

Technical Working Party on Testing Methods and Techniques**TWM/1/12****First Session****Virtual meeting, September 19 to 23, 2022****Original:** English**Date:** September 2, 2022

DURDUSTOOLS: DEVELOPMENT OF A COMMON ONLINE MOLECULAR DATABASE AND A GENETIC DISTANCE CALCULATION TOOL FOR DURUM WHEAT*Document prepared by an expert from Austria**Disclaimer: this document does not represent UPOV policies or guidance*

The annex to this document contains a copy of a presentation on “DURDUSTools: Development of a common online molecular database and a genetic distance calculation tool for durum wheat”, prepared by an expert from Austria, to be made at the first session of the TWM.

[Annex follows]



DURDUSools

Development of a common online molecular database and a genetic distance calculation tool for durum wheat

Presented by Alexandra Ribarits

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EASILY ACCESSIBLE TOOL FOR DUS TESTS

DURDUS and DURDUSools

Objectives of DURDUS (Jan 2018 – Dec 2020)

- To investigate the potential of using a commercial chip to identify varieties to be grown in the field as references and to enable **pre-selection**
- **Efficient management** of reference collections
- Participating EOs: France, Hungary, Italy, Spain and Austria (project lead)

Objective of follow-up project DURDUSools (Jan 2021 – Jan 2023)

- To provide an **easily accessible tool** to be used by DUS experts
- Integration of molecular data into **DUS testing** in durum wheat
- Participating EOs: Hungary, Italy, Spain and Austria (project lead)



PRINCIPLES OF DURDUSTools

State-of-the-art genotyping: 25K DNA SNP-chip

- ☞ Use of a **commercially available DNA SNP-chip**
 - Genotyping using a 25K DNA SNP-chip designed for wheat
 - One chip accommodates 94 samples
 - Data generated by the service provider and uploaded by the coordinator
 - Stored in a database – encrypted information, limited access and defined use
- ☞ Selected information on the varieties stored in another list
 - Elements selected by the DUS experts
 - Regularly updated by the experts
- ☞ Tool uses information from both collections to create the output



3

DATA - SECURE STORAGE, TRANSPARENT USE

Genotypic data provides valuable information

- ☞ Genotypic data is stored on a **safe server**
- ☞ Only admin and coordinator have **access** to raw genotypic data
- ☞ Variety names in the genotypic data are **encrypted**
- ☞ **Access** to the tool is only given to the four entrusted EOs involved in the project and the project coordinator
- ☞ **Breeders** are informed about the genotyping with a prepared letter

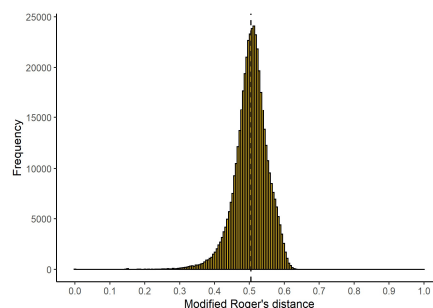


4

CALCULATION OF GENETIC DISTANCES

Modified Roger's distance

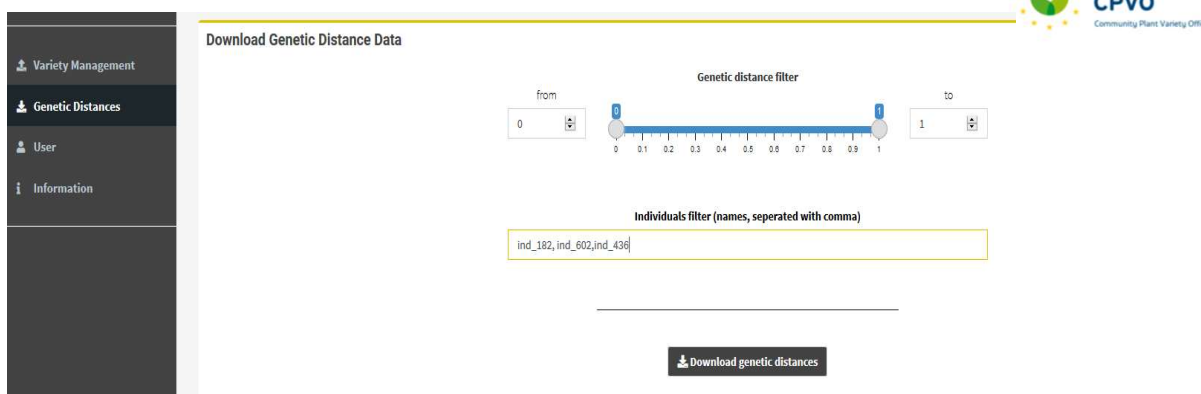
- Calculate genetic distance (GD)
 - GD based on **4,807 high quality SNPs**
 - Pairwise deletion** method: genetic distance calculation based on SNPs that have no missing values between the two varieties
 - On average 4,731 SNPs used for GD calculation
 - Calculation with R Software using **Modified Roger's distance**
 - GD varies from **0.00 to 0.65** (mostly around 0.50)



5

KEY FUNCTION: DOWNLOAD GENETIC DISTANCES

Most relevant feature for DUS experts



- Options to insert in search field: ID, Denomination or Breeder's reference

6

COMPREHENSIVE VARIETY LIST

Regularly updated with candidate varieties



853 varieties/candidate varieties have been genotyped

Variety list is **regularly updated**

- New candidate varieties are added to the variety list
- Some candidate varieties are registered as varieties

Variety Management										
Select columns		Show 10 entries		Search:						
Individual	Year of genotyping	Denomination	Breeder's reference / Synonym	Responsible EO	Status	Year of registration	Name of Breeder	Comment	Excluded from genetic distance calculation	

7

RESPONSIBILITIES OF DUS EXPERTS

Upload and update information



Before genotyping: Upload information on candidate varieties



Upload new variety data

Choose a changed varieties file to upload

Browse...

No file selected

After one year: Update status (V or nV) and add information

ID	Individual	Year of genotyping	Denomination	Breeder's reference / Synonym	Responsible EO	Status	Year of registration	Name of Breeder	Comment	Excluded from genetic distance calculation	username	Inserted	Updated
5	ind_521	2018	Variety 1	ABC	AT	V	2018	Breeder 1		doubled genotyp	EO_AUT_00	2021-11-1	2022-01-27 12:28:38
7	ind_636	2020	Variety 2	DEF	ES	V	2003	Breeder 2		doubled genotyp	EO_AUT_00	2021-11-1	2022-01-27 12:28:38
9	ind_671	2020	Variety 3	GHI	ES	V	2017	Breeder 3		doubled genotyp	EO_AUT_00	2021-11-1	2022-01-27 12:28:38
576	ind_604	2020		ABC	AT	C		Breeder 4			EO_AUT_00	2021-11-1	2022-01-27 12:28:38

8

CURRENT STATE OF USING DURDUSTOOLS

How to use DURDUSTools in DUS testing



Use in second year of DUS tests

- Time constraints for genotyping: current time schedule of seed delivery and sowing
- Phenotypic evaluation (e.g. GAIA) of first year is helpful
- The genetic distance threshold can be adjusted (GD 0.35 – GD 0.4)
- Further testing and more practice in the EOs to increase the benefit in the first year of DUS trials

Practicability and usefulness

- SNP chip with specified number of samples (n=94)
 - Durum wheat is a crop with only few candidate varieties each year → costs
- DURDUSTools is practical and easy-to-use for DUS experts
- All DUS experts confirmed **increased quality** in DUS tests

9

KEY ADVANTAGES OF DURDUS/DURDUSTools

Efficient, promotes cooperation and useful for DUS experts



- ☞ **Cost efficient:** Using a commercially available SNP-chip
- ☞ **Resource efficient:** No lab or molecular knowledge is needed at the EOs
- ☞ Promotes **harmonization** between the EOs
- ☞ **Cooperation** with a state-of-the-art service provider
- ☞ **Needs-oriented:** Output specified together with the DUS experts
- ☞ DUS experts conclude that it is a **very useful tool**

10

Thank you!



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