Scientific Papers. Series A. Agronomy, Vol. LXVI, No. 1, 2023
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

# EVALUATION OF TUBER YIELD AND CULINARY QUALITY FOR TRUE POTATO SEED GENOTYPES GROWN UNDER DROUGHT STRESS FIELD CONDITIONS

**Mihaela CIOLOCA[1], Andreea TICAN[1], Monica POPA[1],
Nina BĂRĂSCU[1, 2], Carmen Liliana BĂDĂRĂU[1, 2], Valentina ȘERBAN[1]**

[1]National Institute of Research and Development for Potato and Sugar Beet, 2 Fundaturii Street, 500470, Brasov, Romania
[2]Transilvania University, Faculty of Food and Tourism, 148 Castelului Street, 500014, Brasov, Romania

Corresponding author email: tican_andreea@yahoo.com

***Abstract***

*The main objective of this study was to evaluate under field conditions potato genotypes derived from true seeds, that showed tolerance to in vitro induced water stress. The biological material was represented by 3 genotypes: GIL19-03-07, ZIL19-02-43 and GIL19-03-29, for which tuber number, yield and culinary quality were determined. The genotype GIL19-03-07 obtained the best results in terms of total number of tubers (647.20 thousand/ha), surpassing the variety Cosiana (control). In a dry growing year, in terms of total tuber production, the results obtained point to the genotype ZIL19-02-43 which obtained a production of 27.19 t/ha, followed by the genotype GIL19-03-07 with a production of 21.21 t/ha. The results of the culinary and technological quality analyses suggest that genotypes GIL19-03-07 and ZIL19-02-43 are suitable as raw material for chips, while genotype GIL19-03-29 is suitable for salads and other culinary preparations due to its pleasant taste and pulp texture.*

***Key words**: culinary quality, field conditions, potato, true potato seed, tuber yield.*

## INTRODUCTION

Potato is a cool climate-loving crop and does not perform well at high temperatures. The modern potato is considered a drought-sensitive crop, and it is susceptible to yield loss because of drought stress. Unfortunately, drought severity, frequency and extent have been increasing around the globe because of climate change (Nasir & Toth, 2022).

The increase in drought stress threatens the global agriculture production and food availability. Drought is a major environmental factor that determines the growth, productivity and distribution of plants (Rukundo et al., 2012).

The negative effects of drought conditions are continuously accentuated by the explosive increase of world population, continuous deterioration of arable land, lack of fresh water, and the current climate change.

Drought is considered to be one of the abiotic stressors affecting plant growth and development, food security and causing the greatest crop losses (Anjum et al., 2011; Zaki & Radwan, 2022). Therefore, the sustainability of production will depend on the identification and development of new drought tolerant varieties (Cochard et al., 2008, cited by Rukundo et al., 2012).

Drought is one of the major constrains facing agricultural production worldwide and its impact is expected to increase in future. The world population is also expected to increase and this will require more safe, nutritious, and healthy foods. The cultivated potato (*Solanum tuberosum*) is an important crop that has the potential of feeding the world. However, it is highly susceptible to drought owing to its shallow root network that occupies the upper 0.3 m of the soil layer (Okayo, 2015).

Water is vital for plant growth and development, and many physiological processes are affected when this element is restricted. In the case of potato, water deficit at the tuber stage causes the most significant yield losses compared to other stages of plant development (Anithakumari et al., 2011). In terms of reproduction, the potato can be propagated by two distinct methods: sexually (by botanical seed) or vegetatively (by tubers). Like all other botanical seeds, TPS has the potential to grow into a full plant, but every plant is genetically different, thus making TPS population heterogeneous. TPS has many advantages over potato seed tubers. The major ones are disease - and pest - free planting material, easy storage and transportation, and a highly reduced seed rate (about 150 g/ha as against 2.5-3.0 t/ha of seed tubers) (Buckseth et al., 2022; Muthoni et al., 2013; Ozturk & Dumanoglu, 2021). True potato seed (TPS) offers an alternative technology of crop production for the regions where resource poor farmers can have quality-planting material at a reasonable cost (Adhikari, 2010). Traditionally potatoes are grown in cool climates. The major potato production is now in the northern latitudes and in the highlands of the tropics. With the use of true potato seed (TPS), potatoes can grow in warm, non-traditional potato growing areas (Tuku, 1994).

In 2019, at the National Institute of Research and Development for Potato and Sugar Beet Brasov, Romania, a study was initiated as part of a research project that aimed to identify in populations derived from botanical seed, characterized by a high degree of uniformity (isogenic lines), one or more prospective genotypes in terms of productivity, tolerance to abiotic and biotic stress factors as well as their culinary quality. The main objective was to assess the possibility of producing an alternative planting material from botanical seed to supplement the potato requirement.

## MATERIALS AND METHODS

**Aspects of field work**. The study was carried out in the experimental field of the National Institute of Research and Development for Potato and Sugar Beet Brasov, Romania. In order to follow the evolution of the genotypes derived from botanical seed under open field conditions, the biological material obtained in a protected area ("insect-proof" space) in 2021, consisting in potato minitubers (Prebase), was planted on 14 April 2022 in the clonal field of NIRDPSB Brasov, located in the traditional potato growing area of our country, which is also considered a closed area. The present study evaluated the total tuber yield (t/ha), total tuber number (thousand/ha), number and production of tubers by size fractions and culinary quality from 3 potato genotypes (GIL19-03-07, ZIL19-02-43 and GIL19-03-29). The Cosiana variety was used as control. Minitubers were planted 25 cm apart and 75 cm between rows. The experience was arranged in a randomized complete block design with three replications.

From a climatic point of view, the production season of 2021/2022 in Brasov was a dry one (Table 1).

Table 1. Average monthly temperatures (ºC), rainfall (mm) and MAA during the production season 2021/2022 in Brasov

| Year/Month | | Average air temperature (ºC) | | | Rainfall (mm) | | |
|---|---|---|---|---|---|---|---|
| | | Recorded | MAA | Deviations | Recorded | MAA | Deviations |
| 2021 | October | 7.2 | 8.3 | -1.1 | 30 | 38.9 | -8.9 |
| | November | 4.6 | 3.1 | 1.5 | 27.5 | 32.8 | -5.3 |
| | December | 1.3 | -2.2 | 3,5 | 45.5 | 27 | 18.5 |
| 2022 | January | -1.0 | -5 | 4 | 21.6 | 25.5 | -3.9 |
| | February | 0.8 | -2.5 | 3.3 | 5.6 | 23.9 | -18.3 |
| | March | 0.8 | 2.6 | -1.8 | 24.8 | 28.9 | -4.1 |
| | April | 8.3 | 8.5 | -0.2 | 64.8 | 50 | 14.8 |
| | May | 14.8 | 13.6 | 1.2 | 48.3 | 82 | -33.7 |
| | June | 19 | 16.5 | 2.5 | 37.5 | 96.7 | -65.1 |
| | July | 20.6 | 18.1 | 2.5 | 50.1 | 99.8 | -49.7 |
| | August | 20.2 | 17.5 | 2.7 | 50.3 | 76.4 | -26 |
| | September | 13.6 | 13.6 | 0 | 65.6 | 52.5 | 13.1 |
| Winter period (X - III) | | 2.3 | 0.7 | 1.6 | 25.8 | 29.6 | -3.7 |
| Growing period (IV - IX) | | 16.01 | 14.8 | 1.45 | 52.77 | 76.24 | -24.4 |
| Production season 2021/2022 (oct. 2021 - sept. 2022) | | 9.2 | 7.7 | 1.52 | 42.52 | 52.92 | -10.4 |

*Source: Weather Station Ghimbav, Brasov County*

In the year 2022 late spring and summer air temperature regime were characterized by a generally higher than usual. In June, July and August the average temperature deviated by more than 2.5°C from the multiannual average (MAA). Also in the period before the potato crop was established (i.e. October to March), the average temperature (2.3°C) was much higher than the MAA value (0.7°C). As regards the precipitation level, the winter period was characterised by a much lower volume than the MAA value (Table 1). Also, in May, June, July and August the low rainfall and the high percentage of warm days were not favourable for the development of potato plants. The amount of rainfall during both winter and the growing season was very low compared to the multiannual average for Brasov and a good water supply for the soil was not ensured.

Pre-planting activities, cultivation and maintenance was in line with current good agricultural practice (Table 2).

Table 2. Calendar of activities performed in experimental field (NIRDPSB Brasov, 2022)

| Activities | Date |
|---|---|
| Autumn plowing (35 cm deep) | 11.11.2021 |
| NPK fertilization (15:15:15) - 1000 kg/ha | 5.04.2022 |
| Land preparation | 8.04.2022 |
| Planting (manually) Planting distance: 25 cm between plants/row and 75 cm between rows | 14.04.2022 |
| Hilling | 04.05.2022 |
| Weed control | |
| Sencor - 0.9 l/ha<br>Lontrel 300 - 0.3 l/ha | 09.05.2022<br>27.05.2022 |
| Disease control | |
| Carial Flex - 0.6 l/ha<br>Carial Star - 0.6 l/ha<br>Lieto - 450 g/ha<br>Shirlane - 400 ml/ha | 31.05.2022<br>15.06.2022<br>29.07.2022<br>18.08.2022 |
| Pest control | |
| Cyperguard – 0.08 l/ha<br>Decis 25 WG - 30 g/ha<br>Coragen - 50 ml/ha<br>Mospilan 20 SG - 0.1 kg/ha | 03.06.2022<br>15.06.2022<br>08.07.2022<br>18.07.2022 |
| Haulm killing (mechanically) | 30.08.2022 |
| Harvesting | 27.09.2022 |

As regards the application of chemical treatments during the growing season of the potato crop, they were mainly aimed to control the potato late blight (*Phytophthora infestans*), aphids and Colorado potato beetle (*Leptinotarsa decemlineata* Say).

To establish the phytosanitary quality of the material, the viral testing of the seed potato has a decisive role. It is a measure applied to obtain a material with the lowest degree of viral infections. On June 21, leaf samples were taken from the field, for all three potato genotypes: GIL 19-03-07, ZIL 19-02-43 and GIL 19-03-29. The ideal time to harvest the leaves is when the plant is young, or at the latest before the flowering period. Viral testing was performed (using the ELISA technique) for 6 potato viruses: Potato leaf roll virus (PLRV), Potato Virus Y (PVY), Potato Virus A (PVA), Potato Virus X (PVX), Potato Virus S (PVS) and Potato Virus M (PVM). Following the obtained results, the tested material proved to be healthy.

**Assessment of the culinary and technological quality of tubers**. Culinary quality was determined based on the organoleptic evaluations carried out on boiled tubers. Overall appearance, crushing on boiling, consistency of the pulp, mealiness, moisture, structure of starch granules, taste and after-cooking blackening are appreciated. For the evaluation of enzymic browning one center slice from three tubers has been taken. These thin slices (3 mm thick) with skin are kept on a glass plate for 4 hours.


a. The color of the cooked pulp after 24 hours


b. Enzymic browning after 4 hours

Figure 1. Aspects in the appreciation of potato quality

Both after-cooking blackening (Figure 1a) and enzymic browning (Figure 1b) are undesirable aspects in the appreciation of potato quality.

For a potato genotype to be appreciated in terms of quality, the color of the pulp must remain unchanged or change slightly.

Polikeit balance was used for the determination of starch. From the total weight of the tuber, water represents 65-87%, the remaining 13-35% being the dry substance, of which starch has the largest share. For ware potatoes a starch content of 12-16% is considered optimal, while for industrial processing, varieties with a higher starch content (over 17%) are preferred.

The three genotypes of potato derived from botanical seed were also evaluated regarding the suitability for obtaining chips. For each genotype, a sample of 3 tubers with skin was weighed. Then the tubers were peeled and weighed again, after which they are sliced lengthwise with the help of a grater (the whole tuber) to obtain rounds (Figure 2).

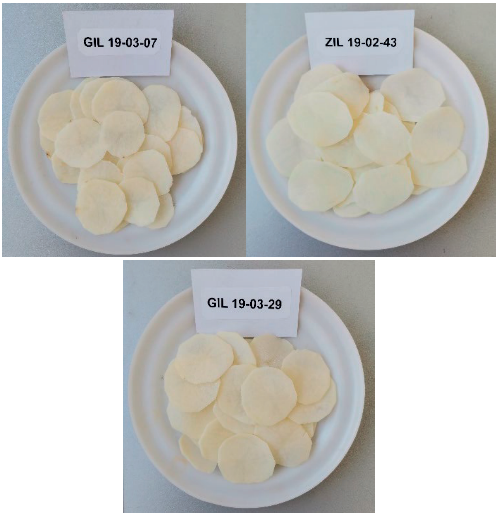

Figure 2. Potato slices before frying

The round potato slices are fried in oil bath, at a temperature of 180ºC. When the slices are crispy, dry (have lost water), they are removed from the oil, placed on a paper towel and weighed. To assess the color of the chip, a standardized scale is used, in the form of cards marked from 1 to 9 (Figure 3). In some countries, light-colored chips are preferred, and in others, slightly more colorful. The color of the chips is directly influenced by the amount of reducing sugars in the tuber. These, present in a higher percentage, give a brown color, rejected by consumers.

Figure 3. Assessment of the chips color

## RESULTS AND DISCUSSIONS

**Results regarding tuber number and yield**

After harvesting, in addition to the total yield (t/ha), the number of tubers and their yield by size fractions were determined. Also, the weight of tubers by size fractions (large, medium and small) was determined for each individual genotype.

The results recorded after harvesting the tubers from the experimental field were processed by variance analysis (Săulescu and Săulescu, 1967).

Regarding the number of large tubers, genotype GIL 19-03-29 came closest to the control variety (Cosiana), compared to which it recorded a negative but insignificant difference (-31.32 thousand/ha), being followed by the genotype ZIL 19-02-43 (-38.52 thousand/ha). Regarding the number of medium tubers, the genotypes GIL 19-03-07 (327.41 thousand/ha) and ZIL 19-02-43 (321.06 thousand/ha) were noted, the differences compared to the control being insignificant (Table 3). The largest number of small tubers/ha was obtained at the GIL 19-03-07 genotype (310.90 thousand/ha), which recorded a positive difference (116.19 thousand/ha) compared to the control variety.

Comparing the three genotypes derived from botanical potato seed with the Cosiana variety in terms of the total number of tubers/ha, it can be seen that GIL 19-03-07 obtained the highest value (647.20 thousand/ha), surpassing the control, compared to which it registered a positive difference of 7.83 thousand/ha. It is followed by ZIL 19-02-43 with a total number of tubers of 525.08 thousand/ha.

Analyzing the influence of the genotype on the distribution of tubers in different size classes, it can be seen in Figure 4 that in all three potato genotypes derived from true seed, the highest percentage was the medium size tubers and then the tubers from the small fraction, exception making the genotype GIL 19-03-29 where the share of tubers from the large fraction (23%) exceeded that of small-sized tubers (16%). The results obtained regarding the distribution of tubers by size category suggest that the genotypes GIL 19-03-29 and ZIL 19-02-43 are competitive from the point of view of marketing the production, which can be used both for consumption and for seed.

Table 3. Effect of genotype on the number of tubers by size fractions and total number of tubers (thousands/ha) (experimental field NIRDPSB Brasov, 2022)

| Genotype | Number of large tubers/ha (thousands) | Diff./Sign. | Number of medium tubers/ha (thousands) | Diff./Sign. | Number of small tubers/ha (thousands) | Diff./Sign. | Total number of tubers/ha (thousands) | Diff./Sign. |
|---|---|---|---|---|---|---|---|---|
| GIL 19-03-07 | 8.89 | -74.50 oo | 327.41 | -33.86 ns | 310.90 | 116.19 ns | 647.20 | 7.83 ns |
| ZIL 19-02-43 | 44.87 | -38.52 ns | 321.06 | -40.21 ns | 159.15 | -35.56 ns | 525.08 | -114.29 ns |
| GIL 19-03-29 | 52.06 | -31.32 ns | 133.76 | -227.51 o | 34.50 | -160.21 o | 220.32 | -419.05 oo |
| COSIANA (Ct) | 83.39 | - | 361.27 | - | 194.71 | - | 639.37 | - |
| | | LSD 5%=40.12<br>LSD 1%=60.75<br>LSD 0.1%=97.59 | | LSD 5%=207.16<br>LSD 1%=313.70<br>LSD 0.1%=503.95 | | LSD 5%=137.70<br>LSD 1%=208.51<br>LSD 0.1%=334.97 | | LSD 5%=270.55<br>LSD 1%=409.70<br>LSD 0.1%=658.16 |

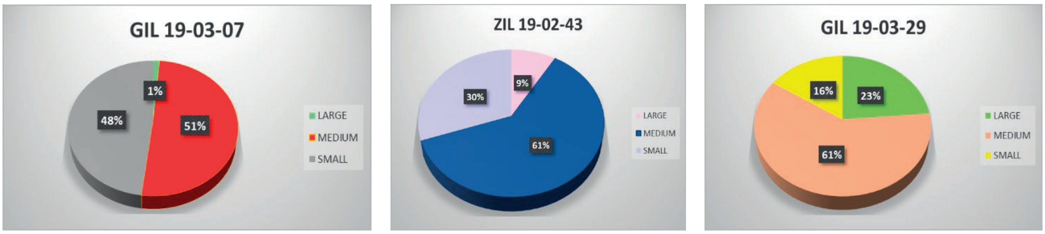


Figure 4. Distribution of tubers by size fractions (%) according to genotype

Examining the data presented in Table 4, regarding the yield of large tubers/ha, the obtained results highlight the GIL 19-03-29 genotype (8.54 t/ha), which came closest to the Cosiana variety (14.20 t/ha), being followed by ZIL 19-02-43 (6.87 t/ha). Regarding the yield of medium tubers, the genotype ZIL 19-02-43 (18.37 t/ha) stands out, surpassing the control (16.18 t/ha) compared to which it recorded a positive difference of 2.20 t/ha. The genotype GIL 19-03-07 obtained the best results regarding the yield of small tubers (4.49 t/ha) recording a difference of 1.90 t/ha compared to the control variety.

Table 4. Effect of genotype on the tuber yield by size fractions and total tuber yield (t/ha) (experimental field NIRDPSB Brasov, 2022)

| Genotype | Yield of large tubers (t/ha) | Diff./Sign. | Yield of medium tubers (t/ha) | Diff./Sign. | Yield of small tubers (t/ha) | Diff./Sign. | Total yield (t/ha) | Diff./Sign. |
|---|---|---|---|---|---|---|---|---|
| GIL 19-03-07 | 1.16 | -13.05 oo | 15.56 | -0.62 ns | 4.49 | 1.90 ns | 21.21 | -11.76 ns |
| ZIL 19-02-43 | 6.87 | -7.33 o | 18.37 | 2.20 ns | 1.95 | -0.64 ns | 27.19 | -5.77 ns |
| GIL 19-03-29 | 8.54 | -5.66 ns | 8.00 | -8.17 ns | 0.39 | -2.19 o | 16.94 | -16.03 o |
| COSIANA (Ct) | 14.20 | - | 16.18 | - | 2.59 | - | 32.97 | - |
| | | LSD 5%=6.80<br>LSD 1%=10.29<br>LSD 0.1%=16.53 | | LSD 5%=8.78<br>LSD 1%=13.29<br>LSD 0.1%=21.36 | | LSD 5%=1.94<br>LSD 1%=2.93<br>LSD 0.1%=4.71 | | LSD 5%=13.11<br>LSD 1%=19.86<br>LSD 0.1%=31.90 |

Regarding the total tuber yield, the obtained results highlighted the genotype ZIL 19-02-43 which obtained 27.19 t/ha, followed by the genotype GIL 19-03-07 with 21.21 t/ha, the differences compared to the control being insignificant. The two potato genotypes derived from botanical seed demonstrated a good production capacity, over 20 t/ha in the conditions of a dry crop year.

**Results regarding the evaluation of culinary quality characteristics**

Analyzing the results obtained regarding the starch content of potato tubers (Table 5), it can be observed that the genotype GIL 19-03-29 recorded the lowest percentage of starch (12.50%), and GIL 19-03-07 had the richest starch content (17.17%). ZIL 19-02-43 recorded a starch content of 14.17%. Thus, the genotypes GIL 19-03-29 and ZIL 19-02-43 are more suitable for fresh consumption, while GIL 19-03-07 lends itself to industrialization.

Table 5. Starch content (%) of potato genotypes derived from true seed

| Genotype | Starch content/replication (%) | | | Average |
|---|---|---|---|---|
| GIL 19-03-07 | 17.25 | 16.75 | 17.50 | 17.17 |
| ZIL 19-02-43 | 14.25 | 14.50 | 13.75 | 14.17 |
| GIL 19-03-29 | 12.50 | 12.25 | 12.75 | 12.50 |

From the point of view of culinary and technological quality, potato genotypes derived from true seed were evaluated in terms of: boiling behavior, dry matter and starch content, flesh color (raw and cooked) and suitability for chips. Table 6 presents mean values for culinary quality traits. By the sum of crushing on boiling, consistency, mealiness, moisture and starch granulation a cooking type index for the studied potato genotypes was obtained. Thus, the GIL 19-03-29 genotype belongs to class A/B, being recommended for salads and other culinary preparations where consistent tubers are needed, which do not crumble, or crumble a little during cooking. The genotypes ZIL 19-02-43 and GIL 19-03-07 belong to class B. Due to the good taste and multiple directions of use, potatoes in this class are highly demanded by consumers, being suitable for most culinary preparations.

Table 7 shows the results regarding the color change of the cooked pulp after 24 hours. Thus, it can be seen that the genotype ZIL 19-02-43 received the best grade, because the pulp color remained almost unchanged, being followed by the genotype GIL 19-03-07, while the genotype GIL 19-03- 29 the color of the pulp has changed compared to the initial appearance, receiving a lower grade.

Regarding the degree of raw pulp enzymic browning, the obtained results (Table 7) highlight the genotype ZIL 19-02-43, which received the best mark (1.5), the color of the fresh pulp remaining almost unchanged (after 4 hours at room temperature) compared to the initial color. This was followed by genotype GIL 19-03-07 (1.83) and genotype GIL 19-03-29 (2.67).

In the industrial process, it is important to know what the peeling losses are and what is the weight difference between the tuber without skin and the sliced one (Table 8). It is desirable that a large amount of the total tuber weight can be used, in order to obtain the final product. In this sense, the genotype GIL 19-03-29 obtained very good results, the losses being the lowest. In order for the losses due to peeling to be as low as possible, the tubers must have a thin skin and the eyes as shallow as possible.

Table 8. Determinations of suitability for chips

| 1 sample = 3 tubers | Genotype | | |
|---|---|---|---|
| | GIL 19-03-07 | ZIL 19-02-43 | GIL 19-03-29 |
| Tubers weight with skin (g) $W_1$ | 402 | 426 | 438 |
| Tubers weight without skin (g) $W_2$ | 326 | 358 | 364 |
| Difference (g) $W_1$ - $W_2$ | 76 | 68 | 74 |
| Weight of round slices (g) $W_3$ | 306 | 340 | 352 |
| Difference (g) $W_2$ - $W_3$ | 20 | 18 | 12 |

When using potato as a raw material to obtain chips, it is important to determine how many chips were obtained from a certain amount of potatoes. Thus, it is calculated (Table 7) what percentage of the total weight of the tuber with skin was used as chips. Regarding this aspect, the genotype GIL 19-03-07 obtained the best results, having a total efficiency of 31.34%. For a potato genotype to be suitable for this purpose, 1 kg of chips must be obtained from 4 kg of potatoes. From this point of view, all 3 studied genotypes fall within this ratio.

Table 6. Apreciation on culinary quality of boiled potato tubers

| Genotype | Average grades for culinary quality traits | | | | | | | | | Coo king |
|---|---|---|---|---|---|---|---|---|---|---|
| | Appearance | Taste | Interior color | Crushing on boiling | Consistency | Mealiness | Moisture | Starch granulation | Cooking type index | |
| ZIL19-02-43 | 1.00 | 3.75 | 2.25 | 1.00 | 1.75 | 2.50 | 2.63 | 2.38 | 10.26 | B |
| GIL19-03-29 | 1.63 | 1.75 | 3.00 | 1.13 | 1.38 | 2.00 | 2.63 | 1.63 | 8.77 | A/B |
| GIL19-03-07 | 2.50 | 2.50 | 2.75 | 1.50 | 1.88 | 2.25 | 2.13 | 2.38 | 10.14 | B |

Table 7. Culinary quality assessment results (chips, enzymic browning and after-cooking blackening)

| Genotype | Dry matter content (%) | Starch content (%) | Enzymic browning | After-cooking blackening | Peeling efficiency (%) | Mechanical processing efficiency (%) | Total efficiency (%) | Chips color |
|---|---|---|---|---|---|---|---|---|
| ZIL19-02-43 | 23.55 | 14.17 | 1.50 | 1.3 | 84.04 | 79.81 | 26.29 | 7.7 |
| GIL19-03-29 | 22.17 | 12.50 | 2.67 | 2.7 | 83.11 | 80.37 | 25.11 | 6.7 |
| GIL19-03-07 | 24.15 | 17.17 | 1.83 | 2.0 | 81.09 | 76.12 | 31.34 | 9.0 |

Regarding the color of the chips, all three genotypes presented a beautiful, golden color, appreciated by the tasters. The best grade was given to the genotype GIL19-03-07 (9), followed by ZIL 19-02-43 and GIL 19-03-29 (Table 7).

When we refer to the potato intended for industrial processing, a high content of dry matter (24% or higher) ensures a better production of the finished product, since the reduced amount of water evaporates faster during frying, and the amount of oil taken up by to the potato slices is smaller. The highest dry matter content was recorded in the genotype GIL 19-03-07 (24.15%).

Potato genotypes with a starch content between 17-19% are preferred for chips. A low starch content in the tubers leads to the absorption of a large amount of oil during frying and the reduction of the product's shelf life. And from this point of view, GIL 19-03-07 also stands out with a percentage of 17.17% (Table 7).

## CONCLUSIONS

Three potato genotypes derived from true seed, which showed tolerance to water stress induced *in vitro*, were also evaluated under open field conditions.

Regarding the total number of tubers, the GIL 19-03-07 genotype obtained the best results (647.20 thousand/ha), surpassing the Cosiana variety (control), compared to which a positive difference of 7.83 thousand/ha was recorded.

Analyzing the results regarding the influence of genotype on the distribution of tubers in different size fractions, it emerged that in all three potato genotypes, the highest percentage had medium-sized tubers and then tubers from the small fraction, with the exception of the genotype GIL 19-03-29 where the proportion of tubers from the large fraction (23%) exceeded that of small-sized tubers (16%).

Regarding the total tuber yield, the obtained results draw our attention to the genotype ZIL 19-02-43 which obtained 27.19 t/ha, followed by the genotype GIL 19-03-07 with a production of 21.21 t/ha, the differences compared to the control variety being insignificant. It should be mentioned that these productions were obtained in the climatic conditions of a crop year which in the summer period was characterized by average temperatures higher than 2.5°C compared to MAA, and the level of precipitation was very low compared to the multiannual average for Brasov, both in winter and in the growing season.

Based on the culinary and technological quality analyses, the characterization of the three genotypes from botanical seed potato is as follows:

- **GIL 19-03-07:** the tubers maintain their firmness during cooking, in general the enzymes that cause the blackening of the pulp are missing and have an excellent color when fried. Tubers have a higher dry matter content and a higher percentage of starch. As a priority direction of use this genotype is suitable as a raw material for obtaining chips.
- **ZIL 19-02-43:** after boiling, the tubers remain intact. The enzymes that cause the blackening of the pulp are missing and the tubers are very attractive. The color of the pulp remains unchanged after boiling or frying. It also meets all the requirements to obtain potato chips.
- **GIL 03-19-29:** The tubers do not crush when boiled, are not floury, have a consistent pulp, they are moist, and the starch structure is fine. The taste is very good and the starch content is lower. Due to the pleasant taste and the texture of the pulp, it is suitable for salads and other culinary dishes.

It is recommended to use the genotypes ZIL 19-02-43 and GIL 19-03-07 which have demonstrated a good production capacity under the conditions of a dry year. Also, as a priority direction of use, the two potato genotypes derived from true seed are suitable as raw material for obtaining chips.

## ACKNOWLEDGEMENTS

This work was supported by the project PN19-32-01-03, "The use of true potato seed lines in order to identify perspective genotypes in the context of global climate change", contract number 37 N/2019.

## REFERENCES

Adhikari, R.C. (2010). Evaluation of hybrid true potato seed families in Nepal. *Proceedings of the Potato AgroPhysiology*, Nevsehir, Turkey, 20-24 September 2010, p. 224-229.

Anithakumari, A.M., Dolstra, O., Vosman, B., Visser, R.G.F., Van der Linden, C.G. (2011). *In vitro* screening and QTL analysis for drought tolerance in diploid potato. *Euphytica, 181*(3), 357–369.

Anjum, S.A., Xie, X.Y., Wang, L.C., Saleem, M.F., Man, C., Lei, W. (2011). Morphological, physiological and biochemical responses of plants to drought stress. *African Journal of Agricultural Research, 6*(9), 2026–2032.

Buckseth, T., Tiwari, J.K., Singhm R.K., Kumar, V., Sharma, A.K., Dalamu, D., Bhardwaj, V., Sood, S., Kumar, M., Sadawarti, M., Challam, C., Naik, S., Pandey, N.K. (2022). Advances in innovative seed potato production systems in India. *Front. Agron., 4*. 956667. DOI: 10.3389/fagro.2022.956667.

Muthoni, J., Shimelis, H., Melis, R. (2013). Alleviating potato seed tuber shortage in developing countries: Potential of true potato seeds. *Australian journal of Crop Science*, *AJCS 7*(12), 1946–1954.

Nasir, M.W. & Toth, Z. (2022). Effect of Drought Stress on Potato Production: A Review. *Agronomy*, *12.* 635. https://doi.org/ 10.3390/agronomy12030635.

Okayo, R. (2015). Drought response in cultivated potatoes: phenotypic behaviours and molecular aspects of signalling and tuberization. *Minor thesis plant breeding; Department of Plant breeding Wageningen University and research Centre*.

Ozturk, G. & Dumanoglu, Z. (2021). Yield performances of pelleted true potato (TPS) seeds in outdoor seedbed growing. *Turkish Journal of Field Crops*, *26*(2), 180–187; DOI: 10.17557/tjfc.1023691.

Rukundo, P., Carpentier, S.C., Swennen, R., (2012). Development of *"in vitro"* technique to screen for drought tolerant banana varieties by sorbitol induced osmotic stress. *African Journal of Plant Science*, 6(15), 416–425.

Săulescu, N.A. and Săulescu, N.N. (1967). *Câmpul de experiență,* ediția a II-a, Editura Agro-Silvică, București.

Tuku, B.T. (1994). The utilization of true potato seed (TPS) as an alternative method of potato production. *Thesis Wageningen. With réf. - With summary in Dutch.* ISBN: 90-5485-253-4. 29344289.pdf (core.ac.uk).

Zaki, H.E.M., and Radwan, KS.A. (2022). Response of potato (*Solanum tuberosum* L.) cultivars to drought stress under *in vitro* and field conditions. *Chem. Biol. Technol. Agric*., *9*(1), 2–19.
https://doi.org/10.1186/s40538-021-00266-z.