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THE ROLE OF GENETIC RESOURCES IN THE IMPROVEMENT AND DEVELOPMENT OF NEW LEGUME CROP VARIETIES

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Abstract. *A decisive role in generating broad heritable variability in breeding material belongs to germplasm sources. The primary method for developing new ideotypes of pea, soybean, and bean is intraspecific hybridization followed by repeated individual selection. The results obtained represent a genetic advancement in the breeding of these crops, leading to the development of new varieties with high adaptability to natural stress factors, broad ecological plasticity, and minimal fluctuations in yield levels.*

Keywords: breeding, germplasm, hybridization, variety, pea, soybean, bean

INTRODUCTION

The favorable dynamics of the development of the Republic's agricultural sector are closely linked to scientific advancements in crop breeding, particularly the creation and implementation of high-performance varieties and hybrids.

The broad application of innovative results in agricultural practice represents an essential component of the national strategy for ensuring food security. The effectiveness of breeding progress largely depends on the diversification of genetic sources used in hybridization programs. In the development of new legume crop varieties, a decisive role is played by germplasm sources, including forms from global collections, local varieties, and native populations.

This paper presents the practical aspect of utilizing genetic resources for the development of new varieties of pea, soybean, and bean.

MATERIALS AND METHODS

The germplasm collection maintained in the laboratory represents a valuable genetic resource for legume crop improvement. It currently comprises 120

accessions of pea (*Pisum sativum*), 361 accessions of soybean (*Glycine max*), and 140 accessions of bean (*Phaseolus vulgaris*). This diverse collection provides a broad genetic base that is essential for breeding programs aimed at developing new varieties with enhanced traits such as stress tolerance, yield stability, and disease resistance.

The varieties studied were evaluated in terms of several morpho-productive traits, yield capacity and quality, disease resistance, and earliness.

Following the assessment of the agronomic performance of the studied germplasm, donors of positive traits and characteristics were identified to address the objectives pursued in the breeding programs.

As a result of hybridization work—the fundamental method in the improvement of self-pollinated crops—new ideotypes were developed and tested throughout all stages of the breeding process. Superior homozygous genotypes that became officially registered varieties have been widely adopted in production practice. Throughout the experiments, cultivation technology was strictly followed for all crops included in the study.

RESULTS AND DISCUSSION

Considering the climate changes observed in the territory of Moldova, research programs have been directed towards developing early-maturing varieties with resistance to hydrothermal stresses.

To reassess the role of pea in crop rotations, research efforts focused on creating new high-yielding technological varieties. From a technological perspective, the varieties *Renata, Pitulice*, *Smaragt*, *Flagman, Topaz 2, Trujenic*, *Zernogradschii 6, Orlovcianin* have been identified as possessing high resistance to pod shattering and lodging.

Their use as parental forms has resulted in the development of new varieties such as *Moldavschii Usatîi*, *MZ-7*, and *Valexa*. Valuable parents with high-yield potential include varieties like *Atica, Dic From, Belcovaia Grozdi*, *Dora*, *Zelenozernîi 1*, *Voroşilovgradschii*, and *Iubileinîi*, originating from diverse geographical backgrounds.

Inclusion of these genotypes in hybridization work led to the creation of varieties such as *Nadia, Grațiana,* and *Mazirina,* which exhibit high productive potential (4500–5000 kg/ha) and increased resistance to pod shattering and lodging. This is attributed to the presence of the "afila" and "defa" genes in the plant genome. Possession of genotypes with such valuable traits allows direct harvesting of the crop while minimizing yield losses.

The agronomic value of the new pea varieties will enable the expansion of pea cultivation areas, supporting the revitalization of scientifically justified crop rotations in the agricultural sector of the republic.

Climate changes associated with global warming have had drastic consequences on the yield levels of soybean and bean crops. The occurrence of extreme temperatures combined with acute moisture deficits results in a 50–70% reduction in seed production in these crops.

To urgently address these emerging issues, a new research program was initiated aimed at providing the country's agriculture with highly adaptive varieties and more stable yields. For this purpose, soybean varieties exhibiting stress tolerance and greater ecological plasticity were identified from the germplasm collection. Varieties with notably early maturity and positive traits include *Anușca*, *Livius*, *Simona*, *Iug 3*, *VNIIS-1*, and *Fischebe*, with vegetation periods of 75–85 days. Their use in initial breeding material creation contributed to the development of new early ideotypes with reduced sensitivity to climatic stresses. Early maturing varieties such as *Deia*, *Amedia*, and *Dumitrița* belong to this group.

The higher adaptability of the new varieties is due to architectural modeling of soybean plants, achieved through hybridization with Chinese forms (*Tillin*, Nr. 4), Ukrainian varieties (*Anușca*, *Anastasia*), and Romanian varieties (*Daciana*, *Ileana*).

Phenotypic modeling is expressed by:

- Reduction of leaf surface area;
- Reduction in the number of branches;
- Decrease in leaf insertion angle, etc.

Under current climatic conditions, new varieties such as *Moldovița*, *Flamura*, *Augustina*, and *Viorela* have gained wider agricultural adoption, demonstrating greater yield stability between 3000 and 3500 kg/ha.

A key advantage of soybean varieties is the protein and lipid content of the seeds. Newly registered varieties like *Flamura*, *Augustina*, *Deia*, *Amedia*, and *Albiflora* have shown protein content above 40% and fat content above 23%, resulting from the deliberate use of parental lines with high protein and fat content in breeding programs.

The higher productivity, quality, and adaptability of the new soybean varieties will maintain the brand "soybean—the crop of the future."

Bean cultivation remains one of the most widely used sources of human food. In arid conditions, bean plants show pronounced negative responses during generative phases, leading to severe reductions in seed yield.

To mitigate the negative impact of climatic factors, forms with lower sensitivity were identified from the laboratory's germplasm. Notable varieties include *Haricovscaia 9*, *Dobrudjanscaia 7*, *Motoriscaia Belaia*, *Kentwood*, and *Aurora*, which served as the basis for new varieties such as *Mariția*, *Petrela*, *Garofița*, and *Mirabela*, with production potentials of 2500–3500 kg/ha.

In response to domestic and international market demands for larger seed size and varied seed coloration, genotypes from diverse geographical origins such

as *Magna, Basarabca 1*, *Muhranula, Bistrenschii*, *Borloti*, and local populations like *Iabloana* and *Provadia* have been used as sources to create new varieties.

The new genotypes obtained from these parental lines are currently undergoing breeding evaluation. An important objective in bean breeding has been the improvement of seed quality. Protein donor varieties such as *Nerusa, Sanilac*, *Gratiot, Aluna*, *Universal*, and *Nebraska* have contributed to the enhancement of protein content in new varieties *Mariţa*, *Garofiţa*, and *Mirabela*, which contain 24–29% protein.

One of the most significant traits for mechanized harvesting suitability is the height of the first pod insertion point. To this end, varieties like *Porumbiţa*, *Timpurie*, *Oca*, *Magna*, and *Tui* have been included in hybridization programs.

The broad adoption of high-performing legume varieties (pea, soybean, bean) will help minimize protein deficits in human nutrition and animal feed.

CONCLUSIONS

1. The results achieved in the breeding of legume crops (pea, soybean, and bean) in recent years are attributed to the efficient use of available genetic resources.
2. The new pea varieties *Nadia* and *Graţiana* exhibit very good performance in the field in terms of seed yield as well as satisfactory resistance to phytopathogenic agents.
3. The new soybean varieties *Moldoviţa*, *Albiflora*, and *Viorela* belong to the group of technological varieties due to their specific plant architecture, which partially mitigates the negative effects of unfavorable environmental factors.
4. The new bean varieties *Petrela*, *Clarina*, and *Mirabela*, which possess a range of positive traits and high taste qualities, occupy a prominent position among the most appreciated products.
5. The reintegration of pea into the national crop rotation, the cultivation of productive soybean varieties with satisfactory ecological plasticity, and the widespread use of new bean varieties in both domestic and international markets will strengthen the country's agricultural sector, addressing some strategic challenges of the National Research and Innovation Program.

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