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THE EXAMINATION OF DISTINCTNESS, UNIFORMITY AND STABILITY OF RYE VARIETIES IN POLAND

ABSTRACT

Every rye variety must pass the examination of Distinctness, Uniformity and Stability (DUS testing) before entry into the Register of Cultivars (National List) and/or granting of Plant Breeder's Rights (PBR).

In addition the rye variety is included into the Register of Cultivars on condition of satisfactory economic value (value for cultivation and use or VCU). Entry of the variety into the Register of Cultivars is rye variety seed marketing requirement.

In Poland the administration of the statutory variety examination (DUS and VCU tests) and the maintenance of the Register of Cultivars and the Register of Plant Breeder's Rights are provided by the Research Centre for Cultivar Testing (COBORU) located at Słupia Wielka.

The organization and procedure of the examination of DUS of rye varieties for Polish requirements are outlined.

Key words: variety testing, rye

INTRODUCTION

In Poland all activities connected with statutory plant variety examination and the maintenance of the Register of Cultivars (National List) and the Register of Plant Breeders Rights are provided by the Research Centre for Cultivar Testing (COBORU) located in Słupia Wielka. Poland, as a member of the International Union for the Protection of New Varieties of Plants (UPOV) since 1989 follows the UPOV Convention and acts according to UPOV regulations. According to Polish Seed Act every variety of rye must pass the examination of distinctness, uniformity and stability (DUS testing) before listing and/or being granted protection. In addition the rye varieties are included into the Register of Cultivars on condition of satisfactory value for cultivation and use (VCU). The variety testing is carried out at the Experimental Stations for Cultivar Testing (SDOO) which belongs to COBORU.

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An applicant (a breeder or his representative) who wants a variety to be registered makes an application with completed Technical Questionnaire to COBORU. He has to pay registration fees for expenses for examination and he has to deliver seeds for official tests.

In 2001 in Poland there are 23 rye varieties in National List and 15 varieties before listing.

THE ORGANIZATION AND METHOD OF EXAMINATION

The DUS tests are conducted at two Experimental Stations for Cultivar Testing in Slupia Wielka and Zybiszów. The minimum duration of tests is a period of two growing seasons.

Each test at each testing place includes in total per growing period:

- row plots – 1200 plants divided between two replicates
- plots with single-spaced plants – 60 single-spaced plants divided between three replicates

The tested rye varieties should be divided into groups to facilitate the assessment of distinctness. Characteristics: ploidy and seasonal type are suitable for grouping purposes. The varieties are randomised within each block and subgroup within the same DUS trial. The plants from the seeds of two or three generations of the same rye variety are grown.

The DUS testing procedures for Polish requirements are based on the Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability of Rye (*TG/58/6*).

These guidelines prepared by the UPOV Technical Working Party for Agricultural Crops are recommended to the member States of UPOV.

Distinctness, Uniformity and Stability are judged on the basis of characteristics and their expressions. The nature of characteristics used in the technical procedure of DUS testing is an important element. Such characteristics must be capable of precise recognition and description.

There are the main categories of characteristics:

— qualitative characteristics which show discontinuous states with no arbitrary limit on the number of states, e.g. shape, colour. They are often controlled by one gene and are usually independent of environmental conditions. Therefore, they are good tools for distinguishing varieties.

— quantitative characteristics are those that are measurable on a one dimensional scale and show continuous variation from one extreme to the other, e.g. length of leaf. For the purpose of description they are divided into a maximum of 9 states, e.g. 1 (very short) to 9 (very long), with the middle state 5 (medium) and the other states formed correspondingly. These characteristics are mostly polygenic and they are more or less influenced by environmental conditions.

— characteristics which are assessed separately may be combined, e.g. the length/width ratio. They are often less influenced by environment than the component characteristics.

Distinctness, Uniformity and Stability of parental lines, hybrids and open pollinated varieties of rye are judged on the basis of 23 characteristics and their expression (Table 1), which are recorded (visually tested, measured) during the growing seasons at the optimum growth stage for the assessment of each characteristic.

Table 1

Characteristics			
No of char.	Characteristics	Time and kind of characteristics	Note
*1	Ploidy	VS	2-diploid 4-tetraploid
2	Grain: colour of aleurone layer	00 VS	1-light 2-dark
*3	Coleoptile: anthocyanin coloration	10-11 VS	1-absent or very weak 3-weak 5-medium 7-strong 9-very strong
4	Coleoptile: length	12-13	i-very short
5	First leaf: length of sheath	M	3-short
6	First leaf: length of blade		5-medium 7-long 9-very long
*7	Plant: growth habit	25-29 VS	1-erect 3-semi-erect 5-intermediate 7-semi-prostrate 9-prostrate
*8	Plant: length (stem, ear and awns)	80-92 M	1-very short 3-short 5-medium 7-long 9-very long
*9	Stem: hairiness below ear	70-85 VS	1-absent or very weak 3-weak 5-medium 7-strong 9-very strong

Table 1

Characteristics (continued)			
No of char.	Characteristics	Time and kind of characteristics	Note
10	Stem: length between upper node and ear	80–92 M	1–very short 3–short 5–medium 7–long 9–very long
*11	Flag leaf: glaucosity of sheath	50–60 VG	1–absent or very weak 3–weak 5–medium 7–strong 9–very strong
12	Leaf next to flag leaf: length of blade	60–69 M	1–very short 3–short 5–medium 7–long 9–very long
13	Leaf next to flag leaf: width of blade	60–69 M	1–very narrow 3–narrow 5–medium 7–broad 9–very broad
14	Ear: attitude	90–92 VS	1–erect 3–semi-erect 5–horizontal 7–semi-recurved 9–recurved
15	Ear: length (without awns)	80–92 M	1–very short 3–short 5–medium 7–long 9–very long
*16	Ear: density	80–92 M	1–very lax 3–lax 5–medium 7–dense 9–very dense 9–very long

Table 1

Characteristics (continued)			
No of char.	Characteristics	Time and kind of characteristics	Note
* 17	Ear: glaucosity	69–75 VS	1-absent or very weak 3-weak 5-medium 7-strong 9-very strong
18	Grain: weight per thousand grains	90–92 M	1-very small 3-small 5-medium 7-large 9-very large
* 19	Grain: length	92 M	1-very short 3-short 5-medium 7-long 9-very long
20	Grain: coloration with phenol	92 VS	1-absent or very light 3-light 5-medium 7-dark 9-very dark
*21	Time of ear emergence	52 M	1-very early 3-early 5-medium 7-late 9-very late
22	Dynamics of ear emergence	52 M	3-slowly 5-medium 7-quick
*23	Seasonal type	VG	1-winter 2-alternative 3-spring

Characteristics that should be used on all varieties in every growing period over which examinations are made and always be included in the variety descriptions;

00–92 – Time of observations (Decimal Code for the Growth Stages of Cereals)

M – Actual measurement

VG – Visual assessment by a single observation of a group of plants or parts of plants

VS – Visual assessment by observations of a number of individual plants or plants parts

The following characteristics are the most important: ploidy, anthocyanin coloration of coleoptile, growth habit of plant, glaucosity of

sheath of flag leaf, time of ear emergence, glaucosity of ear, hairiness below ear of stem, length of plant (stem, ear and awns), density of ear, weight per thousand grains, length of grain, seasonal type.

DISTINCTNESS

„The aim is to check if the candidate variety is different from each of all the commonly known” varieties of rye.

A variety is considered distinct from another when the differentiation is significant and consistent at least at one testing place.

If two different varieties exhibit greater differences than the natural fluctuations of characteristic expression found within one variety, then they are distinct.

The main statistical tool applied assessment of distinctness is analysis of variance (used both for single trials and for their series). After analysis of variance, different methods of between varieties comparison are used. The combined over year distinctness (COYD) method recommended by UPOV is very useful.

In Poland there are used for rye the statistical methods for the so-called „dynamics of flowering” in grasses. They have been elaborated and programmed in COBORU.

UNIFORMITY

A candidate variety must have an acceptable level of uniformity in its relevant characteristics (between plants within the variety).

The assessment of uniformity of parental lines and single hybrids is done on the basis of number of off-types in tested sample of plants.

According to the UPOV recommendation, the assessment of uniformity of parental lines and single hybrids is done applying the following population standard:

- in the case of 600 or 1200 plants 0.5% (6 or 10 off-types)
- in the case of 60 or 100 tested plants or 2.0% (3 or 5 off-types)
 parts of plants with an acceptance
 probability of at least 95%

For open-pollinated varieties and other hybrids than single hybrids relative tolerance limits are used through comparison with comparable varieties already known. For measured characteristics the standard deviation or variance is used as the criterion for comparison.

A variety is considered not uniform in a measured characteristic if its variance exceeds 1.6 times the average of the variance of the varieties used for comparison. Standard deviation for a candidate variety can not exceed 1.26 of that reference varieties. At present this criterion is being replaced by a combined over years uniformity (COYU) method.

Visually assessed characteristics are handled in the same way. The number of plants visually different from those of the variety should not significant (5 per cent probability of error) exceed the number found in comparable varieties that are already known.

STABILITY

In general, stability is the function of uniformity which means that heterogeneous varieties may lack stability. When a submitted sample has been shown to be uniform, it can also be considered to be stable. During the testing of distinctness and uniformity, careful attention is paid to stability. The stability is tested by growing a further generation or new stock to verify that shows the same characteristics as previous seed material of the variety.

CONCLUSIONS

- The report on technical examination and the official description of rye variety prepared in the end of DUS examination are necessary before its registration (NLI and PBR). There is close cooperation between UPOV member countries to harmonize the methods used in DUS testing and in examination of DUS of rye.
- A research international programme named RING-TEST has helped in exchange of experience in DUS testing and harmonisation of the assessment and description of rye varieties.
- UPOV is providing member States with an international system for cooperation in examination. Based on a UPOV model agreement, bilateral agreement concerning DUS testing of rye have been established between Poland and Hungary.

REFERENCES

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