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The new red skin potato variety 'Foresta'

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Abstract Applied breeding research, based on the long experience of some breeders, has led to the emergence, with a higher frequency lately, of a whole series of Romanian varieties. To the National Institute of Research and Development for Potato and Sugar Beet Brasov the breeding goal was to create a potato variety which meets the reguirements of farmers (high yield) and of consumers (red skin variety). The variety 'Foresta' is obtained through sexual hybridization and individual clonal selection from a cross between Angela and Dalida varieties. As vegetation period enroll in the group of moderate late varieties (100-110 days). 'Foresta' has a high yield capacity (60 t/ha), is resistant to black wart (*Synchitrium endobioticum),* medium resistant to different viruses (PVY^0 and PLRV) and present a fairly good resistance to leaf blight and a very good resistance to tuber blight (*Phytopththora infestans*). The starch content and the processing quality were determinated in a specialized laboratory and late blight and viruses resistance were determinated in fields of NIRDPSB Brasov. The resistance to black wart (*Schynchitrium endobioticum*) was determinated to National Station of Testing Pojorâta. The yield capacity in different environmental conditions and also the ecological plasticity of the varieties were tested in State Institute for Variety Testing and Registration network. The variety is conceived for autumn-winter consumption, being suitable for a lot of culinary preparations (mash potatoes, french fries, salad etc.).

Key words

potato, breeding, cultivar description, yield capacity, culinary quality

Potato is the third most important food crop worldwide. The Food and Agriculture Organization (FAO) of the United Nations declared 2008 the 'Year of the Potato' to highlight its value as a global food.

Potato produces the highest amount of energy per unit area and has the highest dry matter yield which may be 74.5% compared to wheat and 58% compared to rice [1].

It also serves as healthy replacement to most of the cereal crops and provides more calories, vitamins, and nutrients per area of land sown than other staple crops [13]. Potato tuber contains 70-80% water, 20.6% carbohydrate, 2.1% protein, 0.3% fat, 1.1% crude fiber and 0.9% ash [12]. Potato is used mainly for three purposes, as table purpose (vegetable and number of recipes), as a seed tuber and as a processed food like chips, wafers, flakes, starch, granules, flour, potato biscuits, potato patties, puffs, wedges, pancakes, dehydrated mashed potatoes, canned potatoes [2].

Climate changes mean that potato production is increasingly vulnerable to a wide range of pathogens, including *Phytophthora infestans* (late blight), nematodes, bacteria, viruses and environmental stresses (drought, heat and salinity) [7].

The content of dry matter, including starch content, is influenced by the variety, the physiological age of tuber at harvesting, the intensity of light, the water supply in the soil, soil conditions etc [16, 14].

To the Romanian consumer was observed a preference for red-skinned varieties. There is also a preference for white-yellow pulp. The pulp must be resistant to raw blackening, not darken after peeling and left in the open air and blackened by boiling.

The culinary quality of the varieties is determined by mealiness, consistency, pulp color, moisture and taste. Mealiness is closely related to consistency and is determined by the easy decomposition of cells after boiling the pulp. The cracking of the tubers during boiling also depends on the turgidity of the tissues. There is a correlation between mealiness, specific gravity and starch content [6].

None of the currently used varieties or cultivars has potential for production in all environments and for all uses [4], since agroecologies vary with respect to soil type, moisture and temperature regimes, fertility condition and the onset, intensity and duration of rain as well as availability of irrigation facilities [11].

In practice, it is observed that once a part of the chain is accustomed to a variety that is considered to meet market requirements, it is difficult to introduce a new variety due to reluctance to what is new, unknown. Therefore, the introduction of new varieties is a long process and requires large investments from those who create them [10].

Material and Method

Like all other varieties obtained to the NIRDPSB Brasov, 'Foresta' variety was obrtained by sexual hybridization followed by individual clonal selection. The classical breeding scheme (Chiru et al., 1992; Bozesan, 2002) contain:

- determining the parents having in atention the physiological and technological qualities;
- hybridization including seedlings, vegetative populations, descendants, yield trials (3 years network testing to the State Institute for Testing and Registration of Varieties - ISTIS);
- patent and national registration in the official catalog of varieties.

The resistance to black wart (*Schynchitrium endobioticum*) was determinated at National Center Test for Resistance to Potato Wart Disease from Pojorâta, Suceava.

The starch content and the processing quality were determinated in the specialized laboratory of NIRDPSB Brasov. Late blight (*Phytophthora infestans*) resistance and viruses resistance were also determinated in the fields of NIRDPSB Brasov.

Results and Discussions

The first step in breeding a new cultivar is the choice of parents. Over the years, the range of material from which to choose has increased. As genitors were used 'Angela' and 'Dalid'a varieties.

The morphological description of the variety 'Foresta' is given in accordance with UPOV characteristics. Plant height is medium, with medium number of stems and erect growth habit. The leaf is big size, with a dark green colour and a medium number of leaflets. The flower corolla is medium, dark red-violet and the frequency of flowers is high. The skin colour of tuber is red, the colour of the flesh is dark yellow and the eyes are moderately deep. **Maturity**: moderately late, a vegetation period of 100-110 days

Disease resistence.

'Foresta' variety is a wart (*Synchitrium endobioticum)* resistant variety and a medium resistant to PVY and PLRV viruses. Two main types of resistance to late blight (*Phytophthora infestans*) have been described in potato: field resistance and resistance (R) gene– mediated resistance [18].

Field resistance (also referred to as general or quantitative resistance) is frequently attributed to major quantitative trait loci (QTL) and a few minor QTL and generally results in partial resistance. Field resistance is considered by some to be more durable than resistance conferred by single R genes [15]. However, partial resistance is also strongly correlated with maturity type and, thus, makes resistance breeding more difficult [17].

The foliar resistance test was in close accordance with the European Association for Potato Research guidelines for foliar-blight-resistance field tests (Dowley et al., 1999) and 'Foresta' variety present fairly good resistance to leaf blight. Also present a very good resistance to tuber blight.

Yield capacity.

In order to obtain the patent of this variety, it was subjected to verifications within the State Institute for Testing and Registration of Varieties, being located experimental fields in 7 locations throughout the country (Sibiu, Satu Mare, Rădăuţi, Luduş, Bacău, Târgu- Secuiesc and Harman-Brasov). Of these locations, two, Târgu-Secuiesc and Hărman, are specific to potato cultivation. For a careful analysis, we should not ignore areas such as Luduş or Satu Mare, which give us general information on the plasticity and adaptability of a future variety (Table 1).

Very good results (40 t/ha) were obtained to SCDCPN Dabuleni in 2018, which demonstrates the expression of the production capacity of the variety in irrigation conditions in the warmer areas of the country.

The dynamics of potato yield formation is significantly influenced by weather conditions. Therefore the average of 3 experimental years gives an objective view of the yield, variety 'Foresta' exceeded the 'Roclas' and 'Christian' varieties.

Table 1

Yielding capacity in State Institute for Testing and Registration of Varieties network (3 years average)

Variety	Yield (kg/ha) / years							Yield average kg/ha
	Tg. Secuiesc	Hărman	Sibiu	Satu-Mare	Rădăuţi	Luduş	Bacău	
Foresta	63.00	46.00	41.33	31.00	33.67	23.00	29.00	38.14
Christian	48.70	40.00	32.00	30.00	30.33	21.67	29.33	33.15
Roclas	50.33	42.33	35.00	31.00	32.33	21.00	28.33	34.33

Cooking and technological quality.

The 'Foresta' variety characters which determine the culinary and technological quality of potato tubers are presented in table 2 and 3. Culinary quality was determined by sensory appreciation of traits related to the overall look of boiled tubers, taste, pulp color, crushing on boiling, consistency pulp, mealiness, moisture, starch granulation, tubers after-cooking darkening.

Based on determined characteristics and their score (gathered the notes for crushing on boiling, consistency, mealiness, moisture and starch

granulation), 'Foresta' variety was classified into A/B cooking type characterized by tubers with good taste, intense yellow pulp color, firm enough, crush very little at boiling, with suitable fine starch granulation and moderate mealiness and moistures.

The tubers dry matter and starch content are very important trait for industrial use. This potato variety has a low dry matter and starch content (19.31% and 12.04%) and is not very suitabble for technological use for potato chips, but are suitable for salad and most other dishes.

The evaluation of raw tubers darkening and after-boiling darkening, where 1 is the note for the lowest level of darkening and 10 is the note for the highest level of darkening, indicate a low level of darkening for 'Foresta' variety. When assessing table varieties, the peeling efficiency, influenced by the shape of the tubers and the depth of the eyes, must also be taken into account when selecting (Donescu, V., 1998). For 'Foresta' variety the efficiency to peeling is 81.46%.

Table 2

Culinary quality traits of 'Foresta' variety compared with standard variety 'Christian'

Culinary quality traits	Foresta	Christian	Observations
Overall appearance	1.13	1.34	1 - very pleasing 4 - unpleasing
Taste	2.03	1.53	1 - excelent 4 - less good
Color	5.63	3.94	1 - white 6 - intense yellow
Crushing on boiling	1.28	1.34	1 - remain whole 4 - hard crushing
Consistency pulp	2.28	2.22	1 - firm hearty 4 - unhearty
Mealiness	2.13	2.56	1 - unmealy 4 - very mealy
Moistures	1.63	2.19	1 - moist 4 - dry
Starch granulation	1.75	1.94	1 - fine 4 - very large granules
Cooking type	A/B	B	

Table 3

The average values of technological and culinary quality

No.	Variety	Dry matter (%)	Starch content (%)	Efficiency to peeling (%)	Raw tubers darkening	After cooking darkening
1.	Foresta	19.31	12.04	81.46	2.83	1.04
2.	Christian	22.83	14.29	79.05	2.33	1.17

Conclusions

The potato variety 'Foresta' have a good capacity of yield, are very well adapted to soil and climate condition of Romania on the base of testing activity on the network of the National Institute for Testing and Registration of Varieties (ISTIS) before homologation.

The high resistance to viruses Y (PVY) and leaf roll (PLRV) permits the multiplication of seed potato a longer time and obtaining a more profitable yield.

Due to the relatively high resistance to the late blight attack, are recommended the use of forecast and warning system and an adequate application of fungicides according to specific climatic conditions. It protects both the environment and human health.

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