

STUDY ON THE CULINARY AND TECHNOLOGICAL QUALITY APPRECIATION OF NEW VARIETIES OF POTATO OBTAINED AT NIRDPSB BRASOV

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ABSTRACT

This study, conducted during 2015-2016 at NIRDPSB Brasov, was initiated in need of acquiring information on new potato varieties (Brașovia, Marvis, Sarmis, Castrum, Cosiana,) created in the institute and pursued their culinary and technological quality appreciation. The biological material analyzed is represented by potato varieties with improved genetic characteristics, both in terms of cultural qualities as well as resistance to diseases (viruses, late blight) and pests.

The culinary and technological quality of a potato variety must satisfy the requirements necessary to obtain raw material suitable for the purpose of use. The culinary quality was established by assessing the traits of overall appearance of tubers boiled, taste, crushing on boiling, pulp consistency, mealiness, pulp moisture, structure of starch granules, pulp color, tuber after-cooking darkening. The technological quality was determined by measuring the tuber starch content and establishing the suitability for processing into chips.

INTRODUCTION

The cultivated potato worldwide belongs largely to just one botanical species, *S. Tuberosum* with thousands of cultivars with great differences in size, shape, colour, texture, cooking characteristics and taste. These are complex attributes that usually show uncontrollable variation since several agronomic factors besides genetic variability affect yield and quality (Kreutzmann et al., 2011).

Quality productions can be achieved only if judiciously exploit the productive potential of varieties in favorable ecological conditions in different areas, using technical means and production performance (seed, fertilizers, pesticides, machinery and equipment) (Ianoși et al., 2002). The characteristics which determine the quality of potato are genetically determined, so they are variety characters which are strongly influenced by ecological and technological conditions. According to Lombardo et al. (2008), it might be possible to define the qualitative profile of the potato genotypes in relation to cultivation site, since the quality of tubers appearing to be affected by environmental conditions.

Sensory information based on few attributes can be used to describe culinary quality of potato varieties (Seefeldt et al., 2011). Culinary quality of potato varieties is determined by sensory appreciation of traits related to the overall look of boiled tubers, taste, crushing on boiling, consistency pulp, mealiness, moisture, starch granulation, pulp color, tubers after-cooking darkening. Boiled potatoes are traditionally preferred to be dry in some countries (Scotland) and waxy in others (Netherlands). They should not disintegrate even if slightly overcooked and this property is hard to combine with a dry texture (Jarvis, M.C., Duncan, H.J., 1992)

Potato after-cooking darkening is a tuber colour defect that occurs after cooking (boiling, baking, frying); is a quantitative trait that is predominantly controlled by genetic

factors. Other tuber quality traits, skin colour, flesh colour, specific gravity and frying colour, are not related to after-cooking darkening (Wang-Pruski, G., 2007)

The technological quality is given by the processing suitability of potato tubers. Thus, according to the product that it is desired to obtain from potato tubers, some technological characteristics are determined. Technological characteristics represented by specific gravity, dry matter content, texture, starch content, reducing sugars are influenced by genotype or cultivar (FELTRAN et al., 2004). The starch content of a potato variety has the greatest impact on cooking properties (www.cookingsciencegny.com)

Olteanu and Asanache (2011) said that "the technological characteristics are judged on the quality of the obtained potato products; thus, for fried potatoes, chips and pommes frites, it is considered yield, color, texture, and oil content. The yield, texture, content of oil's chips are correlated with the tuber dry matter and starch content. Color is one of the most important criteria in chips quality (Hassanpanah et al. 2011). The chips obtained must be light colored as uniform over the entire surface.

This study conducted during 2015-2016 at NIRDPSB Brasov, was initiated in need of acquiring information on this new potato varieties created at the I.N.C.D.C.S.Z. Brasov and pursued their culinary and technological quality appreciation. This information are also important to create improved varieties that satisfy the demand of consumers and the potato processors and growers. The varieties were grown in Braşov on a black earth soil in a non-irrigated crop. At harvest we made appreciations of culinary and technological qualities of tubers production.

MATERIALS AND METHODS

The biological material analyzed is represented by five new potato varieties (Braşovia, Marvis, Sarmis, Castrum, Cosiana) with improved genetic characteristics, both in terms of cultural qualities as well as resistance to diseases (viruses, late blight) and pests.

Braşovia is a new medium early potato variety obtained in 2013 from Amelia x Impala genitors. It has round-oval tubers, with yellow skin and white-yellow flesh. The plants have well developed stems, well developed foliage, with a medium sensitivity to late blight on leaf and tubers, medium resistance to PVY and PLRV, resistance to wart disease.

Marvis is a new medium early potato variety obtained in 2014 from Trezor x Impala genitors. It has long oval tubers, with pale yellow skin and white-yellowish flesh. The plants have well developed stems, well developed foliage, with a medium resistance to late blight on leaf and tubers, medium resistance to PVY and PLRV, resistance to wart disease.

Sarmis is a new medium early potato variety obtained in 2014 from Amelia x Impala genitors. It has round-oval tubers, with yellow skin and white-yellow flesh. The plants have a moderately resistance to late blight on leaf and tubers, moderately resistance to PVY and PLRV, resistance to wart disease.

Castrum is a new medium early potato variety obtained in 2014 from Christian x Dura genitors. It has oval tubers, with yellow skin and light yellow flesh. The plants have well developed stems and foliage, with a medium sensitivity to late blight on leaf and tubers, medium resistance to PVY, PLRV and wart disease.

Cosiana is a new medium late potato variety obtained from Amelia x Impala genitors. It has round tubers, with red skin and white-yellow flesh, shallow deep eyes. The plants have medium to high stems, with a medium resistance to late blight on leaf and tubers, medium resistance to PVY, PLRV and resistance to wart disease.

METHODS

Culinary quality of potato tubers was determined by assessing their behavior to boiling. For each analyzed sample (variety) 6 tubers were peeled and boiled at steam for 60 minutes (fig. 1).

Culinary quality was determined on the basis of the organoleptic evaluations carried out on boiled tubers. Determining the type of use of potato tubers was made by a jury composed of trained specialists who made sensory evaluation of the boiled potatoes and then they give notes for each analyzed trait on a tasting sheet.

Culinary characteristics were determined using the Lugt and Goodijk method (1959) and the scheme for appreciation of potato culinary qualities (table 1) (Ecaterina Constantinescu, 1969, Mureșan, 1999). Based on characteristics determined and their score (gathered the notes for crushing on boiling, consistency, mealiness, moisture and starch granulation), samples of potato were classified into types (groups) of use A, B, C, D and intermediate types A/B, B/C.

Type A: potato for salads. The tubers of this type does not crumble, remain whole, and have a fine structure. The taste is good and have a low starch content. Potatoes of this type are suitable for salad, but can also be used for other dishes.

Type B: the tubers are firm enough, suitable for most dishes. At boiling the tubers crush a little, they are a little wet and have a fine structure. Due to the multiple uses and good taste, the potato varieties of this type are being demanded by consumers.

Type C: includes potatoes which is crushes on boiling, they are mealy and have a quite dry texture; have a coarse structure.

Type D: tubers have a very dry texture; includes potatoes which shatters excessive at boiling, sometimes totally and have a very poor consistency. The potatoes are not used in human consumption. In most countries, this type of potatoes are used in starch and alcohol industries.



Figure 1. Appreciation of culinary quality to boiling for the new potato varieties Brașov 2015-2016

Table 1.

The scheme for appreciation of potato culinary qualities

Culinary quality traits	Graduation			
	1	2	3	4
Overall appearance	Very pleasing	Pleasing	Less pleasing	Unpleasing
Crushing on boiling	Stay entire	Crushing less	Crushing	Crushing more
Consistency	Very consistent	Consistent	Less consistent	Uneven consistency
Mealiness	Waxy	Less mealiness	Mealiness	Very mealiness
Moisture	Wet	Less humid	Rather dry	Dry
Structure of starch	Fine granules	Suitable fine granules	Large granules	Very large granules
Taste	Excelent	Very good	Good	Less good

The evaluation of raw tubers blackening (note for raw tuber blackening).

From each analyzed sample (variety) has been taken one center slice from three tubers. This three slices were left four hours at room temperature and then was used a scale from one to ten to give notes for raw tuber blackening. 1 is the note for the lowest level of row tuber blakening and 10 is the note for the higher level of row tuber blakening.

The evaluation of potato after-cooking darkening (note for after-cooking darkening). From each analyzed sample (variety) has been taken two boiled potato tubers who were left 24 hours at room temperature and then was used a scale from one to ten to give notes for after-cooking darkening. 1 is the note for the lowest level of after-cooking darkening and 10 is the note for the higher level of after-cooking darkening.

The technological quality was established based on determination of the starch content and on suitability of potatoes to processing into chips, respectively: efficiency to peeling (%), efficiency to mechanical processing (%), efficiency to processing into chips (%) and chips colour (1-9).

For the determination of starch was used Polikeit balance. The method is based on determining the specific weight of tubers with special scales (Reimann and Polikeit) and positive correlation between the specific weight and the dry matter content and starch respectively.

The suitability for processing into chips for the varieties under study was analyzed in terms of yield at peeling, yield at slicing, yield of chips and colour of chips (figure 2).



Figure 2. Suitability for processing into chips for the new potato varieties - Brașov 2015-2016

For each variety, it was taken a sample of three tubers. Potatoes were weighed before being peeled and after were peeled. The potatoes were washed and cut into thin slices of 1.75 mm using a grate. The slices were weighed and then washed several times in lukewarm water until the water remains clean, clear and were put to drain in a sieve.

For each varieties we obtained chips by roasting potato slices at 170°C; we calculated their efficiency during cleaning, mechanical processing and chips yield. After that we gave notes for chips colour, using a standardized colour scale for chips quality evaluation, using notes from 1 to 9 (1 = dark colour; 9 = light colour).

Statistical analyses of obtained data were accomplished using the statistical software package MSTAT-C. SPSS was used for statistical analysis with ANOVA, Duncan test, Pearson correlations for the values obtained by sensory analysis.

RESEARCH RESULTS

On average, over the two years 2015-2016, by analyzing the variances of data obtained from the sensorial appreciation performed on samples of boiled potatoes from the five new varieties, significant differences were pointed out between the varieties tasted (table 2.).

Based on the amount of the notes for crushing on boiling, consistency, mealiness, moisture and starch granulation, for each variety, samples of potato were classified into three types of use: Sarmis (8.67) and Castrum (9.50) type A/B, Brasovia (10.42) and Marvis (10.50) type B and Cosiana (13.00) type B/C.

Table 2.

Appreciation of culinary quality to boiling for the new potato varieties Braşov 2015-2016

Variety	Average notes for culinary quality traits								Type of use (4+5+6+7+8)
	Appearance	Taste	Colour	Crushing on boiling	Consistency	Mealiness	Moisture	Starch granulation	
	1	2	3	4	5	6	7	8	
Braşovia	1.92b	1.83ab	3.83b	1.58bc	2.50a	2.42b	2.08a	1.83a	B (10.42b)
Marvis	1.75b	2.25a	3.00c	1.42bc	2.50a	2.42b	2.08a	2.08a	B (10.50b)
Sarmis	1.08c	1.25b	5.50a	1.17c	2.08a	1.92b	1.83a	1.67a	A/B (8.67b)
Castrum	2.17b	1.58ab	4.33b	1.75b	2.50a	1.83b	1.67a	1.75a	A/B (9.50b)
Cosiana	2.75a	1.92ab	4.33b	2.83a	2.42a	3.17a	2.42a	2.17a	B/C (13.00a)
Mean	1.93	1.77	4.20	1.75	2.40	2.35	2.02	1.90	10.42
Standard deviation	0.67	0.79	1.03	0.70	0.65	0.72	0.68	0.55	2.44
CV %	19.12	37.62	14.48	20.54	25.20	26.09	30.47	31.32	19.04
LSD 5%	0.445	0.800	0.733	0.433	0.728	0.738	0.740	0.717	2.389
Minimum	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	5.5
Maximum	3.0	3.0	6.0	3.0	3.0	3.5	3.5	3.0	15.0

On average the Sarmis variety obtained the best notes for appearance (1.08), taste (1.25), crushing boiling (1.17), consistency (2.08), mealiness (1.92). All this notes indicate a variety with a very pleasing overall appearance with tubers that remain whole after boiling and less mealiness. Instead, Cosiana variety obtained the highest notes for the overall appearance (2.75), crushing on boiling (2.83), mealiness (3.17) and that indicate a variety with an overall appearance less pleasing caused by a high level of crushing on boiling and a mealiness texture.

Analyzing the coefficients for Pearson correlations between culinary quality traits, the appreciation notes for mealiness and moisture are positively significantly correlated with moisture (0.986**) and the notes for starch granulation are positively significantly correlated with mealiness (0.884*).

Table 3.

The coefficients for Pearson correlations between culinary quality traits Braşov 2015-2016

	Crushing boiling	Consistency	Mealiness	Moisture	Starch granulation
Crushing boiling	1.000	0.337	0.805	0.701	0.684
Consistency	0.337	1.000	0.298	0.220	0.478
Mealiness	0.805	0.298	1.000	0.986**	0.884*
Moisture	0.701	0.220	0.986**	1.000	0.857
Starch granulation	0.684	0.478	0.884*	0.857	1.000

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Listwise N=5

The evaluation of raw tubers blackening and after-cooking blackening were mediated in table 4. The Duncan test revealed that, on average for two years, the varieties differed significantly in terms of raw tubers blackening and after-cooking blackening. So, the highest degrees of blackening were registered at Marvis variety (4.3 and 3.1) and the lowest degrees of blackening were registered at Sarmis variety (1.7 and 1.4)

Table 4.

The evaluation of raw tubers blackening and after-cooking blackening

Variety	Row blakening	<i>After-cooking darkening</i>
Braşovia	2.8 b	2.2 b
Marvis	4.3 a	3.1 a
Sarmis	1.7 d	1.4 b
Castrum	2.6 bc	1.9 b
Cosiana	1.9 cd	1.8 b
Mean	2.7	2.1
Standard deviation	1.14	0.94
CV%	23.19	33.47
LSD 5%	0.75	0.83
Minimum	1.0	1.0
Maximum	5.0	5.0

Analyzing the coefficients for Pearson correlations between row blackening and *after-cooking darkening* (table 5), it is obvious that there is a significant positive correlation between the two quality traits (0.991**).

Table 5.

The coefficients for Pearson correlations between row blakening and after-cooking darkening

	Row blakening	<i>After-cooking darkening</i>
Row blakening	1.000	0.991**
<i>After-cooking darkening</i>	0.991**	1.000

** Correlation is significant at the 0.01 level (2-tailed)
Listwise N=5

Mean values for the indicators of suitability for processing into chips are presented in table 6. The Duncan test revealed differences between varieties regarding the starch content, efficiency to peeling, efficiency to mechanical processing and the note for chips colour. The highest starch content was recorded at Cosiana variety (16.58%), the highest efficiency to peeling and to mechanical processing at Marvis variety (85.08% and 83.12%) as well the note for the chips colour (8.00).

Table 6.

**Mean values for the indicators of suitability for processing into chips
Brașov 2015-2016**

Variety	Starch content %	Efficiency to peeling %	Efficiency to mechanical processing %	Efficiency to processing into chips %	Note for chips colour (1-9)
Brașovia	15.42b	84.5ab	82.26ab	26.20a	7.50a
Marvis	15.08b	85.08a	83.12a	26.81a	8.00a
Sarmis	15.63b	84.48ab	82.24ab	27.41a	6.08b
Castrum	15.13b	82.86c	80.31c	26.37a	5.79b
Cosiana	16.58a	83.78bc	80.65bc	28.48a	7.37a
Mean	15.57	84.14	81.72	27.05	6.94
Standard deviation	0.888	1.815	1.673	1.664	1.086
CV %	4.46	0.74	1.35	5.35	7.51
LSD 5%	0.835	0.963	1.699	2.230	0.802
Minimum	14.0	81.2	77.9	24.7	5.2
Maximum	17.0	88.8	85.4	30.6	9.0

Analyzing the notes for the chips colour it observed that Marvis, Brasovia and Cosiana varieties are suitable for processing into chips (8.00, 7.50, 7.37).

Table 7.

**The coefficients for Pearson correlations between tuber starch content and
pretability indicators for processing into chips - Brașov 2015-2016**

	Starch content %	Efficiency to peeling %	Efficiency to mechanical processing %	Efficiency to processing into chips %	Note for chips colour (1-9)
Starch content %	1.000	-0.142	-0.413	0.894*	0.126
Efficiency to peeling %	-0.142	1.000	0.958*	-0.017	0.680
Efficiency to mechanical processing %	-0.413	0.000	1.000	-0.268	0.546
Efficiency to processing into chips %	0.894*	0.017	-0.268	1.000	0.113
Note for chips colour (1-9)	0.126	0.680	0.546	0.113	1.000

* Correlation is significant at the 0.05 level

Listwise N=5

After studying the coefficients for Pearson correlations between tuber starch content and pretability indicators for processing into chips, between efficiency to processing into chips and starch content was established a statistically significant positive correlation (0.894*).

CONCLUSIONS

Studies for identifying the culinary and technological qualitative traits and parameters are necessary to characterize the new potato genotypes in order to promote potato production and to indicate culinary destination of the product. After the assessments of culinary and technological quality was found that:

- Sarmis and Castrum varieties had A/B cooking type. Potatoes of this type are suitable for using as potato salad, boiled potatoes. This varieties have a good consistency, moist enough and have a fine structure of starch.
- Brasovia and Marvis varieties had B cooking type. Potatoes are suitable for most dishes, boiled potatoes, mashed potato and even processed as chips.
- Cosiana variety had B/C cooking type; because the potatoes crushes on boiling, they are mealy and have a quite dry texture is recommended for mashed potatoes and processed as chips.

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CONTENTS - VOL. XLVI/1/2016

Working Group No. 1

PLANT CULTIVATION AND ANIMAL GROWING TECHNOLOGIES

BĂDĂRĂU C.L., RAKOSY-TICAN E., AURORI A., CHIRU S.C., OLTEANU GH., STEFAN M., GHINEA A. - The incidence of potato virus y (necrotic strains) in seed potato grown in several Romanian Counties (preliminary studies)	7
BĂDĂRĂU C.L., STEFAN M., BĂRĂSCU N. - Studies regarding the transmission of potato virus y (PVY) through several mechanical means	16
BĂRĂSCU NINA, ȘTEFAN FLORIANA MARIA, HERMEZIU RADU, BĂDĂRĂU CARMEN LILIANA - Study on the culinary and technological quality appreciation of new varieties of potato obtained at NIRDPSB Brasov	22
ZORAN BEŠLIĆ, SLAVICA TODIĆ, NEBOJŠA MARKOVIĆ, ZORAN PRŽIĆ - Influence of early basal leaf removal on yield components and must quality on CV. Sauvignon Blanc	31
BONCIU ELENA, SĂRAC IOAN - Implications of modern biotechnology in the food security and food safety	36
BONCIU ELENA - Basic raw materials used in processing of the snack food (ecological/non ecological) and their expanding capacity	42
BONEA DORINA - The effect of climatic conditions on the yield and quality of maize in the central part of Oltenia	48
BONEA DORINA - Effect of the aqueous extracts of <i>Amoracia rusticana</i> L. on the seed germination and seedling growth of <i>Zea mays</i> L. under drought stress	56
DANIELA DOLORIS CICHI, COSTEA DORIN CONSTANTIN, GHEORGHIU NICOLAE - The cold hardiness of some varieties of grapevine cultivated in the viticultural area Plenita (Southwestern Romania)	62
CICHI MIHAI - Result of the association variety x rootstock on the growth and development of aerial and underground systems in the species of apple and pear	68
CICHI MIHAI, DANIELA CICHI - Aspects regarding the behaviour of the interaction variety/rootstock at some tree varieties on the soils from the region of Oltenia	73
CIOBANU ANDI - Aspects regarding the root system and the stem growing at the Elberta peach variety	78
FLORICA COLĂ, VIORICA URECHEAN MUGUREL COLĂ - Behavioural indicators in the nutrition-excretion process of the Holstein-Friesian cattle exploited at S.C.D.A. Simnic	83
COLĂ MUGUREL - Results regarding the behavioural indicators during the automatic milking of the dairy cattle exploited at S.C.D.A. Șimnic Craiova	87
MARIJA ĆOSIĆ, RUŽICA STRIČEVIĆ, NEVENKA DJUROVIĆ, LJILJANA PROKIĆ, MILENA MARJANOVIĆ, DJORDJE MORAVČEVIĆ - Impact of irrigation regime and application of kaolin on the stomatal conductance and leaf water potential of pepper and tomato	92
MIHAELA CROITORU, RETA DRĂGHICI, I. DRĂGHICI, MILICA DIMA, EMILIA CONSTANTINESCU, MARIANA NICULESCU - The influence fertilization on the quality production of rye in the conditions of sandy soils from southern Oltenia	101
MILJAN CVETKOVIĆ, ZORANA KUNOVAC, BORUT BOSANČIĆ - Bearing potential of raspberry CV. 'Polka' as dependent on the type of aboveground growth	109
MILICA DIMA, MIHAELA CROITORU, RETA DRĂGHICI, EMILIA CONSTANTINESCU, MARIANA NICULESCU - Researches regarding on the efficacy and selectivity of herbicides to combat weeds from lavender on sandy soils	115
DOBRE CL.M., COTIGĂ C. - Adapting perennial graminaceae production for hills`area of Oltenia region	119
DOBRE CL.M., COTIGĂ C. - Organic and mineral fertilization of temporary grasslands – ecological measure and the efficiency on enhancing fodder production scenario in the hills`area of Oltenia region	122
DOBRE M., OSICEANU M., SĂLCEANU C., SUSINSKI M. - The influence of tillage on soil water	125
ŽELJKO DOLIJANOVIĆ, MILENA SIMIĆ, NEBOJŠA MOMIROVIĆ, ĐORĐE MORAVČEVIĆ, BILJANA JANOŠEVIĆ - The effects of different cover crops on grain yield of popcorn (<i>Zea mays</i> L. ssp. <i>everta</i> sturt)	129
DRĂGHICI IULIAN, RETA DRĂGHICI, MIHAELA CROITORU - Capitalizing of the sandy soils from southern Oltenia through cultivation of new varieties of triticale	134

RETA DRAGHICI, AURELIA DIACONU, DRAGHICI IULIAN, MILICA DIMA, MIHAELA CROITORU, MARIETA PLOAE, COTEȚ GHEORGHE, ALINA PARASCHIV - Results on the influence space nutrition on growth and development of sweet potato plant under sandy soils in southern Oltenia	140
RETA DRAGHICI, DRAGHICI IULIAN, AURELIA DIACONU, MILICA DIMA - Variability of genetic resources of cowpea (<i>Vigna unguiculata</i>) studied in the sandy soil conditions from Romania	147
ROXANA DUDOIU, VIOREL FATU, CARMEN LUPU, DARIA POPA, ELENA RADU, MARIANA POPESCU - Antimicrobial activity of <i>Ocimum basilicum</i> essential oil against stored fungi	154
IANCU PAULA, SOARE MARIN, BONEA DORINA, PĂNIȚĂ OVIDIU - Preliminary results concerning the genetic variability of some mutant lines of wheat experimented to ARDS Caracal	159
NICOLAE IONESCU, FLORIAN TRĂȘCĂ, GINA MINCĂ, GEORGETA TRĂȘCĂ, IULIA CIODARU AND MARIA VOICA - Fruit characteristics of <i>Digitaria sanguinalis</i> (L.) scop. weed from maize crop ...	165
TATJANA JOVANOVIĆ CVETKOVIĆ, DRAGUTIN MIJATOVIĆ, IVANA RADOJEVIĆ, ZORICA RANKOVIĆ-VASIĆ, DRAGAN NIKOLIĆ, IVANA MOŠIĆ - The characteristics of fruitfulness of some interspecies grapevine cultivars	172
TATJANA JOVANOVIĆ-CVETKOVIĆ, DRAGUTIN MIJATOVIĆ, RADA GRBIĆ - Effect of climatic parameters on uvological characteristics of variety 'Blatina'	178
KAKHA NADIRADZE, NANA PHIROSMANASHVILI - An importance of virus free seed production systems in Georgia	185
CHRISTOS KARELAKIS, EFSTRATIOS LOIZOU, MARIUS VLADU - Exploring the competitiveness, of the Greek fisheries sector	188
KRGA I., SIMIĆ A., BIJELIĆ Z., MANDIĆ V., VASILJEVIĆ S., KARAGIĆ Đ., MILIĆ D. - Interspecies relations and yield of different field pea/oats mixtures	199
MARKOVIĆ, N., PRŽIĆ, Z., TODIĆ, S., BEŠLIĆ, Z. - Productive and technological characteristics of table varieties growe in the conditions of Oplenac vineyards	206
SAŠA MATIJAŠEVIĆ, ZORAN BEŠLIĆ, ZORAN PRŽIĆ, DRAGOLJUB ŽUNIĆ, SLAVICA TODIĆ, NEBOJŠA MARKOVIĆ, ZORICA RANKOVIĆ-VASIĆ, BRATISLAV ĆIRKOVIĆ, VERA VUKOSAVLJEVIĆ, DUŠICA ĆIRKOVIĆ, MERSIJA DELIĆ - Influence of cultivar characteristics of Muscat table grapevine cultivars (<i>Vitis vinifera</i> L.) on grape brandy composition and quality	213
MORAVČEVIĆ, Đ., GVOZDANOVIĆ VARGA, J., DOLIJANOVIĆ, Ž., ĆOSIĆ, M., DELIĆ, D., UGRINOVIĆ, M. - Effects of continuous fertilization on the cucumber seedling quality	218
KLAJDI NALLBANI, TURMALA J., ENSTELA SHUKULLARI, REXHEP BAJRAMAJ - Hormonal treatment to prevent the residue of placenta in cows	223
NIȚU SORINA, ȘTEFAN FLORIANA MARIA, CHELMEA CARMEN, HERMEZIU MANUELA - Preliminary studies on maintaining the biodiversity of medicinal plants within NIRDPSB Brasov	228
C.V. POPESCU, Claudia BORLEANU, C. BORA - Measurements concerning some yield elements on sunflower cultivars in the climatic conditions of 2016 at S.C.D.A. Simnic	235
IVANA RADOJEVIĆ, MILOŠ RISTIĆ, MLAĐAN GARIĆ, TATJANA JOVANOVIĆ CVETKOVIĆ, ZORICA RANKOVIĆ-VASIĆ, DRAGAN NIKOLIĆ, ZORAN PRŽIĆ - Yield and quality of Müller-Thurgau clone GM11 of Nis grape growing region	242
RĂDULESCU DIANA, TĂNASIE ȘTEFANIA ELIZA, DUMITRU FLORIN - Correlations between some physiological processes of maize hybrids with Minerva and Danubiu influence on yield and quality of grain	246
RĂDULESCU DIANA, TĂNASIE ȘTEFANIA ELIZA, DUMITRU FLORIN - Differentiated application of nitrogen and phosphorus can cause physiological traits in maize	251
ZORICA RANKOVIĆ VASIĆ, DRAGAN NIKOLIĆ, ALEKSANDAR PETROVIĆ, BRANISLAVA SIVČEV, NEDA KOSTADINOVIĆ, NIKOLINA LISOV, SAŠA MATIJAŠEVIĆ - Some important agrobiological and technological characteristics of promising grapevine genotypes obtained for red wine production	255
C.A. ROȘCULETE, ELENA ROȘCULETE - The influence of foliar fertilizers on rape crops from SCDA Caracal	261
ELENA ROȘCULETE, ROȘCULETE C. A. - The influence of freezing on the vitamin C content in some vegetable products	266
SĂLCEANU C., OLARU L. - Researches on weed control on strawberries	271
SAVESCU PETRE - Researches regarding the changes of the NAD and FMN coenzymes state from the lemon juice after sweetening task	276
SAVESCU P, POENARU MARIA MAGDALENA, IACOBESCU F. - Study regarding the development of organic farming systems in Romania as the basis for obtaining of innocuity agricultural raw materials – used in functional food	281
TĂLMACIU NELA, TĂLMACIU MIHAI, MIROIU CARMEN, HEREA MONICA - New contributions to the knowledge of the morphology, ecology and damage caused by mining moth chestnut (<i>Cameraria orhidella</i> Deschka & Dimic) in the Husi - Vaslui areal conditions from eastern of Romania	286

TĂLMACIU NELA, TĂLMACIU MIHAI, MIROIU CARMEN, HEREA MONICA - Observations on the biology of the <i>Cameraria ohridella</i> Deschka Dimič species (leaf mining moth), dangerous pest of the chestnut tree	290
MARIUS VLADU, CRISTINA-EMANUELA VLADU - Studies on the implementation of the classification system "SEUROPO" to award quality classes of carcasses of pig	297
Khafa A., Margariti K., Kumbe I. - Seroprevalence of <i>Toxoplasma gondii</i> infection in pigs in extensive breeding from Saranda district of Albani	304
ZELJKOVIĆ SVJETLANA, ŠUŠAK UROŠ, TODOROVIĆ VIDA - Influence of two biostimulants application on growth and development of <i>Tropaeolum majus</i> L.	308

Working Group No. 2

SOIL SCIENCES

EUGENIA GAMENT, MARIANA MARINESCU, VERA CARABULEA, GEORGIANA PLOPEANU - Steel slag, a substitute of liming materials in agriculture	314
GRECU FLORINA, PAVEL ȘTEFAN - Pedological and chemical characterization of a brown – stagnic vertosoil in order to establish the fertilization plan	322
ANCA-ROVENA LĂCĂTUȘU, RADU LĂCĂTUȘU, MIHAIL DUMITRU, IRINA-RAMONA MORARU, ANDREI VRÎNCEANU, CLAUDIA BĂLĂCEANU, LAVINIA BURTAN - Decontamination of a petroleum hydrocarbons polluted soil by different bioremediation strategies	326
MARIANA MARINESCU, ANCA LACATUSU, EUGENIA GAMENT, GEORGIANA PLOPEANU, VERA CARABULEA, MARINESCU MIHAI - A review of biological methods to remediate crude oil polluted soil	335
MATEI GABI-MIRELA, MATEI S., MOCANU VICTORIA, DUMITRU SORINA - Microbiological characterization of suppressive forest soil from Enisala	341
MATEI S., MATEI GABI-MIRELA, DUMITRU SORINA, IGNAT P. - Research on the role of microbial consortium in biosynthesis of humic precursors based on secondary exometabolites	348
POPESCU CRISTIAN - The natural condition of formation and the main features of soils from Farcas locality, district Dolj	357
POPESCU CRISTIAN - The cropping characterization of soils from Vladaia locality, district Mehedinti	364
RUJOI B., F. BARCA - Possibilities of soil regeneration using the caustobiontes in early stages of carbonization	372
CARMEN SIRBU, CIOROIANU TRAIAN, ADRIANA GRIGORE, ANA-MARIA STANESCU, BOGDAN RUJOI, NICOLETA MARIN, LAVINIA BURTAN, MONICA DUMITRASCU, EMILIA NICU - Obtaining and testing of fertilizers with organic substances	376
TUDOSOIU C., ACHIM ELENA., GANEA-CHRISTU I. - Analytical calculation of water retention capacity, specific for forestry terraces situated on slope degraded lands	382
VUJOSEVIC A. - The influence of substrate composition on the development of seedlings of annual flowers <i>Catharanthus roseus</i> L.	391

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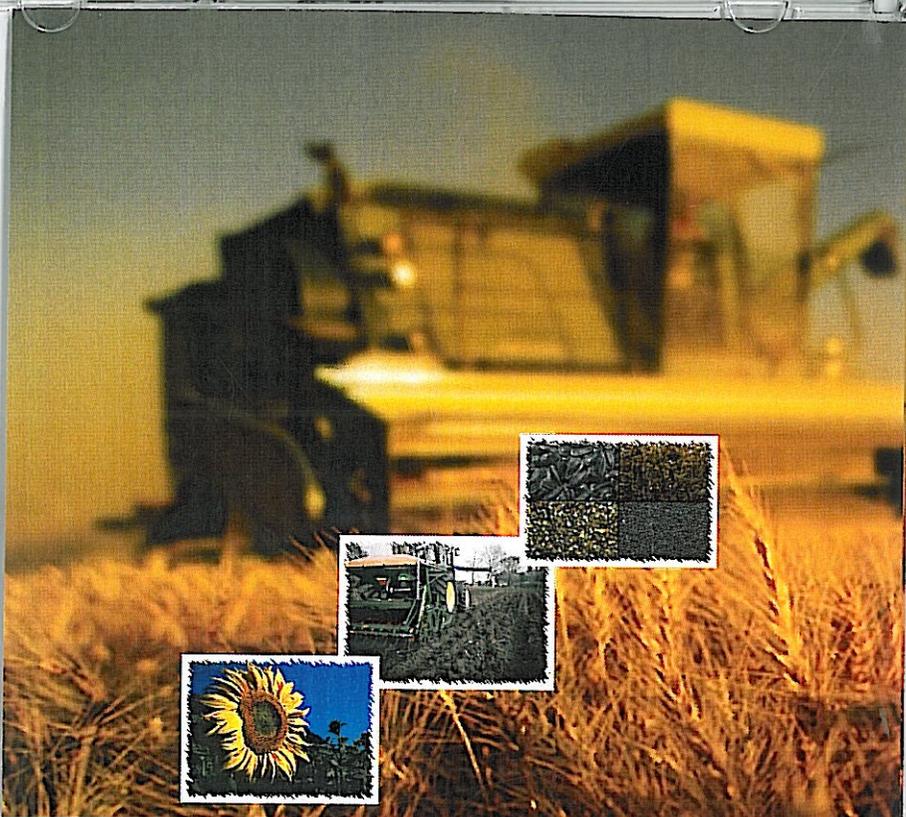
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