

Experiences of Members of the Union in Measures to
Improve the Efficiency and Effectiveness of DUS Testing

The Discriminating Power of Characteristics

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Geneva, March 26, 2012

The discriminating power of characteristics

- **dis-crim-i-nate**

to note or observe a difference; distinguish accurately: to discriminate between things

- **pow-er**

ability to do or act; capability of doing or accomplishing something.

How well do characteristics detect differences in varieties?

The discriminating power of characteristics is important for

- DUS testing
 - the distinctness test
 - the selection of reference varieties to include in the DUS trial
- Practical application of variety descriptions
 - eg to identify ornamental varieties
 - eg by the cereals Crop Expert in the field to verify the variety and check its uniformity

Choice of characteristics to be assessed in the DUS test

- Decided by Crop Experts in TWP subgroup who write Test Guideline (TG) for new species (see TGP/7/1)
- Characteristics are added/removed when TG is reviewed
- A new characteristic may be adopted immediately, or member states may monitor it, discuss it at TWP, then decide
- Experience or knowledge of the crop, or of similar crops, helps select discriminating and important characteristics, eg time to flowering

The discriminating power of characteristics - in general:-

- Qualitative (QL) characteristics - generally less affected by the environment and so tend to provide expressions that are consistent over years, locations and between operators
- Quantitative (QN) characteristics and Pseudo qualitative (PQ) characteristics tend to have GxE interactions, so location is important to expression and discriminating power

eg pea spur characteristics (UPOV 33, QN) useful for distinctness test in France, but not in the United Kingdom

- If notes used to assess distinctness, GxE interactions tend to be less apparent
- If statistics used to assess distinctness, GxE interactions tend to be more apparent

(See General Introduction_4.4 & TGP/9/1_5.2)

The discriminating power of characteristics - in more detail:-

- Practical experience gives the following decreasing order of discrimination:-
 - Those QL characteristics not affected by environment, eg presence/absence of feature
 - (QL), QN & PQ characteristics that exhibit gross, obvious differences eg obvious height, color or shape differences
 - other QN characteristics with 2 or 3 state differences
other PQ characteristics
and QN characteristics with statistically derived tolerances to decide differences

Factors affecting the discriminating power of characteristics:-

- Range and distribution of states expressed by reference varieties and candidates
- Environment
- Reproductive/Breeding system
- New breeding/novel traits
- Uniformity of population
- Trial quality
- The quality of the example varieties

The discriminating power of characteristics in herbage

QN characteristics measured. COYD for distinctness.

Can also analyse the data to assess the discriminating power of characteristics ...

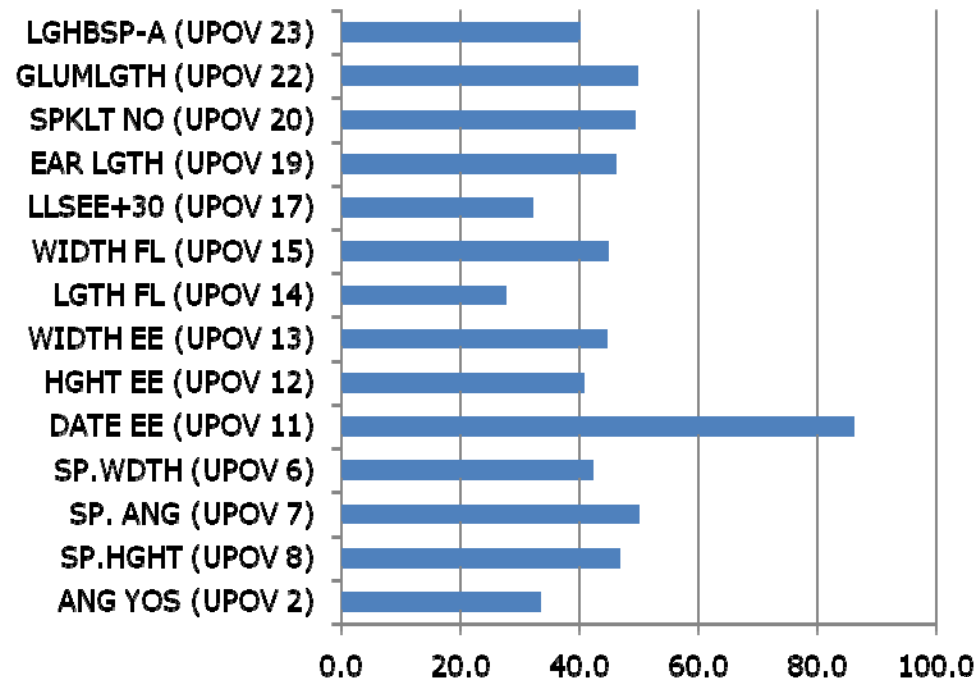
eg PRG FORAGE 3rd year test in 2009 - 284 varieties (reference varieties and candidates), data on 14 characteristics...

Analysis A: Individual characteristic separations

ANG YOS (UPOV 2) alone separates 13428 (33.4%) of the 40186 (=284x283/2) possible pairs of varieties

SP.HGHT (UPOV 8) alone separates 18771 (46.7%) of the 40186 possible pairs of varieties etc.

% of pairs separated by characteristic alone

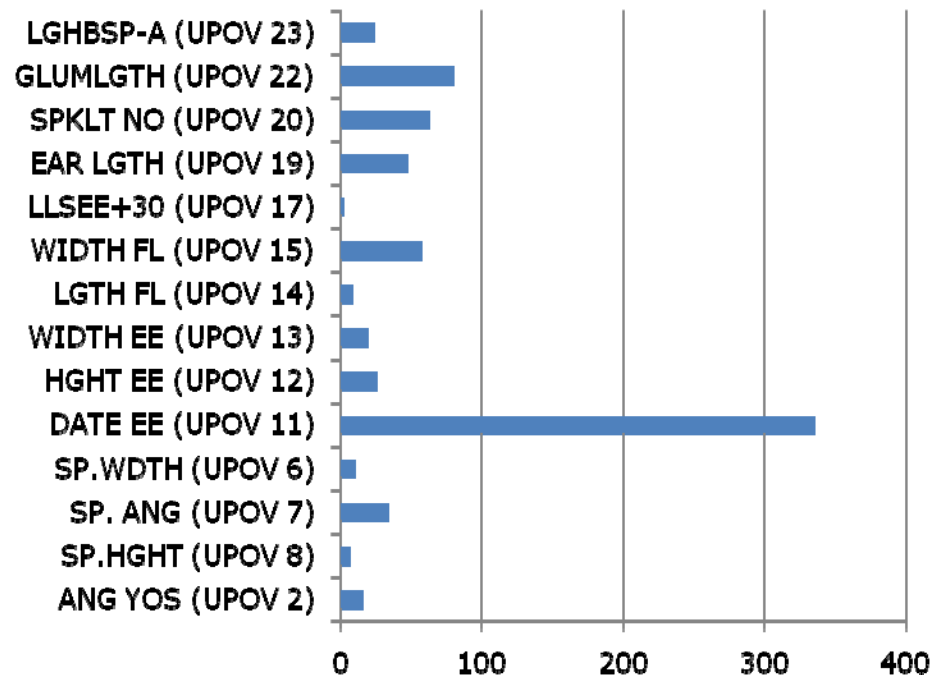


Analysis B: the number of variety pairs to which a characteristic is essential

15 of the 40186 pairs of varieties would not be separated if ANG YOS (UPOV 2) was not present

6 of the 40186 pairs of varieties would not be separated if SP.HGHT (UPOV 8) was not present etc.

No of the (40186) pairs the characteristic is essential to



Analysis C: Minimal characteristic set

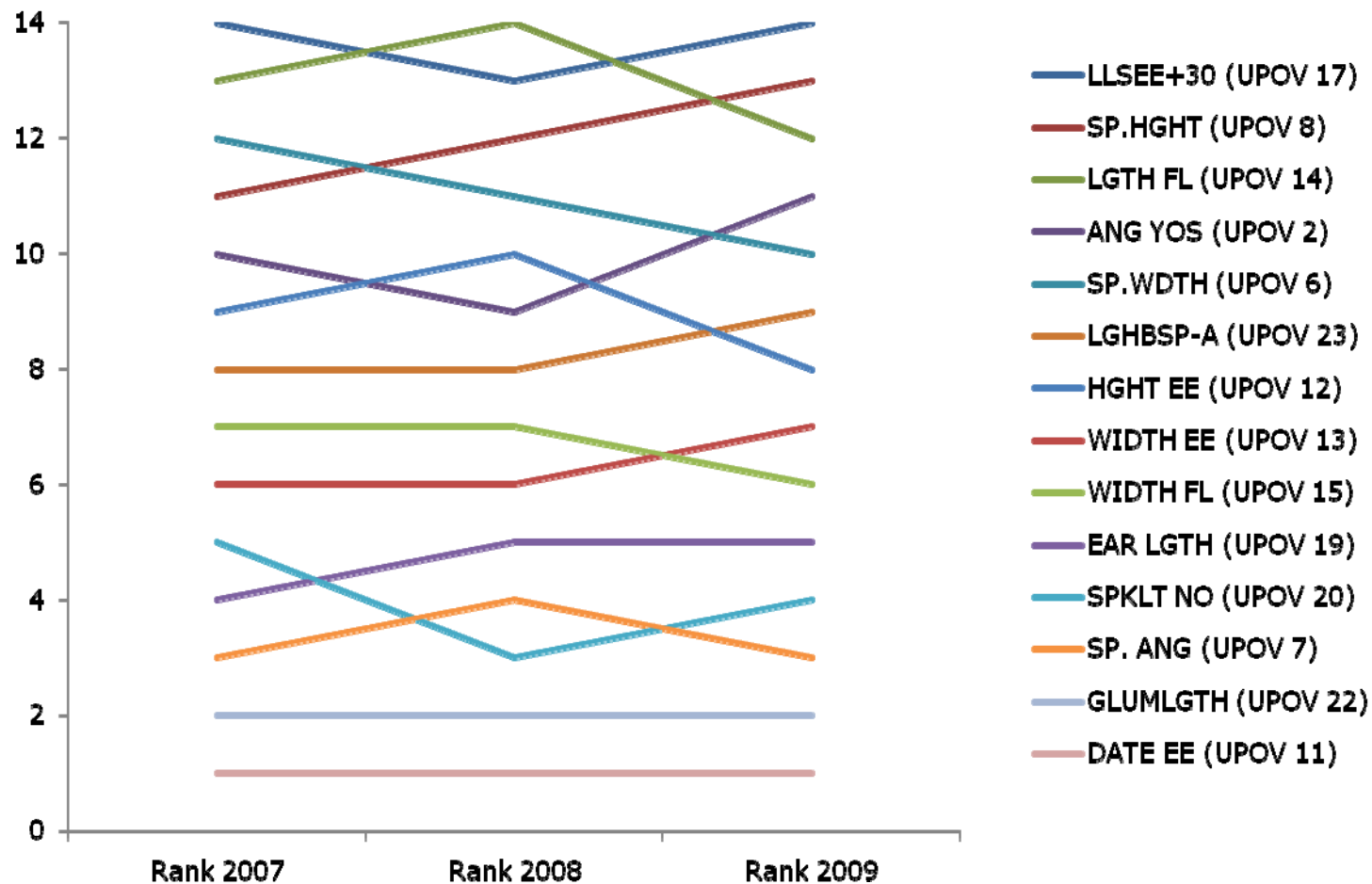
DATE EE (UPOV 11) alone separates 34623 (86.2%) of the pairs of varieties

Using GLUMLGTH (UPOV 22) as well separates a further 2795 pairs of varieties, giving 93.1% separated in total etc.

Characteristic	No of additional pairs separated	Cumulative % of total pairs separated
DATE EE (UPOV 11)	34623	86.2
GLUMLGTH (UPOV 22)	2795	93.1
SP. ANG (UPOV 7)	1222	96.2
SPKLT NO (UPOV 20)	645	97.8
EAR LGTH (UPOV 19)	308	98.5
WIDTH FL (UPOV 15)	210	99.0
WIDTH EE (UPOV 13)	98	99.3
HGHT EE (UPOV 12)	54	99.4
LGH BSP-A (UPOV 23)	33	99.5
SP.WDTH (UPOV 6)	23	99.6
ANG YOS (UPOV 2)	17	99.6
LGTH FL (UPOV 14)	8	99.6
SP.HGHT (UPOV 8)	6	99.6
LLSEE+30 (UPOV 17)	2	99.6

The GxE interaction causes the discriminating power of herbage QN characteristics to change somewhat between years

Rank of minimal characteristic set of PRG FORAGE 3rd year test in 2007, 2008, 2009



The discriminating power of characteristics in herbage (continued)

- If measurement error is reduced in measured QN characteristics, then discriminating power is increased, eg by automated measurement (Image Analysis) in pea (TWC/22/7).
- GxE interactions also cause the example varieties to move about on the herbage QN characteristics (true scale is continuum). So variety descriptions are of limited use to select reference varieties to include in trial, and other methods must be used, eg Cyclic Planting

General comments on discriminating power of characteristics

- The asterisked characteristics listed in the Test Guidelines are observed on all varieties in DUS trials in all member states (plus other characteristics ...)
- Some characteristics are useful only rarely, maybe not even every year, but when used they are invaluable, eg lodicules in barley
- In some crops where all varieties are from a similar genetic base and discrimination is difficult eg Spring Barley, more characteristics are sought
- A reduction in number of characteristics does not necessarily save costs: more direct comparison plots may be needed ⇒ greater costs

General comments on discriminating power of characteristics (continued)

- Not all characteristics express or are equally useful in all countries,
 - eg greyness of pea - only one state is seen in the United Kingdom but is very useful in France.
 - eg cereals grouping characteristics red/white chaff and presence/absence of awns - based on current United Kingdom varieties, both states are seen, but most candidates fall into one state
- Particularly where crops are global, TWP discussions of experiences with characteristics and consequent harmonization are invaluable

Thank you for your attention