

FIELD CROP BREEDING IN LITHUANIA DURING THE NINE DECADES: METHODS AND RESULTS

Vytautas Ruzgas

Institute of Agriculture,
Lithuanian Centre for
Agriculture and Forestry
Research

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The first step: initiator

prof.D.Rudzinskas

- Professor Dionyzas Rudzinskas, one of the outstanding plant breeders and initiator of the Lithuanian plant breeding started this breeder carrier at the Moscow Agricultural Institute in 1902, later he found Moscow and Dotnuva Plant Breeding Stations .
- In 1902 he attended prof. K. Rümkers lectures at Breslau University, visited well-known German seed production farms of Rimpau, Gizike, Strube, Besseler, Cimbale, Heine, Rabethe etc. and Svalöf Plant Breeding Station in Sweden.
- In this Station prof. D. Rudzinskas was impressed by the idea of individual plant selection which was more progressive than mass selection.

In 1911 D. Rudzinskas visited the USA, Canada and Sweden. At the University of California he studied the modern laboratory of wheat milling and bread baking, seed production system of the USA, met a famous breeder L. Berbank. On his way home he visited for the second time the Swedish plant breeder and scientist Nelson-Ehle .

In the study tours of 1902 and 1911 D. Rudzinskas familiarized himself with the more progressive plant breeders and research institutions as well as seed production systems and companies. D. Rudzinskas implemented the best ideas from his personal investigations and experience of foreign plant breeders in his breeding activities in Moscow and later in Dotnuva.

D. Rudzinskas paid a great attention to plant genetic resources. He collected local cultivars in Russia during his expeditions to many regions. In 1916 at the age of 50 D.Rudzinskas, was appointed to professorial rank.

In 1922 prof. D. Rudzinskas returned to Lithuania and established Plant Breeding Station in Dotnuva. In fact the Lithuanian plant breeding started in 1911 at the Baisogala Plant Breeding Station, but activity was discontinued due to First World War.

With permission of Moscow Plant Breeding Station's authorities as regards of great personal contribution to Russian plant breeding, D. Rudzinskas brought 380 seed samples of agricultural crop varieties and breeding lines, developed by himself.

In fact D. Rudinskas continued in Dotnuva the breeding activities and development of new varieties, whose initial material had been created in Moscow.

Question: when and where started Lithuanian plant breeding?

1924 the Dotnuva Plant Breeding Station joined the Geographical Investigation Nursery system, initiated by the Petersburg Bureau of Applied Botany and Breeding (later Institute). These investigations covered 30 regions. Dotnuva was the westernmost point.

International testing net initiated by prof. N.Vavilov, who called prof. Rudzinkas as his personal tutor. The Geographical Investigations were conducted in Dotnuva for four years, and the varieties from this program served as a genetic source for breeding programs.

The first breeding schemes and field designs

- The first breeding scheme proposed by D.Rudzinskas was following:
- 1 year – hybridization nursery;
- 6 years – development of stable line;
- 3 years – control plot tests;
- 2 years – seed multiplication.

One of the most important tasks in the first breeding scheme was to identify which of the newly developed lines are more promising. D. Rudzinskas developed the test-sample method for it.

In the control nursery the breeders planted single plants at set intervals and collected one test-sample per line. At harvesting they took plants from 1 m² plot with roots and analyzed single plants. Plants demonstrating weak and extremely good performance were discarded.

After that 10 plants, most representative of the newly developed line, were selected. Analysis of the selected 10 plants showed whether the lines were promising or not. It was very important for test-sample method to achieve uniform plant density.

In the first years chief method was analytical breeding. The breeders selected the best plants from the local or foreign varieties.

The development of new varieties through hybridization was more time and labour consuming which was a problem for Plant Breeding Station.



In 1932 the breeding schemes were changed because the test-sample method was labour consuming and not high reliable.

In the new scheme the lines in early generations were visually evaluated by breeders.

Then the lines were tested in replicated yield trials with 5-6 replications in 1.25 m² plots in the first year, in the second and third year in 2.5 m² plots. The seed was sown by hand using special equipment.

Further selected lines were tested for 3-4 years in 5.0-7.5 m² plots using special sowing machine.

The last stage of breeding was so called “variety testing” . The promising lines in this nursery were tested for 3-4 years in 10-15 m² plots using more advanced methods.

Modified Plant Breeding scheme 1932

Analytical breeding

1st year selection of plants from population
2nd year observation of pure lines
3rd year observation of pure lines

Synthetic breeding

1st year crossing
2nd year multiplication of new lines
F₁
3rd year multiplication of new lines F₂
4th year selection of pure line F₃-F₄

Initial testing of lines
(2 years)

Testing of selected lines
(3-4 years)

Testing of new varieties on farms

Testing of new varieties in
Dotnuva Plant Breeding Station
3-4 years

First year seed multiplication

Second year seed multiplication

Production of
Pre-basic seed

The plant breeding schemes changed later with higher mechanization level of field trials.

Since 1997 the requirements for variety protection have been changed. In accordance with the law on the variety protection the varieties have to be more uniform, compared with the former requirements. Therefore the plant breeding schemes have been modified. For example, the scheme of winter wheat breeding is the following:

1. **Crossing block** .

F1 kernels are divided in to 2 groups. One half is sown on a field , the other- in greenhouse for the doubled haploid program..

2. **F1 nursery**, rows (conventional method,) CM;

Doubled haploid program (DH).

3. **F2 nursery**, 10- 15 m² plots, CM;

4. **F3 nursery**, 10- 15 m² plots, CM;

5. **F4 nursery** 10- 15 m² plots, CM;

6. **F5 nursery** single rows, CM;

Single rows, plants from DH program;

7. **F6 nursery**, single rows;

8. **F7 (control block)**, plots 5 m², 1 replication;

Plots from DH programme, 5 m² , 1 replication;

9. **F8- F10 replicated yield trials** (CM and DH), 15- 20 m², 4 replications.











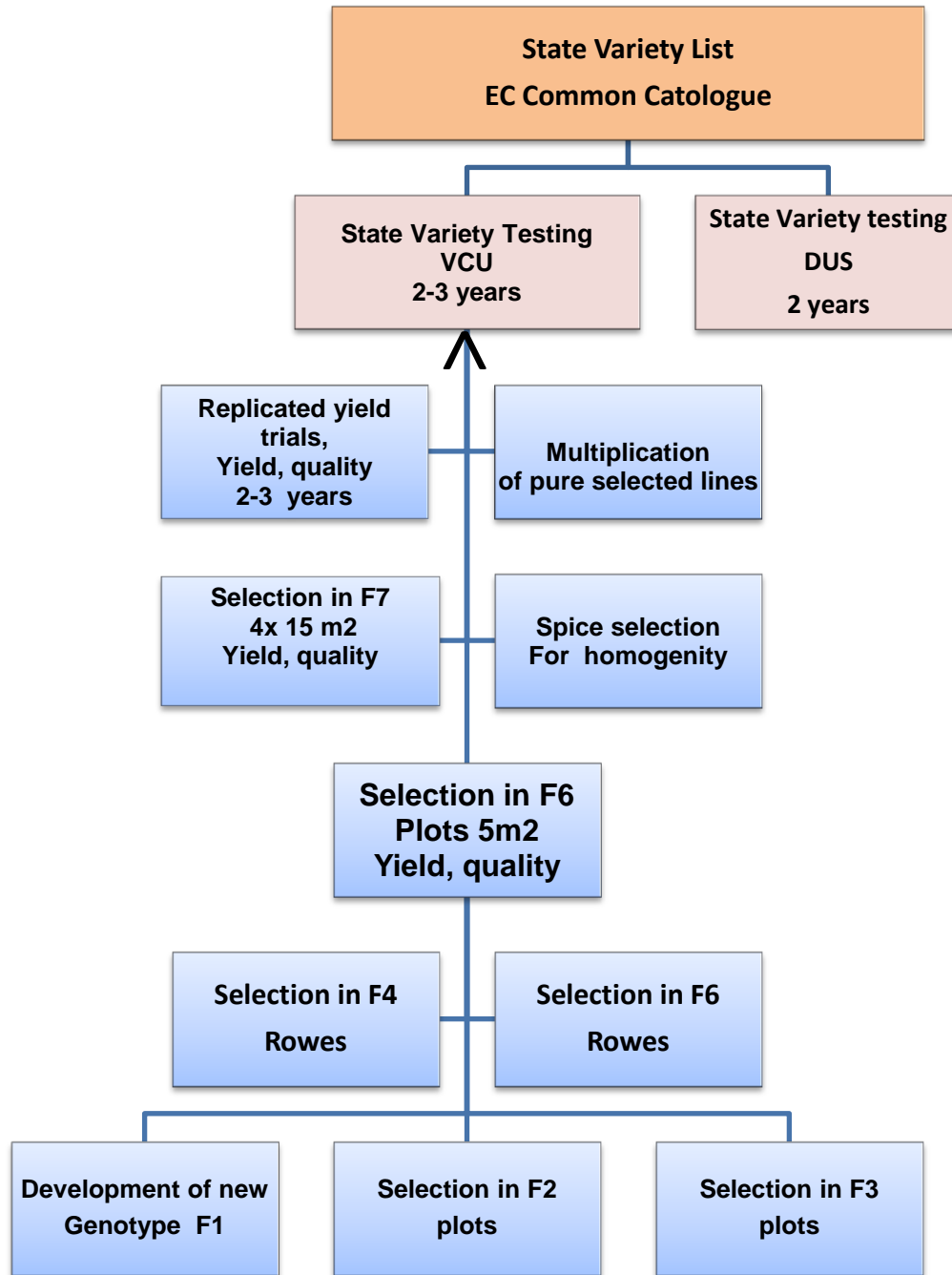






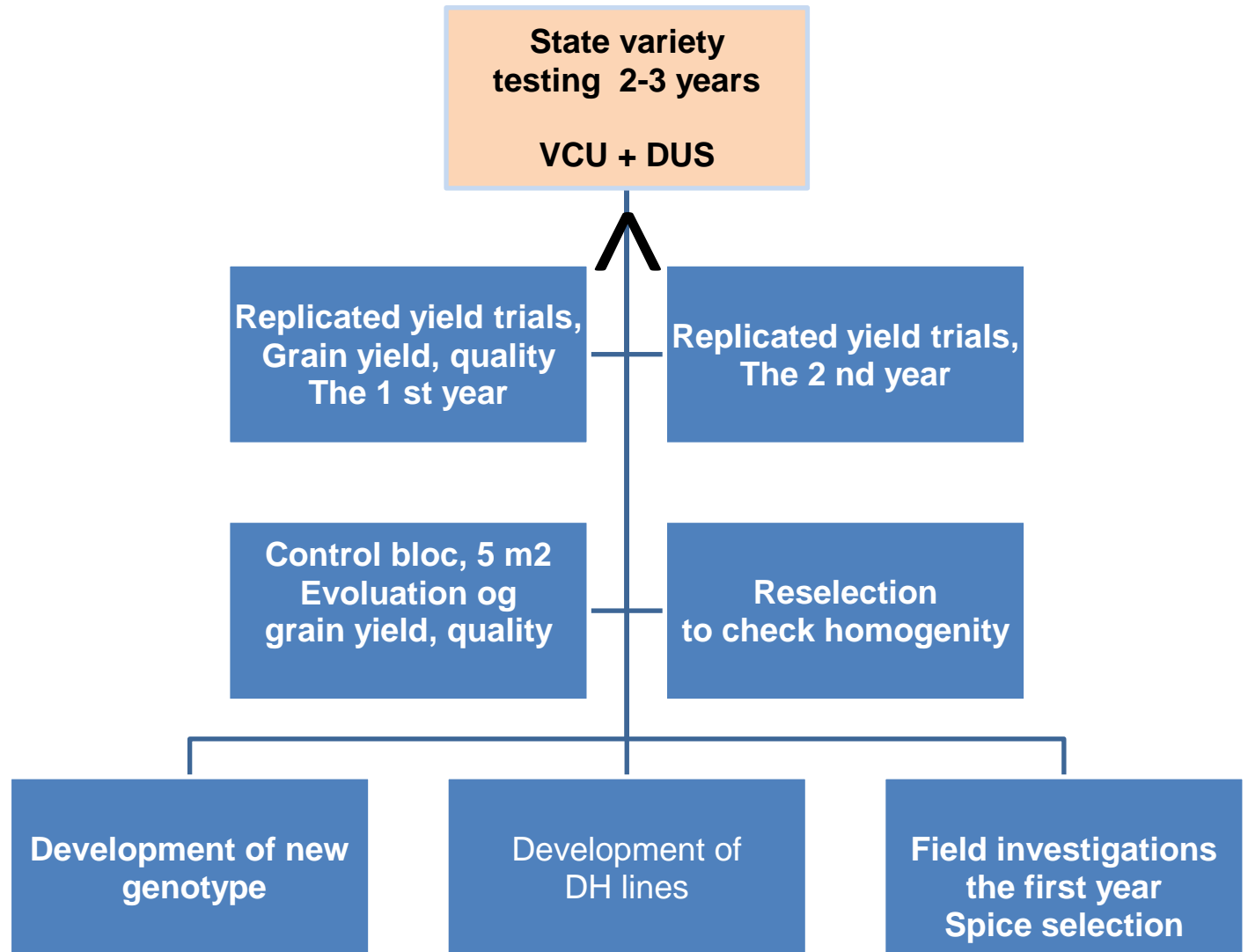
**Conventional
Plant
Breeding scheme**

12-13 years



**Plant scheme
including
biotechnology**

**9-10
years**



RESULTS

- **Since 1922 the breeders of the Dotnuva Plant Breeding Station and the Institute of Agriculture as an heir of the former station have developed 308 varieties of agricultural crops.**
- **The National Variety List 2014 included 99 varieties developed at the Institute of Agriculture.**

The share part of the varieties, bred at Institute of Agriculture in the National Variety List, 2014

Crop	Varieties in the List, total	Home-bred varieties	
		Total	Share part in the national list, %
Winter wheat	34	9	26
Winter rye	12	4	33
Spring barley	38	7	18
Oats	11	2	18
Pulses	26	10	38
Perennial grasses	95	51	54
Flax	10	6	60
Potatoes	29	5	17

Thank you for attention



K.Ruseckas. Pjovėja