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International Union for the Protection of New Varieties of Plants

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ADDENDUM TO GENETIC SELECTION OF SIMILAR VARIETIES FOR THE FIRST GROWING CYCLE: EXAMPLE FRENCH BEAN

prepared by an expert from the Netherlands

The Annex to this document contains a copy of a presentation on "Efficient DUS test in French bean (*Phaseolus vulgaris* L.) by using molecular data: Genetic selection of similar varieties for the first growing cycle", prepared by an expert from the Netherlands, to be made at the sixteenth session of the Working Group on Biochemical and Molecular Techniques and DNA-Profiling in Particular (BMT).

[Annex follows]

ANNEX

EFFICIENT DUS TEST IN FRENCH BEAN (*PHASEOLUS VULGARIS* L.) BY USING MOLECULAR DATA: GENETIC SELECTION OF SIMILAR VARIETIES FOR THE FIRST GROWING CYCLE

Presentation prepared by an expert from the Netherlands

Efficient DUS test in French bean (*Phaseolus vulgaris* L.) by using molecular data: Genetic selection of similar varieties for the first growing cycle

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BMT La Rochelle, November 2017

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Efficient DUS test in French bean (1)

- Many varieties in same group (TG/12/9 Rev. 2): dwarf, white flower, round, green pod without string, white seed, resistant to BCMNV. And many of them also resistant to *Colletotrichum* (Cl) and *Pseudomonas* (Psp).

The following have been agreed as useful grouping characteristics:

(a) Plant: growth type (characteristic 3)
(b) Flower: color of standard (characteristic 16)
(c) Pod: shape in cross section (through seed) (characteristic 22)
(d) Pod: ground color (characteristic 24)
(e) Pod: stringiness of ventral suture (characteristic 29)
(f) Seed: number of colors (characteristic 43)
(g) Seed: main color (largest area) (characteristic 44)
(h) Seed: secondary color (characteristic 45)
(i) Resistance to *Bean common mosaic necrosis virus* (BCMNV) (characteristic 50)

- In total 353 varieties known in this group, of which 226 resistant to Cl and Psp.
- Yearly 8 to 14 new applications at Naktuinbouw.

Efficient DUS test in French bean (2)

- Information on other characteristics, as stated in the (national) TQ, is being used for a careful selection of reference varieties for the field trial
  - Leaf: green color
  - Flower: size of bracts
  - Pod: length
  - Pod: width
  - Pod: intensity of ground color
  - Seed: weight
- Information in TQ not always complete and/or accurate: e.g.
  - very dark green leaves (9) and pods 14,5 cm in DUS test,
  - dark green leaves (7) and pods 12-13 cm in TQ

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Efficient DUS test in French bean (3)

- Based on grouping characteristics and careful use of other information in TQ **15 to 20** reference varieties selected per application.
  - Expensive (**2 – 3 hours** per application for an expensive DUS expert)
  - Too many to have a good side by side comparison
  - Risk of mistakes in selection due to inaccurate information on TQ.
  - In case of mistakes (2015: 3 cases on 12 new applications) again check on reference varieties, but now based on own, complete description. Risk on 3 years of testing.

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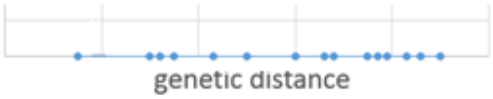
Theory towards more efficiency: Genetic selection of similar varieties for the first growing cycle

- Year 1 test 1



- Year 1 test 2
  - Genetically similar varieties in field
  - Side by side comparisons
  - Complete description of candidate by EO

Bloem: kleur vlag	**wit**	1	
Flower: colour of standard	*white*		
Bloem: kleur zwaarden	**wit**	1	
Flower: colour of wing	*white*		
Alleen stambonen Peul: lengte (exclusief snavel)	**midden tot lang**	6	**circa 15 cm**
Dwarf beans only Pod: length (excluding beak)	*medium to long*		*prox. 15 cm*
Alleen stokbonen Peul: lengte (exclusief snavel)	**niet van toepassing**	-	
Climbing beans only Pod: length (excluding beak)	*not applicable*		
Peul: breedte op breedste punt	**smal**	3	**circa 10 mm**
Pod: width at maximum point	*narrow*		*prox. 10 mm*
Peul: transversale breedte	**midden**	5	**circa 10 mm**
Pod: transversal width	*medium*		*prox. 10 mm*
Peul: verhouding transversale breedte/breedte op breedste punt	**midden**	5	
Pod: ratio transversal width/width at maximum point	*medium*		

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Theory towards more efficiency: Genetic selection of similar varieties for the first growing cycle

At the end of year 1:

- Compare complete, own description with descriptions in database: any morphologically close variety not in trial in year 1?
- If conclusion in the field was 'clearly distinct' and if no morphologically close variety expected from 'paper': **positive decision on dictinctness at the end of year 1.**
- If in the field a reference variety was close or if variety on paper looks morphologically close: **perform second year trial**.

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Genetic selection of similar varieties for the first growing cycle: example French bean

Benefits:

1. As the description of the application is complete and all descriptions are made by the examination office itself, one can be strict in selecting: not coming to 15 to 20 reference varieties, but none or only a few in a short time (less than 30 minutes).
   less time
   less space
   better quality of the side-by-side comparison
2. Possibly 1 year of testing is sufficient to declare the variety Distinct. (clearly distinct in year 1 and dna result adds confidence that distinctness will be consistent over years)
   less examination costs for breeder

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Genetic selection of similar varieties for the first growing cycle: example French bean

Costs:

1. DNA test
2. Maintenance of DNA database: based on a well defined and robust marker system. High resolution and validated.
3. Submission of seeds in time (at present at Naktuinbouw submission of seeds 4-5 weeks before actual sowing)

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Naktuinbouw results in French bean 2015, 2016

	Genetic selection 1st growing cycle				Traditional
Application	Number of genetically similar varieties	Number of references in year 1 (includes similar variety by breeder)	Number of references to be added in year 2 (similar on paper)	Total number of references in 2 years trials	Total number of references in 2 years trials
A	3	3	5	8	21
B	3	4	7	11	14
C	1	1	2	3	6
D	2	3	1	4	5
E	1	2	1	3	12
F	1	3	0 D year 1	3	25
G	1	4	2	6	13
H	5	7	1	8	15
I	4	5	0	5	13
J	1	2	2	4	17
K	0	1	3	4	14
L	1	2	1	3	9
M	5	6	3	9	13
N	0	1	3	4	16
			TOTAL	75	193

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Naktuinbouw results in French bean 2015, 2016

- 1 candidate of 2015 Distinct after year 1
- All other candidates (8) of 2015 Distinct after 2 years
- Also with genetic first selection no 3rd year needed for candidates of 2015
- 5 candidates of 2016 probably Distinct after 2 years, also with genetic first selection
- A reduction of more than 60% of the reference varieties

less time for selection similar varieties
better quality of the side-by-side comparison

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For the near future

- Continuous addition of new candidates and reference varieties to the DNA database
- AFLP database to be transferred to SNP

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TGP/15

TGP/15 gives a positive assessment of model *Combining phenotypic and molecular distances in the management of variety collections*

- Examples are known of parent lines in maize, potato.
- Study of very many variety pairs resulted in thresholds for both morphological and molecular distance.

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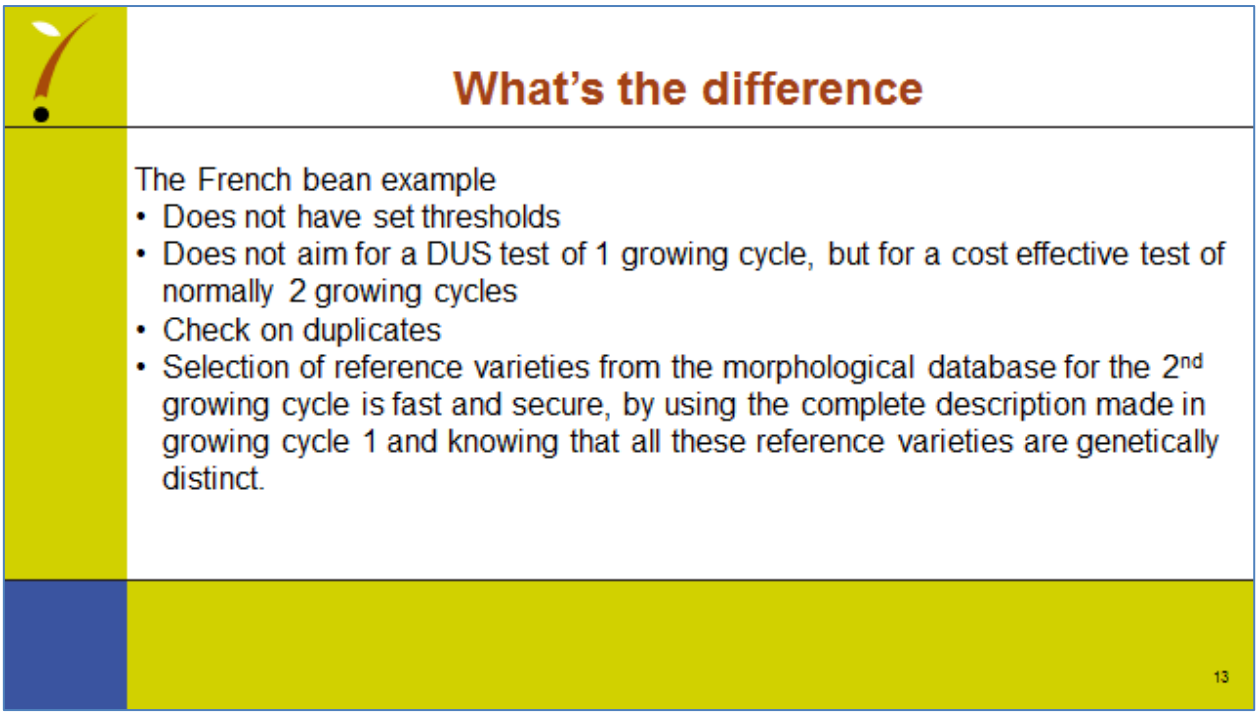

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