.).

Potato have a positive reaction to the improvement of water regime of soil, gives large productions, rich in protein and fats. Water is one of the major factors that strongly influence the level of production (Table 4.).

Table 4.

Potato productions made in the meadow of Somes Letca area, Salaj, depending of irrigation system, fertilization and variety, between 2011-2012

1. Potato production under the years 2011 and 2012				
Variants	Kg/ha	%	Dif.	Semnific.
2011	8150.83	100.0	0.00	-
2012	6691,11	82,1	- 1459.72	00
DL p 5%			+ 317.11	
DL p 1%			+ 732.30	
2. Potato production in 2011 and 2012, depending on irrigation regime				
Variants	Kg/ha	%	Dif.	Semnific.
Non-irrigated	5899,17	100,0	0.00	-
Irrigated	8942.78	151,6	+ 3043,61	***
DL p 0,1%			2297.68	
3. Potato production in 2011 and 2012, depending on fertilization				
Variants	Kg/ha	%	Dif.	Semnific.
Unfertilized	6251.67	100,0	0,00	-
Fertilization with natural fertilizer	7207.50	115.3	+955.83	**
Fertilization with natural fertilizer and chemical	8803.75	140,8	+2552.06	***
DL p 5%			603.15	
DL p 1%			830.76	
DL p 0,1%			1143,71	

4. Potato production in 2011 and 2012, depending on variety				
Variants	Kg/ha	%	Dif.	Semnific.
Redsec variety	8315.28	100,0	0,00	-
Milenium variety	6526.67	78.5	-1788.61	000
DL p 0,1%			555.53	
5. Potato production based on interaction between variety and year (2011-2012)				
Interactions D to A	Kg/ha	%	Dif.	Semnific.
D1 A1 Redsec variety, 2011	8991.11	100,0	0,00	-
D2 A1 Milenium variety, 2011	7310.56	81.3	- 1680.56	000
D1 A2 Redsec variety, 2012	7639.44	100,0	0,00	-
D2 A2 Milenium variety, 2012	5742.78	75.2	- 1896.67	000
DL p 0,1%			785.63	
6. Effect of irrigation on the potato production between 2011 and 2012, depending on fertilization				
Interactions B to A and C (Irrigation, year, fertilization)	Kg/ha	%	Dif. difference	Semnific.
B1 A1 C1 Non-irrigated, 2011, Unfertilized	4813.33	100,0	0,00	-
B2 A1 C1 Irrigated, 2011, Unfertilized	8398.33	174.5	+3585.00	***
B1 A1 C2 Non-irrigated, 2011, Fertilization with natural fertilizer	5751.67	100,0	0,00	-
B2 A1 C2 Irrigated, 2011, Fertilization with natural fertilizer	9963.33	173.2	+4211.67	***
B1 A1 C3 Non-irrigated, 2011, Fertilization with natural fertilizer and chemical	7766.67	100,0	0,00	-
B2 A1 C3 Irrigated, 2011, Fertilization with natural fertilizer and chemical	12211.67	157.2	+4445.00	***
B1 A2 C1 Non-irrigated, 2012, Unfertilized	5103.33	100,0	0,00	-
B2 A2 C1 Irrigated, 2012, Unfertilized	6691.67	131,1	+1588.33	*
B1 A2 C2 Non-irrigated, 2012, Fertilization with natural fertilizer	5416.67	100,0	0,00	-
B2 A2 C2 Irrigated, 2012, Fertilization with natural fertilizer	7698.33	142.1	+2281.67	**
B1 A2 C3 Non-irrigated, 2012, Fertilization with natural fertilizer and chemical	6543.33	100,0	0,00	-
B2 A2 C3 Irrigated, 2012, Fertilization with natural fertilizer and chemical	8693.33	132.9	+2150.00	**
DL p 5%			1426.01	
DL p 1%			2147.57	
DL p 0,1%			3498.44	
The factors studied: Factorul A. Year: A1 – 2011, A2 – 2012; Factorul B. Irrigation regime: B1 – non-irrigated, B2 – irrigated; Factorul C. Fertilization: C1 – unfertilized, C2 – fertilization with natural fertilizer, C3 – fertilization with natural fertilizer and chemical; Factorul D. Variety: D1 – Redsec variety, D2 – Milenium variety.				

Drought and the soil water deficit can cancel the positive effect of fertilization, of the quality of planting material, the measures taken for the culture that are very expensive technological connections.

The water can be considered the most important limiting factor of production, which to a large extent determines the profitability of irrigated the culture conditions.

CONCLUSIONS

In the economic perspective, the potato culture is an intensive culture which requires a relatively big consumption of manual and mechanical labor and an important volume of material costs, totaling a value of high technological investments.

Was found that the Letca area in the center of Transylvania Somes Plateau, the rainy periods have alternated with dry or very dry. In the situation drought years 2011 - 2012 irrigation was a technological solution favorable recording of significant production increases. Analyzing the results obtained in dry years 2011-2012, it is found that higher production have been obtained in 2011, the good year for potato culture.

According to the obtained results, for the two variety studied, are ensured production increases by applying irrigation during the vegetation period. Irrigated potato cultivation proved to be in the experimental field conditions Letca, from 2011-2012, economically efficient.

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