

DUTCH EARLY POTATO VARIETIES IN BOSNIA AND HERZEGOVINA

Josip COTA¹, Milana SILJ²

¹Federal Department of Agriculture, Sarajevo, Bosnia and Herzegovina

²Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina

(Corresponding author: j.cota@fzpz.com.ba)

Abstract

The five varieties (Adora, Arizona, Saviola, Attrice and Antea) were examined in experiments during 2011. The study was carried out at Butmir (at approximately 500 m above sea level) and Glamoc, (about 900 m a.s.l.).

The productive characteristics of potato varieties (yield, weight and the number of tubers per plant) were studied. The experiments were carried out at randomized block system, in four repetitions. The feedback results were processed with the analysis of variance. The experiment was performed on acid soil lacking humus and phosphorus and containing enough potassium for a normal growth of the crops. The climatic conditions were favorable for the potato growth. Higher yield in comparison to Adora was evident at the following varieties: Arizona (49%), Saviola (31%), Arttice (21%) and Antea (36%). Dry matter content ranged from 21.40% in the case of Arizona variety, up to 22.90% in the case of Attrice. The testing of potato varieties should be continued in the future, in order to find the best conditions for farming in Bosnia and Herzegovina.

Key words: *potato, variety, yield, quality* .

Introduction

Variety is an important component in crop production and seed is the basic reproductive material. Well-chosen variety gives higher yields and better quality itself in the same conditions and without any particular investment. Since 1995 until now over 60 varieties of potatoes has been introduced in Bosnia and Herzegovina. Selection of varieties depends on the purpose and requirements of consumers. Varieties with shorter vegetation period with early tuberisation and quickly forming of tubers are selected for the production of early potato. Besides knowing the production characteristics of each variety it is necessary to know their specific production characteristics and requirements in terms of: seed dormancy, size of vegetation area, depth of planting, fertilization irrigation, resistance to stress, as well as protection, storage and consumption quality. Varieties that form 10-12 tubers per plant provide stable and high yields while very high yields are achieved with varieties that form about 15 tubers per plant, with mandatory irrigation. The aim of the study was to show the most important characteristics of newly introduced Dutch potato varieties, their productivity characteristics and agrotechnical specificity as well by the means of network of micro-experiments in different agroecological conditions. The introduction of appropriate varieties into production, based on preliminary examination in our conditions, will provide an increase in the potato yield.

Material and methods

The study was carried out at Butmir (at approximately 500 m above sea level) and Glamoc, (about 900 m a.s.l.) in 2011. The five varieties were examined in experiments: Adora, Arizona, Saviola, Attrice and Antea. A class of seeding material was used. The experiments, were carried out at randomized block system in four repetitions. Planting of potatoes was done manually with 75 cm between row distance and 33 cm within row plant distance respectively, achieving the density of 40.000 plants per hectare. Standard agricultural practice for the potato crop was applied. Mineral fertilizers in quantities 80-100 kg/ha N, 100-120 kg/ha P₂O₅ and 180-200 kg/ha K₂O of pure nutrients were applied (total quantity of P and K in early spring as well as 60% of N, while 40% of N was used for top dressing). Crop protection was against the blight pathogen (*Phytophthora infestans* Mont de Bary) and pest Colorado potato beetle (*Leptinotarsa decemlineata*) as needed. Phenological observations of a number of parameters were carried out during vegetation. Harvest of potato tubers was carried out manually after drying of aboveground mass. After harvest, total weight and the weight of tuber fractions in a sample of 10 plants per variety was analyzed. Samples of potato tuber were taken during the harvest in order to determine the qualitative characteristics of varieties. Content of dry matter and starch in potato tubers was determined with standard method for potatoes (Rajman scale). The results were statistically analyzed using analysis of variance.

Soil and weather conditions

The experiment was set up on brown valley soil in Butmir and on brown, medium-deep soil on the limestones and dolomites in Glamoc. Soil reaction in Butmir is acidic and alkaline in Glamoc. In content of nutrients, soil in Butmir and Glamoc are poorly supplied with phosphorus. Soil on both localities has been moderately supplied with potassium.

Table 1. Chemical characteristics of soil at experimental fields

Locality	pH		Content (%)		mg/100g soil	
	H ₂ O	KCl	Total nitrogen	Humus	P ₂ O ₅	K ₂ O
Butmir	6,28	5,45	0,230	1,75	11,50	8,50
Glamoc	8,10	7,40	0,09	1,80	6,90	12,00

Climatic conditions vary from one locality to another. Mountain climate prevails in Glamoc where summers are cool, and the winters are cold while in Butmir we have quite harsh winters and moderately warm summers.

The following tables provide a multi-year averages of temperature and precipitation for these sites. Data for 2011 were are provided for Sarajevo and Livno since a weather station in Glamoc is not in use.

Table 2. Monthly air temperature (°C) for 2011

Locality	I	II	III	IV	V	VI	VII	VIII	IX
Sarajevo	0,2	0,6	5,2	11,0	14,0	18,9	20,5	21,7	19,1
Livno	0,8	1,9	4,5	10,5	14,1	18,5	19,7	20,8	17,7
Average Sarajevo(1996-2005)	0,07	1,02	5,27	9,58	15,16	18,7	20	19,81	14,4
Average Livno (1996-2005)	0,17	0,47	4,45	8,69	14,57	18,3	19,98	19,56	14

Table 3 Monthly precipitation (l/m²) for 2011

Location	I	II	III	IV	V	VI	VII	VIII	IX
Sarajevo	37,9	35,9	40,7	32,7	103,6	76,3	134,4	4,8	38,9
Livno	40,8	21,0	87,7	48,3	85,5	82,4	115,4	21,1	27,6
Average Sarajevo(1996-2005)	70	71,4	50,8	85,1	70,6	71,8	74,5	65,3	124
AverageLivno(1996-2005)	93,5	76,8	71	110,4	71,5	60,7	48,2	60,9	121

In comparison to multi-year average, the temperatures were favourable during potatoes experiment. Average monthly temperatures were favourable in fourth, sixth, seventh and ninth month in Sarajevo while in fourth, eight and ninth month in Livno compared to multi-year average. Precipitation during the growing season of potato were relatively well distributed. Rainfall excess was in the fifth, sixth and seventh month in both places compared to multi-year average.

Results and discussion

Emerging uniformity, vigor, crop uniformity and length of the growing season is highly influenced by external factors *Suvajdžić, Glišić (1975/76)*.

Table 4. Emerging uniformity, the number of additives, vigor, crop uniformity, length of growing season of potatoes at Butmir

Variety	Emerging uniformity (1-5)	Number of additives	Vigor	Crop uniformity (1-5)	Length of growing season
Arizona	5	-	4	4	121
Saviola	3	-	3	3	110
Actrice	4	-	4	5	106
Antea	5	-	4	5	113
Adora (St.)	5	-	4	4	95

Experiments were established in well-prepared soil. Emerging was relatively good while emerging uniformity ranged from 3 to 5. The most uniform emerging had varieties Arizona, Anthea, Adora, while poorer uniformity of emerging was registered with other varieties studied. There was no additives within varieties. Varieties were relatively uniform by vigor. There was no differences within varieties.

Length of the growing season has fluctuated from variety to variety, what is essentially varietal characteristic, ranging from 95 to 121 day in Butmir. The length of the growing season had been influenced by climate. The shortest vegetation of 95 days had a variety Adora, and longest vegetation had variety Arizona - 121 days. In relation to Adora vegetation was longer by 26 days in the variety Arizona.

Table 5. Number of potato tubers per plant (10 boxes) at Butmir

Variety	Ill tubers	> 55 mm	28-55 mm	< 28 mm	Average tuber mass g-
Arizona	0	18	77	25	12
Saviola	1	7	58	30	9
Actrice	0	13	55	18	8
Antea	1,5	17	58	27	10
Adora (St.)	0	6	71	16	9

Number of tubers per plant bed is a characteristic of the variety that can vary depending on the climate and growing conditions. Among the varieties studied highest number of tubers had variety Arizona (12 tubers/plant) and the lowest variety Actrice (8 tubers/plant).

Table 6. The average mass of potato tubers (10 beds) in g and % at Butmir

Variety	Ill tubers		> 55 mm		28-55 mm		< 28 mm		Average tuber mass g-
	G	%	G	%	g	%	g	%	
Arizona	0	0	4125	40,74	5600	55,30	400	3,95	101,2
Saviola	0	0	1200	22,42	3750	70,09	400	7,47	53,5
Actrice	0	0	2800	40,00	3950	56,42	250	3,57	70,0
Antea	0	0	3750	43,85	4500	52,63	300	3,50	85,5
Adora (St.)	0	0	1250	18,51	10500	77,77	250	3,70	67,5

The average tubers weight and number of potato tubers were done by sampling 10 beds of each variety at Butmir. It may be noted that sorts had varying weight of tubers, from 53.5 g in the case of Saviola to 101.2 g in the case of Arizona variety. There was higher percentage of medium sized tubers (28-55 mm) compared to large and small. The highest percentage of tubers of this fraction had a standard variety Adora (77.77%). Minimum small tubers, less than 28 mm, had a variety Anthea - 3.50% and a maximum variety Saviola - 7.47%. The number of small tubers is the characteristic of the variety and the result of climatic conditions for the growth of potatoes in the summer months, as well as toxic effects of herbicides (Sencor) in the variety Saviola.

Table 7. The yield of potato per variety (t / ha)

Variety	Locality				Average	
	Butmir	%	Glamoč	%	Cultivar	%
Adora (St.)	22,43	100	27,6	100	25,0	100
Arizona	35,52**	158	39,12**	141	37,3*	149
Saviola	24,27**	108	41,15**	149	32,7	131
Actrice	25,34**	113	35,32**	128	30,3	121
Antea	27,66**	123	40,45**	146	34,01	136
Lsd _{p=5%}	0,52		0,65		10,81	
Lsd _{p=1%}	0,74		0,91		17,94	

Compared to the standard variety Adora, the varieties tested had significantly higher tuber yield at both sites. The highest yield at the locality of Butmir had variety Arizona, 58% higher than the standard and the variety Saviola 49% higher yield than Adora at the locality of Glamoc. Significantly higher average yield in comparison to Adora was evident at the following varieties: Arizona (49%), Saviola (31%), Arttice (21%) and Antea (36%).

Table 8. The yield of potato per localities (t/ha)

Locality	Yield (t/ha)	%
Butmir	27,04	100
Glamoc	36,70*	136
Lsd _{p=5%}	6,89	
Lsd _{p=1%}	11,40	

Differences in the yield of potatoes are being observed depending on the year (Ćota J., Hadžić A., Spahović E., 2005.). Higher yield of potato was in Glamoc, 36% higher than in Butmir.

Table 9 The chemical composition of potato tubers at Butmir

Variety	Starch content %	Dry matter content %
Adora	16,50	21,70
Arizona	16,20	21,40
Saviola	16,70	21,90
Actrice	17,60	22,80
Antea	17,00	22,20

Based on the content of starch and dry matter it can be concluded that the highest percentage of starch had a variety Actrice 17.60% and 22.80% of dry matter, while the lowest had a variety Arizona 16.20% with 21.40% of starch.

Research of other authors have shown that the content of dry matter and starch fluctuates in a very wide range. Starch content depends on the variety (*Quasem, 1978*), day length (*Jakovljević, 1965*), nutrition with micro and macro elements (*Stojiljković, 1986*), length of growing season and other factors. *Ćota, et al. (2004)* find that the qualitative properties of potato react to the slightest changes in agro-ecological factors. In dry and sunny years starch content is higher, while being lower in colder and wetter years, with more cloudy days and precipitation. The content of dry matter and starch increases with later maturing of tubers (*Ćota, 2002*). Varieties with higher content of dry matter and starch have higher nutritional value.

Conclusions

The four varieties (Arizona, Saviola, Attrice, and Antea) were examined in experiments during 2011, along with standard variety Adora. Air temperatures were favorable for the development of potatoes in relation to a multi-year average. Precipitation during the growing season of potato were relatively well distributed. The shortest vegetation of 95 days had a variety Adora, and the longest vegetation of 121 days had a variety Arizona.

Among the early varieties tested the highest number of tubers had a variety Arizona (12 tubers/plant).

It may be noted that the varieties had varying weight of tubers, from 53.5 g in the case of Saviola variety to 101.2 g in the case of Arizona. The highest percentage of large tubers had a variety Antea 43.85%.

In comparison to standard Adora variety, varieties tested had significantly higher tuber yield at both localities. The highest yield at the locality of Butmir had variety Arizona, 58% higher than the standard and the variety Saviola 49% higher yield than Adora at the locality of Glamoc. Significantly higher yield of potato in comparison to Adora was evident at the following sorts: Arizona (49%), Saviola (31%), Arttice (21%) and Antea (36%).

Significantly higher yield of potato was in Glamoc, 36% higher than in Butmir.

Variety Actrice had the highest percentage of starch 17.60% and 22.80% of dry matter.

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