

Technical Working Party for Agricultural Crops

Forty-Sixth Session

Hanover, Germany, June 19 to 23, 2017

TWP/1/16**Original:** English**Date:** June 9, 2017**Technical Working Party for Vegetables**

Fifty-First Session

Roelofarendsveen, Netherlands, July 3 to 7, 2017

Technical Working Party for Ornamental Plants and Forest Trees

Fiftieth Session

Victoria, Canada, September 11 to 15, 2017

Technical Working Party for Fruit Crops

Forty-Eighth Session

Kelowna, Canada, September 18 to 22, 2017

Technical Working Party on Automation and Computer Programs

Thirty-Fifth Session

Buenos Aires, Argentina, November 14 to 17, 2017

SOFTWARE FOR STATISTICAL ANALYSIS IN DUS EXAMINATION*Document prepared by the Office of the Union**Disclaimer: this document does not represent UPOV policies or guidance***EXECUTIVE SUMMARY**

1. The purpose of this document is to report on the development of software for statistical analysis in the examination of distinctness, uniformity and stability (DUS).
2. The TWPs are invited to note the developments concerning software for statistical analysis in DUS examination, as set out in paragraphs 3 to 7 of this document.

BACKGROUND*Statistical methods used in the DUSTC software package*

3. The TWC, at its thirty-fourth session, held in Shanghai, China, from June 7 to 10, 2016, received a presentation by an expert from China on “Statistical methods used in the DUSTC software package”, including a demonstration of the software package that incorporates statistical analysis procedures, including the methods for calculating COYU and COYD (see document TWC/34/32 “Report”, paragraph 89).

A ring-test comparing three different software packages for COYD

4. The TWC received a presentation by an expert from China on “A ring-test comparing three different software packages for COYD”, a copy of which is reproduced in the Annex to this document. The TWC noted that the same data set was used to compare results generated for the COYD procedure using the statistical packages developed in China (DUSTC), Germany (SAS) and the United Kingdom (DUST). The TWC noted that the three different software packages produced the same result (see document TWC/34/32 “Report”, paragraph 95).

A single tool for DUS computation process

5. The TWC received a presentation by an expert from France on “A single tool for DUS computation process”, a copy of which is reproduced in the Annex to document TWC/34/29. The TWC noted the integration of new functions in the GAIA software and use of the same interface for different processes, such as COYD and COYU, using the same data set (see document TWC/34/32 “Report”, paragraphs 92 to 94).

6. The TWC noted the changes to the data structure in the Excel file used to upload data to GAIA with the introduction of information on replicates and number of plants per replicate. The TWC noted that the improvements made would still allow GAIA to be available free of charge.

7. The TWC agreed to invite France to report on progress in the development of a single tool for DUS computation process at the thirty-fifth session of the TWC.

8. The TWPs are invited to note the developments concerning software for statistical analysis in DUS examination, as set out in paragraphs 3 to 7 of this document.

[Annex follows]



A ring-test comparing three different software packages for COYD

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Ministry of Agriculture, China
Shanghai, China, June 7-10, 2016



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- Data used for COYD
- Statistical Tools
- Results



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Data used for COYD

- 45 varieties of Sorghum with two cycles, last five are candidate varieties:
- ✓ Time of anthesis, one datum for each cycle
- ✓ Plant length, twenty data for each cycle



Time of anthesis
(days)

variety number	cycle 1	cycle 2
C01	84	81
C02	89	89
C03	85	88
C04	87	82
C05	85	82
C06	89	80
C07	89	83
C08	81	81
C09	84	80
C10	87	81
C11	88	89
C12	89	89
C13	83	84
C14	83	83
C15	80	81
C16	83	84
C17	81	81
C18	80	80
C19	84	88
C20	88	89
C21	89	82
C22	85	85
C23	83	83
C24	86	88
C25	86	87
C26	89	82
C27	81	83
C28	88	88
C29	88	87
C30	82	87
C31	81	88
C32	82	81
C33	80	88
C34	82	88
C35	81	82
C36	87	88
C37	84	81
C38	81	81
C39	81	82
C40	45	43
C41	80	88

Plant length
(centimeter)

variety number	cycle 1	cycle 2
C01	152.35	144.6
C02	155.9	148.85
C03	180.2	142.85
C04	133.8	130.4
C05	139.85	141.15
C06	163	152.05
C07	145.45	135.75
C08	162.15	150.8
C09	135.85	128.05
C10	157.7	143.1
C11	156.8	152.9
C12	158.8	150.85
C13	151.3	158.85
C14	148.6	153.1
C15	161.2	152.05
C16	137.1	121.9
C17	160.35	128.85
C18	149.5	130.5
C19	115.3	114.7
C20	137.1	128.45
C21	167.8	143.7
C22	176.6	158.45
C23	147.7	128.45
C24	144.2	149.4
C25	147.1	148.85
C26	148.85	130.4
C27	168	140.9
C28	143.85	123.4
C29	129.3	116.3
C30	188.4	130.85
C31	149.25	119.45
C32	180.1	125.6
C33	188.7	130.15
C34	166.9	133
C35	150.25	158.25
C36	146.8	135
C37	154.85	144.85
C38	159.2	139.5
C39	159.4	134.5
C40	92.85	81.4
C41	147.15	120.5



Statistical tools

- DUST software, created by the United Kingdom (GB) in 1998, written by FORTRAN 90 language.
- SAS software, data collected by a Visual Basic (VB) software created by Germany (DE).
- DUSTC software, created by China in 2012, written by Pascal language in Delphi platform.




DUSTN—GB



afbi
DUST Analysis System
Version 1.0.0.0

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UNIFORMITY

```

graph TD
    U1[U1] --- UNIF[UNIF]
    U2[U2] --- UNIF
    U3[U3] --- UNIF
    UNIF --- V[V]
    V --- UNIFD[UNIFD]
    
```

DIFFERENCES

```


graph TD
    D1[D1] --- DIFF[DIFF]
    D2[D2] --- DIFF
    D3[D3] --- DIFF
    DIFF --- E[E]
    E --- ANALS[ANALS]
    ANALS --- EQB[EQB]
    EQB --- D[D]
    EQB --- W[W]
    EQB --- M[M]
    D --- CANF[CANF]
    W --- IGT[IGT]
    M --- DOUT[DOUT]
    M --- MOST[MOST]
    IGT --- S[S]
    S --- FCF[FCF]
    S --- GLO[GLO]
    
```

```

graph TD
    W1[W] --- MA[MA]
    M1[M] --- PL[PL]
    
```


SUMMARY FOR CODES AT 1.0% LEVEL *HIGHER THAN ADJ YEAR 2000**

CARDIATE VAR	27	30	39	40	41
1 901	30	30	30	3	30
2 902	30	30	30	3	30
3 903	30	30	30	3	30
4 904	3	3	30	3	30
5 905	30	30	30	3	30
6 906	30	30	30	3	3
7 907	30	30	30	3	30
8 908	30	30	30	3	3
9 909	3	3	30	3	30
10 910	30	30	30	3	30
11 911	3	3	30	3	30
12 912	30	30	30	3	30
13 913	30	30	30	3	30
14 914	3	30	30	3	30
15 915	30	30	30	3	30
16 916	3	3	3	3	30
17 917	30	30	30	3	30
18 918	30	30	30	3	30
19 919	3	3	3	3	3
20 920	3	3	30	3	30
21 921	30	30	30	3	30
22 922	30	30	3	3	3
23 923	3	30	30	3	30
24 924	3	30	30	3	30
25 925	3	30	30	3	30
26 926	3	30	30	3	30
27 927	30	30	30	3	3
28 928	3	30	30	3	30
29 929	3	3	3	3	30
30 930	30	30	30	3	30
31 931	3	30	30	3	30
32 932	3	30	30	3	30
33 933	30	30	30	3	30
34 934	30	30	30	3	30
35 935	30	30	30	3	30
36 936	30	30	30	3	30
37 937	-	30	30	3	3
38 938	30	-	30	3	30
39 939	30	30	-	3	30
40 940	3	3	3	-	3
41 941	3	30	30	3	-
NO OF NO VARS	23	32	35	0	33
DIFFERENCES	30	30	30	3	30
CARDIATE VAR	27	30	39	40	41

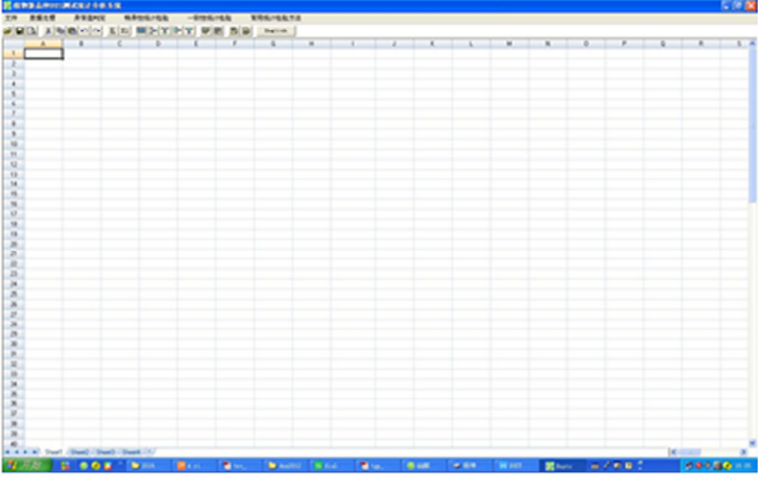



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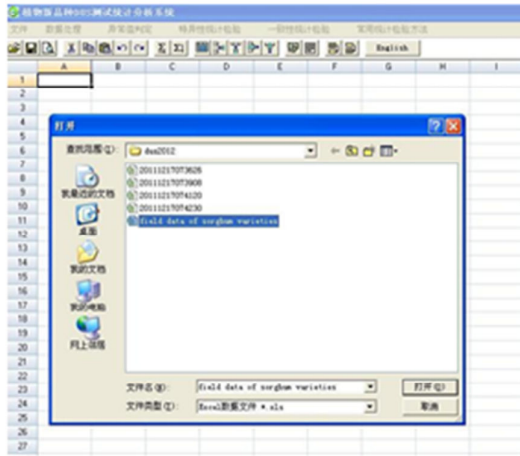
DUSTC—CN



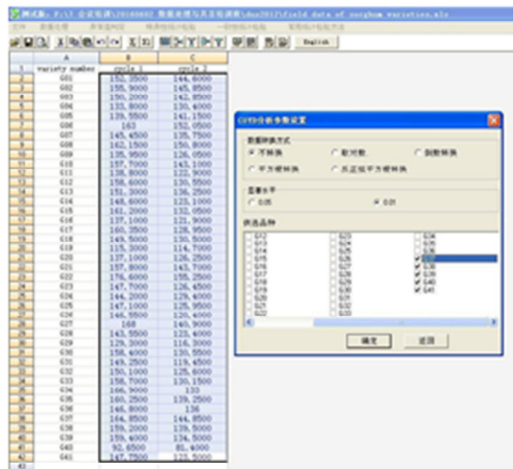


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open an excel document with field data



select data zone, click parameters board to select method to convert original data, significance level, candidate varieties





Art	Prüft	Jahr Anbaukarte	Anzahl Jahre	2014 - 2016	frst
WD	Schanhong	2016	3		

Prüfung	Prüfung	Prüfung	Prüfung	Prüfung	Prüfung	Prüfung	Prüfung	Prüfung	Prüfung
101	148 4750	8 3750	8 3750	-1 5250	41 4500	0	-12 8500		
102	150 4750	8 3750	-1 5250	-2 0750	-10 0000	0	-12 2000		
103	146 5250	8 3250	2 8250	8 4250	-10 0000	0	-10 0000		
104	132 1000	22 7500	17 2500	14 0000	-48 5750	0	3 5250		
105	142 3000	14 5000	0	8 0000	-13 2500	0	-1 2250		
106	157 5250	-2 4750	-8 1750	-15 5750	-10 0000	0	-21 0000		
107	140 0000	14 2000	8 7500	8 3000	-15 5750	0	-4 8750		
108	158 4750	-1 5250	-1 7500	-9 5250	-18 4000	0	-20 0000		
109	139	23 0000	18 3000	18 3000	-10 0750	0	-4 5250		
110	150 4000	4 4000	-8 0000	-2 4000	-13 1750	0	-14 7750		
111	130 8000	24 0	10 0000	16 1000	-10 0250	0	-4 7750		
112	145 5750	10 2750	4 7750	2 3750	-17 0000	0	-8 0000		
113	142 1750	11 2750	8 5750	2 1750	-10 7000	0	-8 1000		
114	136 8000	18 0	13 0000	11 1000	-48 8250	0	-4 2250		
115	148 5250	8 2250	2 7250	5 2750	-10 0000	0	-11		
116	139 0000	25 2000	18 0000	17 4000	-10 4250	0	-4 1250		
117	144 0000	10 2000	4 7000	2 2000	-17 4250	0	-8 2250		
118	140	14 0000	9 3000	8 9000	-12 9750	0	-4 2750		
119	116	20 0000	24 0000	21 0000	-17 0750	0	-20 8250		
120	131 4750	23 1750	17 4750	15 2750	-40 0000	0	-3 0000		
121	150 4000	4 4000	-2 4000	-2 0000	-13 1250	0	-15 1250		
122	145 5250	-11 5750	-10 5750	-10 0750	-10 0000	0	-10 2000		
123	137 0750	17 7500	12 2750	8 7500	-10 0000	0	-1 4000		
124	136 0000	10 0000	12 0000	10 7000	-10 1750	0	-1 1750		
125	136 5250	18 3250	12 8250	10 4750	-40 0000	0	-8 0000		
126	133 4750	21 2750	15 7750	13 4750	-46 4000	0	-2 1500		
127	154 4000	5 4000	4 1000	-1 0000	-17 4250	0	-18 8250		
128	133 4750	21 2750	15 7750	13 4750	-46 4000	0	-2 1500		
129	132 8000	32 0000	28 0000	24 0000	-25 1750	0	-12 8250		
130	144 4750	10 1750	4 8750	2 4750	-17 4000	0	-8 0000		
131	134 3000	20 3000	17 3000	-17 0000	-47 0750	0	-1 0750		

results will be showed in another sheet



SAS—DE

In the first step we choose species, trial-station and time-period

COY Daten entladen 1.06

Art: Prüft: Jahr Anbaukarte: Anzahl Jahre: 2014 - 2016 frst

In the second step we choose the candidate-varieties:

Prüfstation bestimmen

1x3 2016 Schanhong

Prüfung	Jahr	Typ	Bezeichnung
2016	1	DU	LP 0176
2016	2	1	LP 0176
2016	1	1	LP 0106

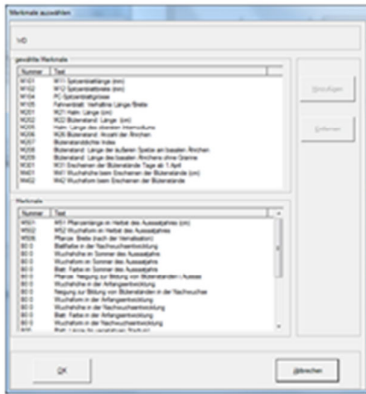
Sortiment

Prüfung	Typ	Bezeichnung
2016	1	DU LP 0176
2017	1	DU LP 0176
2018	1	DU LP 0176
2019	1	DU LP 0176
2020	1	DU LP 0176
2021	1	DU LP 0176
2022	1	DU LP 0176
2023	1	DU LP 0176
2024	1	DU LP 0176
2025	1	DU LP 0176
2026	1	DU LP 0176
2027	1	DU LP 0176

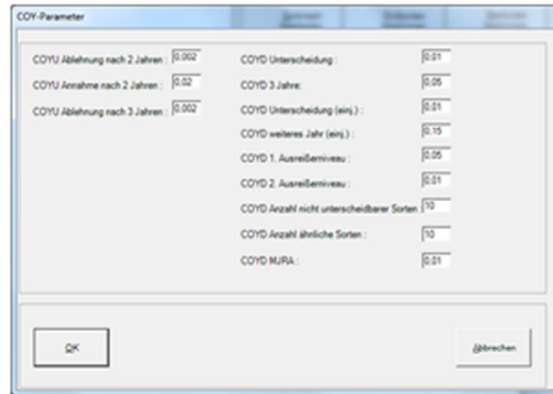




In the third step we choose the characteristics:



In the last step we choose the probability-levels:



Kenn-Nr.	Sorte	37	38	39	48	41
1	Sorte 01	1J	NU	1J	2U	1J
2	Sorte 02	NU	NU	NU	2U	1J
3	Sorte 03	1U	1J	1J	2U	NU
4	Sorte 04	1U	1U	1J	2U	NU
5	Sorte 05	2J	NU	NU	2U	NU
6	Sorte 06	NU	NU	NU	2U	1U
7	Sorte 07	1J	NU	NU	2U	NU
8	Sorte 08	NU	NU	NU	2U	1U
9	Sorte 09	2U	1U	2J	2U	NU
10	Sorte 10	NU	NU	NU	2U	1J
11	Sorte 11	1U	1U	1J	2U	NU
12	Sorte 12	NU	NU	NU	2U	NU
13	Sorte 13	NU	NU	NU	2U	1J
14	Sorte 14	1U	1J	NU	2U	NU
15	Sorte 15	NU	NU	NU	2U	NU
16	Sorte 16	1U	1U	1U	2U	1J
17	Sorte 17	NU	NU	NU	2U	NU
18	Sorte 18	1J	NU	NU	2U	NU
19	Sorte 19	2U	1U	2U	2U	1U
20	Sorte 20	1U	1U	1J	2U	NU
21	Sorte 21	NU	NU	NU	2U	1J
22	Sorte 22	NU	1U	1U	2U	2U
23	Sorte 23	1U	NU	NU	2U	NU
24	Sorte 24	2U	2J	1U	2U	NU
25	Sorte 25	1U	1J	1J	2U	NU
26	Sorte 26	1U	1J	1J	2U	NU
27	Sorte 27	NU	NU	NU	2U	1U
28	Sorte 28	2U	2J	2J	2U	NU
29	Sorte 29	1U	1U	1U	2U	1J
30	Sorte 30	NU	NU	NU	2U	NU
31	Sorte 31	1U	1J	1J	2U	NU
32	Sorte 32	1U	NU	NU	2U	NU
33	Sorte 33	1J	NU	NU	2U	NU
34	Sorte 34	NU	NU	NU	2U	1J
35	Sorte 35	NU	NU	NU	2U	1J
36	Sorte 36	2J	NU	1J	2U	NU
37	Sorte 37	-	NU	NU	2U	1U
38	Sorte 38	NU	-	NU	2U	1J
39	Sorte 39	NU	NU	-	2U	NU
40	Sorte 40	2U	2U	2U	-	2U
41	Sorte 41	1U	1J	NU	2U	-
-	RnZ, NU/3J	16	23	23	0	23
-	Unter_73J	neIn	neIn	neIn	Ja	neIn

1J: further test year necessary in one characteristic (difference between test and candidate variety is lying between least significant difference for the first (1%) and for second (5%) limit)

2J: further test year necessary in two characteristics (difference between test and candidate variety is lying between least significant difference for the first (1%) and for second (5%) limit)

1U: there is a difference in one characteristic

2U: there is a difference in two characteristics

NU: there is no significant difference





Results

1% COYD criterion (LSD)	GB	CN	DE
Time of Anthesis	5.40	5.40	5.40
Plant Length	16.65	16.65	16.65

Perfect

- GB, CN and DE have the same result of criterion.
- DE produces a integrated result which is different from GB and CN.



#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q								
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43

Time of anthesis

Plant length





[End of Annex and of document]