

Breeding progress in oat cultivars of the Czech and Czechoslovak origin and assessment of their similarity

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The objective of the work was to collect and evaluate cultivars that originated or were grown in the Czech Republic and the former Czechoslovakia.

The collection of 69 accessions from the genebank was enlarged with those from the genebanks in the USA, Sweden, Germany, Poland, Great Britain, Russia, Lithuania and Hungary. In 2003-2006, a total of 115 cultivars were evaluated of which, 78 landraces and obsolete cultivars, 37 advanced cultivars.

Thirty-five morphological, biological, agronomic and quality traits were evaluated using the National List of Descriptors. Both scores according to the list of descriptors and metric data were used. Transformation of metric data to scores according to the list of descriptors can change distribution for some traits.

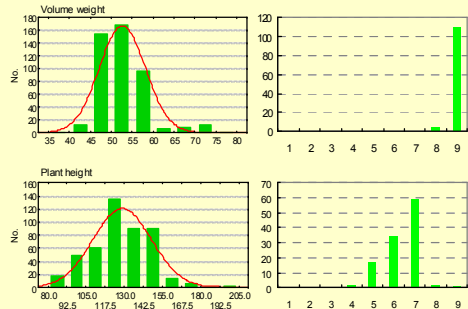
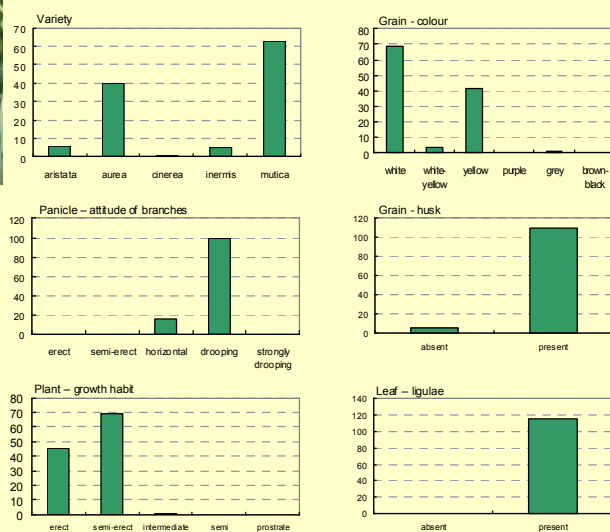
Variability of the set

The variability and distribution within the selected experimental set were described for individual traits. As for morphological traits, the examined accessions are very similar and in a number of traits some categories are missing.

Comparison of the histograms for metric data and scores according to the list of descriptors



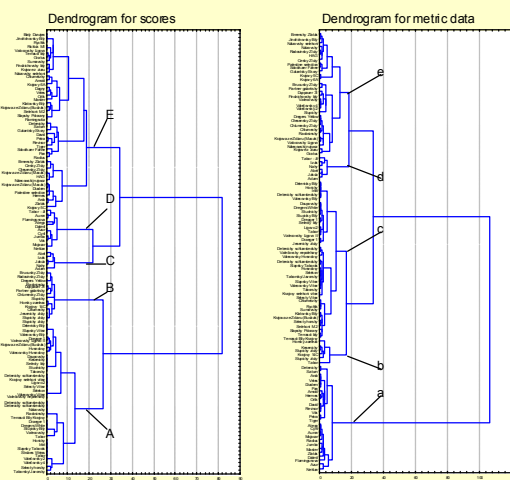
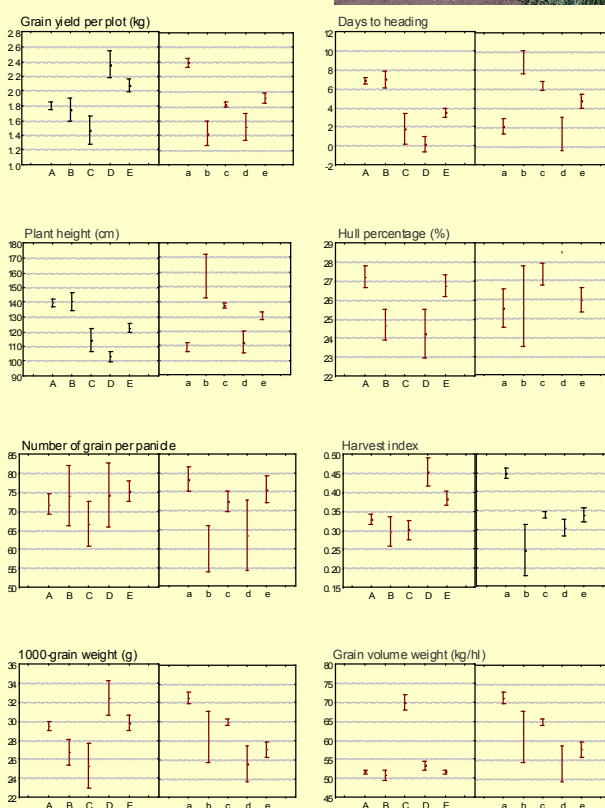
Distribution of the values of selected morphological traits according to the list of descriptors



Similarity of the cultivars

Using analysis of principal components, the traits that contribute most to a total variability were defined. The scored traits include grain colour, kernel covering, days to heading, panicle length, plant height, number of panicle layers, panicle shape and awnedness, and the metric traits include groat yield, harvest index, grain yield, plant height, panicle length, days to heading, grain weight per panicle, percentage of sieving fraction and TGW.

Mean values of selected traits in the groups (using score data A, B, C, D, E and metric data a, b, c, d, e)



Cluster analysis (Ward's clustering method, Euclidean distance) was used to create similar cultivar clusters. Clustering by using scores according to the list of descriptors and metric data clearly defined hullless cultivars and both methods distinguished advanced cultivars from obsolete ones.

Numbers of cultivars in the groups (using scores according to the list of descriptors and metric data)

	A	B	C	D	E
A	39	14	5	11	46
a	28			10	18
b	6	2	4		
c	40	32	1		7
d	6		5	1	
e	35	5	9		21

Group:

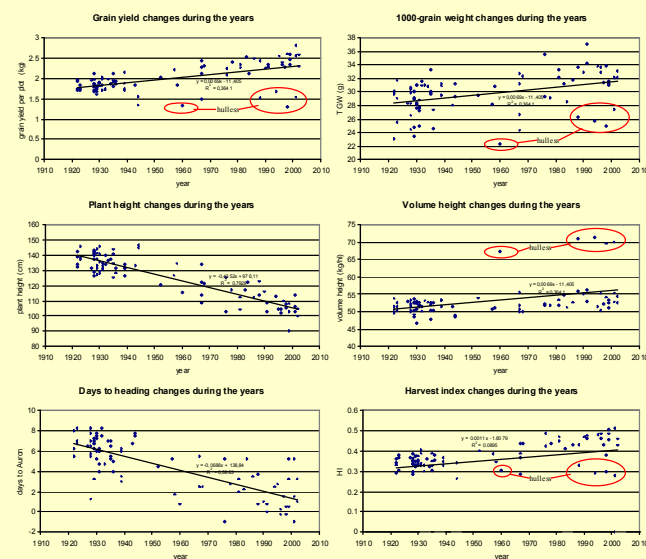
- A** local and obsolete cultivars, white grain
- B** local and obsolete cultivars, yellow, most of them repatriated from genebanks
- C** hullless cultivars
- D** modern cultivars
- E** mixed group, divided into sub-groups depending on grain colour and period of origin

- a** modern cultivars, high yield, short plants, early, high TGW
- b** low yield, late, long panicles with low number of grain, low grain volume weight
- c** late cultivars, high hull content, medium value of yield components
- d** mostly hullless cultivars
- e** late, small grain, medium value of most traits, medium value of most traits



Breeding progress

To evaluate the breeding progress, cultivars released in different periods are compared and the slope of the regression of the cultivars' yield against the year of their release is calculated. A correct value of the "year of the release" may be very problematic in cases of the local cultivars or obsolete cultivars from the first half of the 20th century and older.



Based on the period of origin, the cultivars were divided into the two groups (the cultivars originated before 1945 and those after 1945) and changes in individual traits during the breeding process were analysed. The first group consists of local and obsolete cultivars developed by selection, the second group of cultivars developed by crossing.

Differences between groups of cultivars

	Group A	Group B	Difference		t-test	
			B-A	%	t	p-value
Grain yield per plot (kg)	1.82	2.21	0.39	121.3	-7.4686	0.000000
Groat yield per plot (kg)	1.34	1.69	0.36	126.6	-10.4392	0.000000
Days to heading	5.8	2.3	-3.6	38.6	8.6915	0.000000
Days to maturity	2.0	0.8	-1.2	39.4	4.4285	0.000022
Plant height (cm)	136.0	112.2	-23.7	82.5	11.7673	0.000000
Length of second upper leaf (cm)	33.4	31.9	-1.5	95.5	3.4323	0.000837
Width of second upper leaf (cm)	1.6	1.5	0.0	96.9	1.7430	0.084062
Panicle length (cm)	23.0	19.4	-3.6	84.3	9.5039	0.000000
Number of panicle layers	6.4	6.2	-0.1	98.1	2.2274	0.027905
Number of grain per panicle	71.9	76.9	5.0	107.0	-2.6296	0.009739
Grain weight per panicle (g)	2.1	2.4	0.3	115.7	-4.8757	0.000004
Number of panicles per m ²	367.9	379.3	11.4	103.1	-1.3726	0.172606
TGW (g)	28.7	30.8	2.1	107.4	-4.0740	0.000086
Grain volume weight (kg/hl)	51.3	55.1	3.8	107.4	-4.9981	0.000002
Percentage of sieving fraction (%)	59.7	76.4	16.7	128.0	-4.3493	0.000030
Hull percentage (%)	26.6	25.9	-0.8	97.1	1.7517	0.082667
Harvest index (%)	32.9	41.7	8.8	126.7	-7.8573	0.000000

The increase was confirmed in the groups of modern cultivars in grain yield, TGW, grain number per panicle, grain weight per panicle, grain volume weight, sieving 2 mm, harvest index, resistance to diseases and lodging; decrease in plant height, length of panicle and hull percentage. The period to heading shortened by 3.5 days and to maturity by 1 day.

Acknowledgements

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