

SOME ASPECTS REGARDING VEGETABLES BREEDING IN ROMANIA IN THE YEARS 2015-2025

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Abstract

Improved varieties have had a main role in the increases in yield and quality of vegetable crops. In this respect, the vegetables seed market is very dynamic and competitive, and predominant varieties are quickly replaced by new others. During the last years, an immense quantity of new knowledge on the genetic diversity of vegetables and the utilization of genetic resources, breeding methods and techniques, and utilization of modern biotechnologies in vegetables crop breeding has accumulated. Unfortunately, in our country, in the last years, we have lost a great part of genes stock; many breeding laboratories have not enough modern devices and international cooperation is not too strong. We discuss what is possible to do in the next years in order to solve the main problems of this field: researchers training; devices for laboratory and field; breeding objectives in main cultivated vegetable species and so on.

Keywords: breeding vegetable, new varieties, objectives, breeding team, pathogens resistance.

1. THE NEED TO ACHIEVE A NEW BREEDING PROGRAMMES OF VEGETABLE SPECIES

The production and consumption of vegetables have risen sharply in recent decades. Worldwide, in the last 15 years, the production has increased by 15 %, a growth rate higher than in other groups of plants. The increasing of the production and areas in the last decade is a continuation of the trend occurred after the Second World War. In the period 1961-2000 the areas planted with vegetables and melons have increased by 153 % and the total production by 253 % (Voican et al., 2002).

The vegetables are an important part of a healthy and varied nutrition, enriching the body with more substances which may prevent diseases, such as vitamins (A, B1, B2, C, PP), antioxidants and minerals (Dumitrescu et al., 1998). As a result, we expect that in the near future, the need of vegetable products will increase. The improvement activity has had and will continue to have a crucial role in increasing production, in diversifying the product range, in the quality of vegetable products. From this point of view, the market of vegetable seed is very dynamic; there is a strong competition between the seed production companies. Varieties and vegetable hybrids generally have a short life, being quickly replaced by new cultivars. Therefore, genetics and breeding methods, but - especially novelties, are of great interest to the breeders of the vegetable species, researchers and students.

Especially after 1980, an enormous amount of information on the genetic diversity of vegetable genetic resources has been accumulated, of the breeding methods and techniques, of the

development and use of modern biotechnology. The activity of obtaining new cultivars is currently the attribute of large specialized companies, in which the powerful teams of specialists with top equipment activate who keep the secrecy of the improvement techniques for maintaining competitive advantage. Unfortunately, the Romanian researchers' access to all current knowledge of genetics, biotechnology and breeding techniques vegetables has declined drastically in the last 20 years and just in the period when the most important findings are obtained.

Vegetable breeding activity in Romania decreased in intensity due to the unprecedented decrease of the research funds and, hence, the number of researchers; both the laboratory equipment and mechanical means in the field have become obsolete or have been decommissioned and the area has become unattractive for the young graduates of faculties.

However, the improvement vegetables activity should not be discontinued in pending better times. The researchers who still activate get good results, despite the difficulties. They need to join young people to acquire basic technique and try to obtain varieties and new hybrids with superior characteristics, adapted to the local culture conditions and responding to the Romanian consumer preferences.

2. MAIN RESULTS OBTAINED BY ROMANIAN BREEDERS OF VEGETABLE DURING 1995-2014 PERIOD

The main argument in the possibility of reviving the work of improvement is that the breeders of the vegetable species from Romania have achieved in the last 25 years numerous successes in the difficult conditions of transition to market economy, followed by a prolonged economic crisis. Very valuable varieties for consumption tomatoes of summer-autumn and for the tomatoes for processing have continued to appear. After a long period in which early tomato hybrids for field and greenhouses missed, at RDSVG Buzau, the *Siriana* F1 hybrid was created, which extends in production due to high yielding, to the earliness and outstanding organoleptic qualities. Breeders from RDSVG Buzau are proud of not only the *Siriana* hybrid but also of the cherry tomato creations also a novelty in the domestic assortment. Nationally, we notice new varieties of chili pepper, bell pepper, long pepper and eggplant approved in the last 15 years that make up a variety conveyor that can cover long periods of consumption with fresh fruit from the early to the late varieties. In this group of vegetables the first F1 hybrids appeared productive, uniform as vigor of plants, with the fruit shape and size that is very attractive (*Andra* and *Felicia* F1 hybrids, with eggplants). At pumpkin vegetables appeared the first F1 hybrid zucchini and "*cornichon*" cucumbers, and at peas and beans the native assortment now includes varieties with different growing seasons for different destinations (fresh consumption or industrialization) and for different methods of culture. Another remarkable result of the last years is the getting of the first Romanian hybrid carrot that joins several other new varieties obtained from the breeders from RDIVFG Vidra and RDSVG Buzau.

A review of the most significant results of the improvement of vegetables is shown in Table 1, which gives the percentage of Romanian varieties and hybrids in production. It can be observed that scientific research in Romania has provided growers valuable varieties and hybrids, which in many cases have more weight in production than the imported cultivars. At the same time, it should not be overlooked that with the assortment destined to the crops for greenhouses, a field that will be expanded more and more in the future, the achievements are very modest. With the early cabbage, cucumbers, early tomatoes, lettuce and other crops for greenhouses, the domestic varieties weight is between 5 and 10 %.

Table 1. The domestic vegetable varieties weight (% , 2012)

Species	Romanian Cultivars Weight, (%)	Species	Romanian Cultivars Weight, (%)
Tomatoes (for open field)	90	Onion	50
Pepper (tomato-pepper, long pepper, cayenne pepper)	90	Garlic	100
Eggplants	95	Garden Peas	30
Early cabbage	0	Garden Beans	15
Summer and autumn cabbage	85	Other vegetables (for open field)	92
Cucumbers (for open field)	20	A total of field vegetables	60
Squashes (for open field)	20	Early Tomatoes for protected crops	5
Root vegetable (carrot, parsnip, parsley, celery, beetroot, radishes)	50	Other protected crops (cucumbers, peppers, eggplant, lettuce, zucchini, beans)	5

It is only in the period 1990-2012, with all the difficulties related to the decreasing numbers of researchers, the precarious material basis and the insufficient funding, the research in the field has managed to create and introduce into production a large number of varieties and hybrids, as shown in Table 2.

The improvement activity in the surveyed period got 227 new cultivars to 38 vegetable species, but the number of F1 hybrids is still modest (only 18 hybrids to 209 varieties). There are numerous examples of varieties and vegetable hybrids created in Romania and approved both by growers and consumers. We selected in Table 3 some of these creations.

The main features and characteristics of the new cultivars are most often higher than those made previously. There is still some lag especially for the introduction of resistance to pathogens and insect attack. In Table 4 we present the main pathogens attacking some vegetable species and the authors' mention on resistance or tolerance to attack. It is noted that most claims of tolerance or resistance to diseases are found in peppers and eggplants, while in other species, no such claims, so growers do not know whether or not such cultivars possess resistance. The lack of claims relating to certain pathogens expresses most often, the authors' uncertainty regarding the degree of tolerance or resistance due to the inability of testing on controlled infections.

Table 2. Vegetable Varieties and Hybrids Registered in the Catalogue during 1990-2012

Species	Number	Observations	Species	Number	Observations
Witloof cicory	2	-	Morcov	5	Hybrids – 2
Pepper	37	Chili Pepper – 13 Mild Pepper – 12 Long Pepper – 11 Cayenne Pepper – 1	Fennelflower	1	-
Okra	2	-	Parsley Leaves	1	-
Basil	1	-	Parsley Root	1	-
Cucumbers	20	Hybrids – 7	Watermelon	2	-
Onion	17	Hybrids – 2 Red Onion – 3 Chives – 1	Melon	3	-
Chicory	2	-	Parsnip	1	-
Savory(thyme)	3	Wild thyme – 1	Eggplants	11	White – 1, Hybrids – 2
Cauliflower	2	Autumn	Sweetcorn	1	-
Zucchini	6	Hybrids 2	Rhubarb	1	-
Tomatoes	28	Hybrids – 3 Cherry Type – 2 For Industrialization – 8 Fresh Consumption – 15	Redishes	6	Early Radish – 1 Summer Radish – 4 Summer-Autumn Radish – 1
Cabbage	12	Hybrids – 2 Autumn – 9 Summer – 1	Salad	8	-
Dwarf Beans	17	-	Sage	1	-
Climbing Beans	5	-	Beetroot	2	-
Fennel	1	-	Spinach	3	-
Kohlrabi	2	-	Origanum	1	-
Lovage	1	-	Dill	2	-
Orache	3	-	Celeriac	2	-
Peas	10	-	Garlic	4	-

Table 3. Examples of Varieties and Vegetable Hybrids Agreed both by Farmers and Consumers

CULTURE	CULTIVAR
Tomatoes	Siriana F1*, Pontica 102, Viorica, Darsirius, Buzău 47, Kristinica, Carisma*, Coralina*;
Round Pepper	Cornel 209, Asteroid 204
Bell Pepper	Bârsan, Galben Superior, Ceres, Arum, Buzău 10*, Vidra 9*
Long pepper	Siret
Cayenne pepper	Iute Delicios
Eggplants	Andra F1*, Luiza, Contesa, Daniela, Belona*, Drăgaica* , Buzău H1* and Eleonora;
Carrot	Triumf F1 and Bucovina F1
Celery	Bistrița
Onion	De Buzău
Autumn cabbage	Buzoiana, Mocira, Poiana;
Garden Beans	Auria Bacăului*, Menuet, Ioana*;
Garden Peas	Vidra 187, Armonia, Ișalnița 60, Diana;
Cucumbers	Sirius F1*, Ierprem*; Cornișa F1;
Marrows	Compact F1*, Perfect;
Sweet Melon	Fondant*;

*) The cultivars marked with an asterisk are recommended for the protected crops

Table 4. Indications on Resistance or Tolerance to Pathogens in Romanian Vegetable Cultivars

Species	The most frequent pathogens	Exemples of varieties with resistance (R) or tolerance (T)
Tomatoes	<i>Phytophthora infestans</i> (mildew)	-
	<i>Botrytis cinerea</i> (gray mold)	-
	<i>Fulvia fulva</i> (brown staining of leaves)	-
Pepper	VMT	Cornel (R); Asteroid (R); Orest (R);
	<i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i> (Fusarium)	Orest (T);
	<i>Verticillium dahliae</i> (verticilliose)	Orest (T); Bârsan (T); Cornel (T); Lider (R?); Asteroid (T); Oranj(T); Asteroid și Oranj varieties have also tolerance to <i>Alternaria capsici</i> .

	<i>Botrytis cinerea</i> (gray mold)	-
Eggplant	<i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i> (fusariosis)	-
	<i>Verticillium dahliae</i> (verticilliose)	Andra F1 (T); Felicia F1 (T); Luiza (T); Contesa (T);
	<i>Phytophthora parasitica</i> (mildew)	Andra F1 (R); Felicia F1(R); Luiza (R); Contesa(R);
Cucumbers	<i>Pseudoperonospora cubensis</i> (mildew)	-
	<i>Pseudomonas lacrymans</i> (angular staining)	-
	<i>Sphaeroteca fuliginea</i> f.sp. <i>cucurbitae</i> (mildew)	-
Onion	<i>Peronospora destructor</i> (mildew)	-
	<i>Erwinia carotovora</i> (bacteriosis)	-
	<i>Botrytis allii</i> (gray mold)	-
Carrot	<i>Erwinia carotovora</i> (bacteriosis)	-

3. MAIN OBJECTIVES OF IMPROVING VEGETABLES IN THE NEXT PERIOD

The success of a long-term breeding program is related to the adoption and implementation of a coherent strategy. Random and uncertain funding with values that may decrease from one year to another, cannot lead to competitive results with what is already obtained in the traditional countries and companies. As in any strategy we must start from: a) what it is (where we are); b) to establish our goals; c) how we shall achieve the proposed objectives.

a) One must first start from the existing situation, showing the *strengths*, *weaknesses*, *opportunities* and *threats* in the system that allow us to determine exactly where we are. We can easily identify, among the strengths, the existence of the organized research units and of a number of specialists with knowledge and passion for improvement. Other strengths relate to:

- the experience gained during almost 50 years of functioning of the vegetable research network;
- the accumulation within the institute's portfolio and the stations of profile of some patents on some valuable varieties that cannot be reproduced by other manufacturers (exclusivity);
- the growers' knowledge of some varieties developed in the country and the existence of a constant demand for these due to the credibility of the research stations, gained over time;
- the existence of the stations' sites that contain important information that growers need.

Among weaknesses (much more numerous than strengths) one may identify the lack of funding which means the small number of staff and the impossibility of creating multidisciplinary teams, low wages, the lack of equipment and means of production in the field, difficulties in accumulating strictly specialized knowledge, the small number of international partners, the sharp decrease of the germ-plasma fund, etc.

The main opportunities are related to the relatively large areas cultivated nationally, surfaces that can oscillate around approx. 150,000 hectares, the relatively high cost of vegetable seed which is an incentive for the producers of grains, the consumers' attachment to the Romanian vegetables, characterized by high quality nutrition and taste. Other opportunities are related to the unprecedented growth of the Internet that can provide connections across the globe, not just in the

country, the possibility of creating an online store, the transmission of all information about products that can attract those interested;

- the emergence of some funding opportunities within the sector program and of the possibility of research funding from the European funds for 2014-2020;

- the ability to regain the land taken illegally in court, the land required for the isolation in space and the producing of the basic seed.

The program has many *threats* related to the market conquest by large international companies and the difficulty of competing with them without a good marketing program in place. Foreign companies offer to farmers similar products (seeds) at lower prices when it comes to seeds of old varieties, or at very high prices when it comes to new hybrids, which induces in the mind of the cultivator the idea of the hybrids of great value;

- the insufficient concern or lack of concern of the state authorities to support this activity sector;

- the land and the stations' buildings are located in the space within or in close proximity to cities, have a very high value, and therefore of particular interest for the "hunters in the real estate", with permanent risk of losing their ownership;

- the danger of losing indigenous genetic heritage, extremely valuable, collected and improved over 50 years of activity.

b) The second factor to be considered is related to the mission of breeding (where we want to go), i.e. assuming clear objectives: what species will be improved; to what directions of culture and whose purpose will be to the new creations addressed (open field crops, green or plastic house, for fresh consumption or processing), what place their own creations in the cultivated area will occupy, etc. It is very important for what kind of creations we turn our efforts, respectively to what features and qualities will print to the new creations so that they can be requested by vegetable producers and consumers.

c) The third factor to be noted in the strategy is how we achieve the proposed objectives (providing financial resources, personnel or training, sources of germ-plasma, the material basis of field and the laboratory equipment, marketing programs, multiplication, the approval and certification of creations).

The main issue on which we will focus more is about setting goals for improvement, which eventually will make the size and expenditure of each species breeding program.

Often, there are, in every species, many current and future goals that a breeding program must solve. The breeder should identify important issues affecting the production and quality of each species in the area that new cultivars will be cultivated. The goals should be prioritized and worked on many projects the budget allows us, the personnel and material basis. Almost all the breeding programs should aim at three objectives: the resistance to pathogens and insects, the increase of production and the improving of quality. Each of these has, in each species, many research directions.

The large number of species does not allow us to detail the myriad of issues concerning the improvement objectives.

Significant progress on long-term in breeding programs cannot be achieved without the development of "in vitro" culture techniques, which allow overcoming barriers of incompatibility to hybridization between cultivated species and wild relatives from which specific resistance genes should be introduced. Other targets for improvement should relate to improving resistance to soil salinity which is or may become a problem of land planted with vegetables, and increasing resistance to low or too high temperatures. Throughout the world is already working to introduce resistance to insects' attack or other pests (mites, nematodes) and it is possible that such creations to

get in our country. Therefore, the future improvement teams should be able to address these new issues.

4. REFERENCES

- Dumitrescu, M., Scurtu I., Stoian, L., Glăman, Gh., Costache, M., Lăcătuș, V. (1998). Producerea legumelor. Ed. Artprint.
- Gallais, A., Bannerot, H. (1992). Amelioration des especes vegetales cultivee INRA.
- Maloy, O. (1993). Plant Disease Control-Principles and Practice -John Wiley and Sons;
- Peirce, Lincoln. (1987). Vegetables - Characteristics, Production and Marketing. John Wiley and Sons.
- Prohens, J., Nuez, F. (2008). Handbook of Plant Breeding –Vegetables - Springer;
- Scurtu, I., Lăcătuș V. (2013). Romanian Vegetable Growing – Present and Prospective for 2020-2025. Management strategies, year VI, special issue.
- Voican, V., Scurtu, I., Costache, M., Lăcătuș V., Stoian, L., Roman T., Dumitrescu, M. (2002). Cultura legumelor în câmp, Ed. Phoenix.