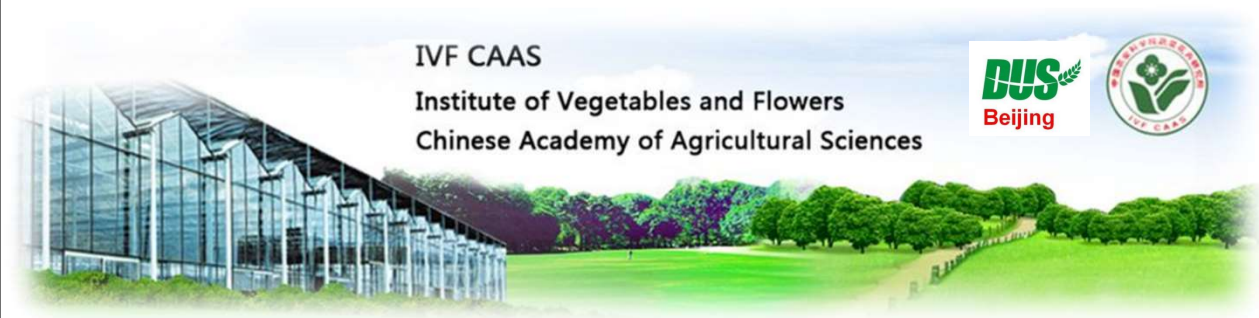


Technical Working Party for Agricultural Crops**TWA/52/5 Rev.****Fifty-Second Session
Virtual meeting, May 22 to 26, 2023****Original:** English
Date: May 23, 2023



DUSCEL STATISTICAL ANALYSIS SOFTWARE*Document prepared by an expert from China**Disclaimer: this document does not represent UPOV policies or guidance*

The annex to this document contains a copy of a presentation “Development of Statistical Analysis Software: DUSCEL4.5”, made by an expert from China, at the fifty-second session of the TWA.

[Annex follows]



IVF CAAS
Institute of Vegetables and Flowers
Chinese Academy of Agricultural Sciences



DEVELOPMENT OF STATISTICAL ANALYSIS SOFTWARE :
DUSCEL4.0

Yang Kun
Deputy director of Beijing Sub-center of New Plant Variety Tests, MARA, China

TWA52, Virtual meeting, May 22 to 26, 2023

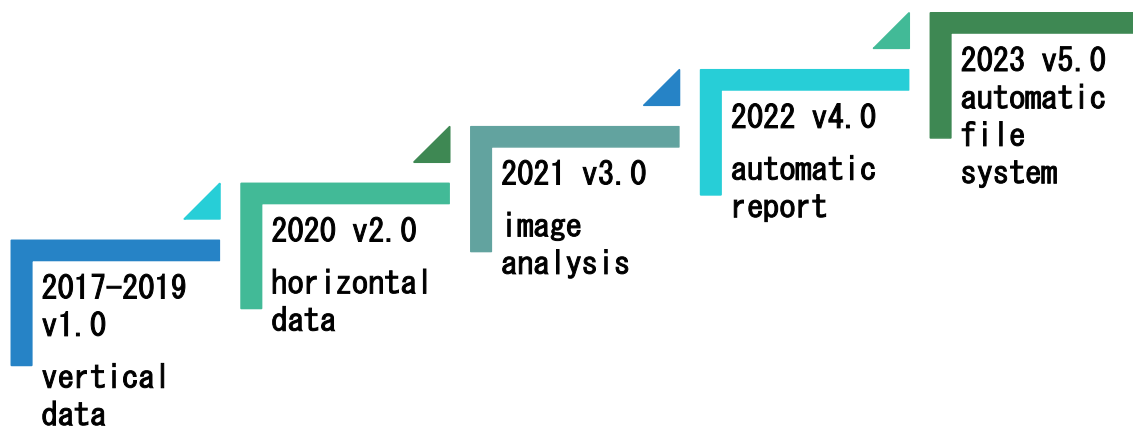
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1. History
2. Problems
3. Developments
4. Plans

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SCHEDULE OF DUSCEL



HISTORY OF REPORTS

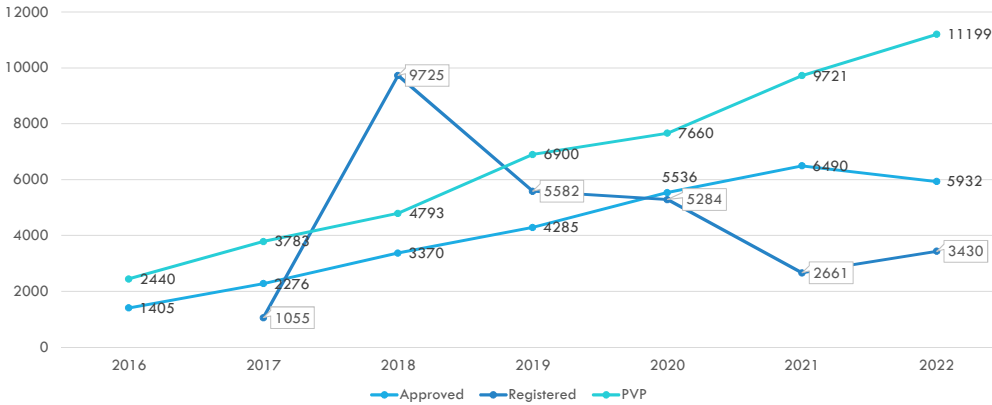
1. 2019, DUSCEL V1.0, 12 sheets and 46 functions, reported in TWC37.
2. 2020, DUSCEL V2.0, 6 sheets and 55 functions, reported in TWC38.
3. 2021, DUSCEL V2.5, 7 sheets and 52 functions, reported in TWA50.
4. 2021, DUSCEL V3.0, 5 sheets and 42 functions, reported in TWC39.
5. 2022, DUSCEL V3.5, 8 sheets and 35 functions, reported in TWV56.
6. 2022, Development of statistical analysis software, reported in TWM1.

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VARIETIES OF PVP, APPROVED AND REGISTERED

Statistics on application number of varieties in China from 2016 to 2022



Approved:
29294

Registered:
27737

PVP
applications :
62636
PVP granted:
23101

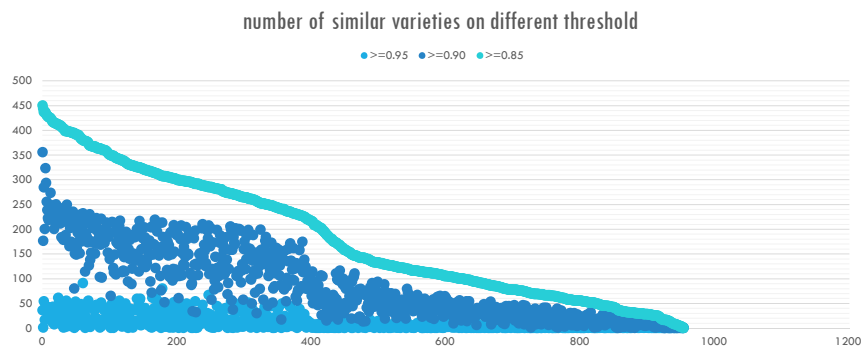
STATISTICS OF SIMILAR VARIETIES FOR TOMATO

1142 trial data for all 935 tomato varieties from 2017 to 2022:

Average correlation coefficient between years for same variety is 85%;

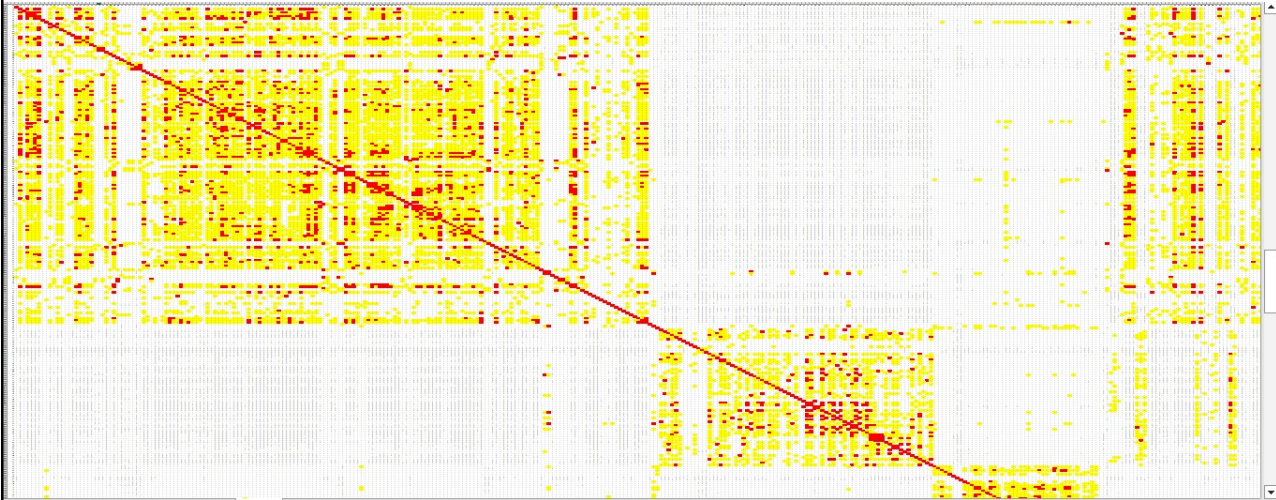
Average correlation coefficient between all varieties is 68%;

Average number for similar varieties for each variety is 181, 84 and 10 for different correlation coefficient 0.85, 0.90 and 0.95.



trial	variety
9	1
7	1
6	3
5	4
4	8
3	28
2	341
1	568
6	935

PREVALENCE OF LOW-LEVEL REPETITIVE BREEDING



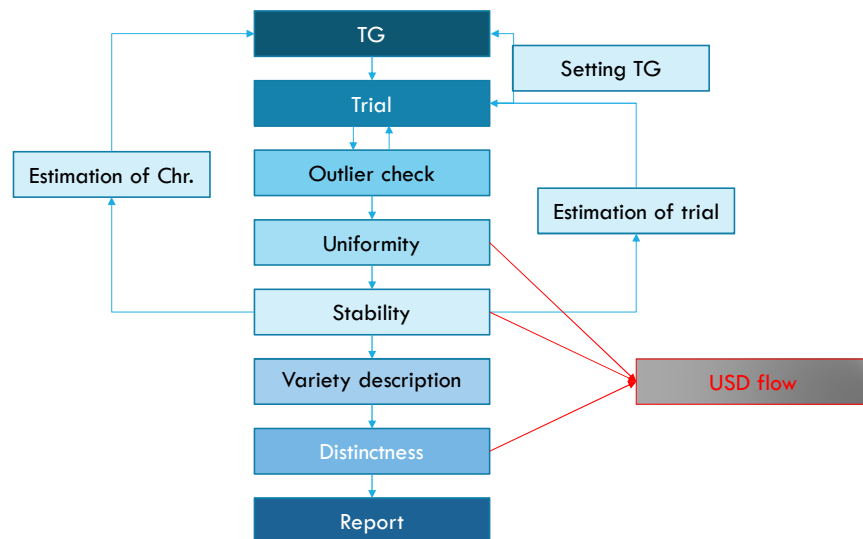
PROBLEMS OF DUS TESTING

1. Testers contribute most part of variance in data.
2. Environmental conditions contribute a significant variance in data.
3. There are no unified methods for trial design and statistical analysis.
4. There are no unified decision threshold for DUS.

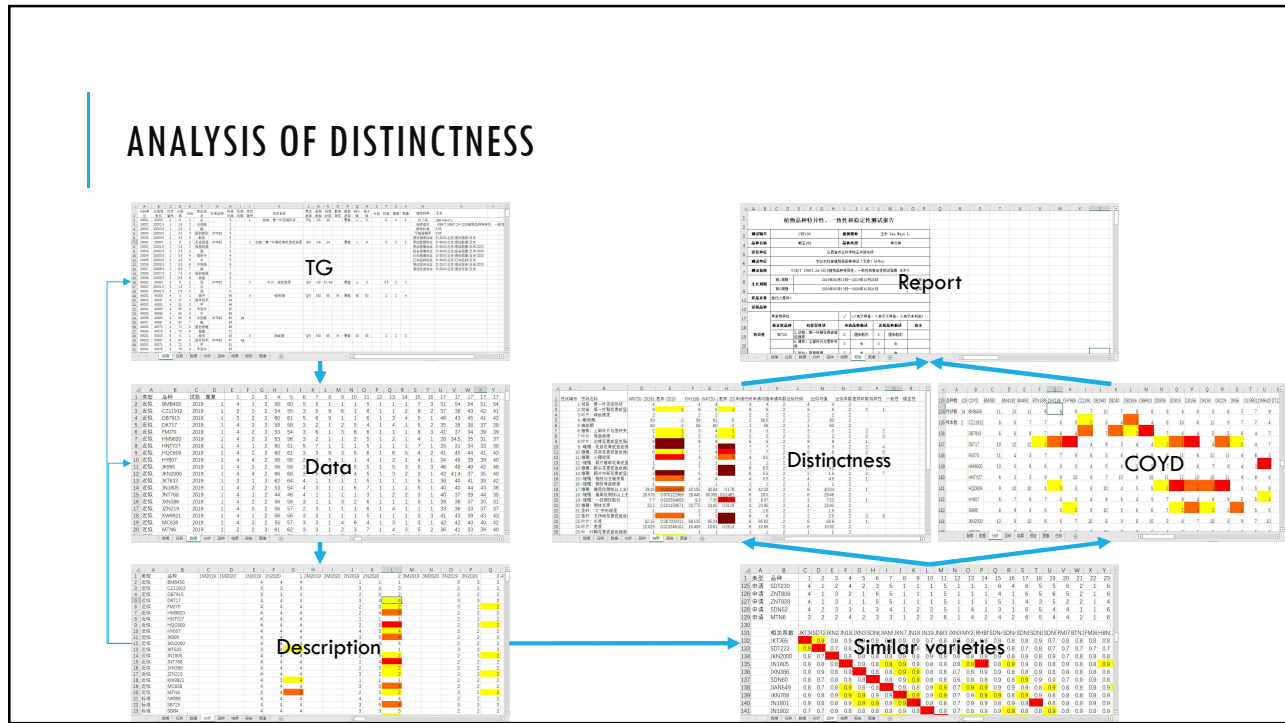
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NEW FLOW : RECYCLING, PRECISE AND EFFICIENT



ANALYSIS OF DISTINCTNESS



ANALYSIS OF UNIFORMITY AND STABILITY

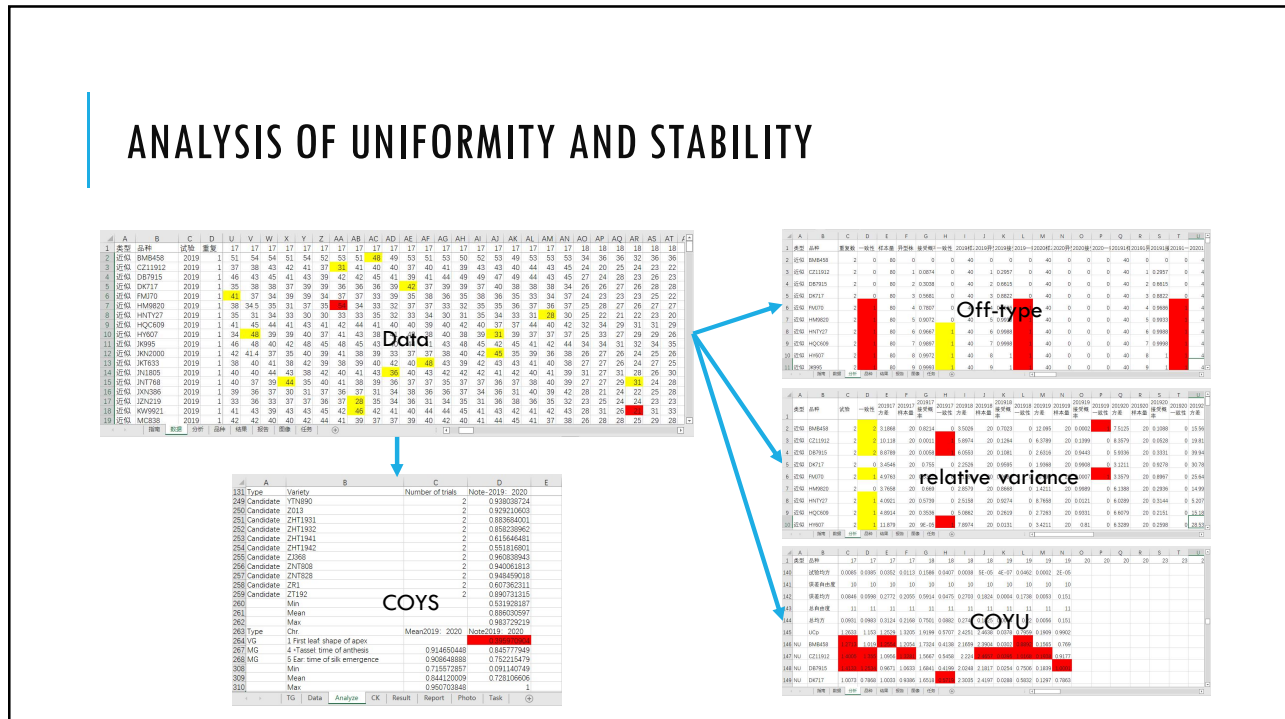


IMAGE CHECKING

Id/name	Type	Address	Name	Photo1	Photo2	A	B	C	D	E	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	
1.jpg	文件	D:\蔬菜库\2020\2017-08T1A				1	类型	品种	1	2	3	类型	品种	1M2015	1M2020	1N2019	1N2020	1	2M2015	2M2020	2N2019	2N2020	2	3M2015	3M2020	3N2019	3N2020	
2.jpg	文件	D:\蔬菜库\2020\2017-08T1A				2	近似	CZ11912	3		2	近似	CZ11912															
3.jpg	文件	D:\蔬菜库\2020\2017-08T1A				3	近似	DB7915	3		2	近似	DB7915															
4.jpg	文件	D:\蔬菜库\2020\2017-08T1A				4	近似	BMB458	4		3	近似	BMB458															
						4	近似	DK717	4		3	近似	DK717															
						4	申请	BM4192	4		2	近似	K995															

品种	品种	品种
2018-2191A	2018-2191A	2018-2191A
2018-2088A	2018-2088A	2018-2088A
2018-2088B	2018-2088B	2018-2088B
2018-2088C	2018-2088C	2018-2088C
2018-2088D	2018-2088D	2018-2088D
2018-2088E	2018-2088E	2018-2088E
2018-2088F	2018-2088F	2018-2088F
2018-2088G	2018-2088G	2018-2088G
2018-2088H	2018-2088H	2018-2088H
2018-2088I	2018-2088I	2018-2088I
2018-2088J	2018-2088J	2018-2088J
2018-2088K	2018-2088K	2018-2088K
2018-2088L	2018-2088L	2018-2088L
2018-2088M	2018-2088M	2018-2088M
2018-2088N	2018-2088N	2018-2088N
2018-2088O	2018-2088O	2018-2088O
2018-2088P	2018-2088P	2018-2088P
2018-2088Q	2018-2088Q	2018-2088Q
2018-2088R	2018-2088R	2018-2088R
2018-2088S	2018-2088S	2018-2088S
2018-2088T	2018-2088T	2018-2088T
2018-2088U	2018-2088U	2018-2088U
2018-2088V	2018-2088V	2018-2088V
2018-2088W	2018-2088W	2018-2088W
2018-2088X	2018-2088X	2018-2088X
2018-2088Y	2018-2088Y	2018-2088Y
2018-2088Z	2018-2088Z	2018-2088Z

IMAGE ANALYSIS

DUS图像处理

原图地址: E:\M65\214\附件实例\原始照片\2020\申请\2015_1.jpg

新图地址:

打开图像

保存结果

比例尺: 123.006969726867 10mm

长度: 6.21122675134091 cm

光标:

X: 3324 Y: 1541

起点: X: 2560 Y: 1547

终点: X: 3324 Y: 1541

原图角度: 41.74.207 66.173.225

新图角度: 22.88.169 43.169.206

RGB值: 999 111B

Type	Variety	23. Corolla lobe: main color	24. Corolla lobe: secondary color	26. Corolla lobe: tertiary color	30. Corolla tube: main color of inner side
CAN	2019QN001	71A			N79A
CAN	2019QN002	N81A	79C		79B
CAN	2019QN003	N66B	68C		N79B
CAN	2019QN004	N66B	68C		N79B
CAN	2019QN005	N66A	68A		N77B
CAN	2019QN006	80B	3C		151A
CAN	2019QN007	71A	N155A		6C
SIM	2019QN008	64A	N155A		N186B
CAN	2019QN009	83A	N155A		151A
CAN	2019QN010	86A	N155A		86B
SIM	2019QN011	N87A			149D
CAN	2019QN012	69A	72C	73A	79A
SIM	2019QN013	N66B			144D
CAN	2019QN014	62B	2C	71D	7A
SIM	2019QN015	68B	68A		68C
CAN	2019QN016	83B	83A		151A
SIM	2019QN017	N89A	N92D		83B
CAN	2019QN018	N74A	46B		153C
SIM	2019QN019	53A	183A		7A
CAN	2019QN020	4D	5C		7A
SIM	2019QN021	6A			153D
CAN	2019QN022	61B	61A		153D

RHS COLOR

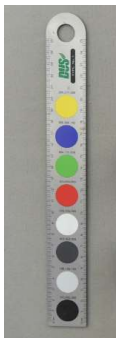
RHS	R	G	B
1A	235	224	67
1B	232	225	87
1C	236	232	144
1D	241	234	164
2A	246	225	59
2B	241	227	91
2C	243	236	149
2D	244	234	174
3A	250	226	64
3B	245	228	85
3C	246	232	128
3D	248	237	157

RHS1	RHS2	DIST
1A	1B	20.24846
1A	1C	77.42093
1A	1D	97.69852
1A	2A	13.63818
1A	2B	24.91987
1A	2C	83.25863
1A	2D	107.8425
1A	3A	15.42725
1A	3B	20.97618
1A	3C	62.498
1A	3D	91.85859
1A	4A	29.22328
1A	4B	60.06663
1A	4C	87.04596
1A	4D	124.8038
1A	5A	12.40967
1A	5B	16.88194
1A	5C	50.35871
1A	5D	90.21641
1A	6A	24.39262
1A	6B	19.05256
1A	6C	32.44996
1A	6D	81.31421
1A	7A	33.61547
1A	7B	20.61553
1A	7C	24.83948

$$DIST = \sqrt{(r1-r2)^2 + (g1-g2)^2 + (b1-b2)^2}$$

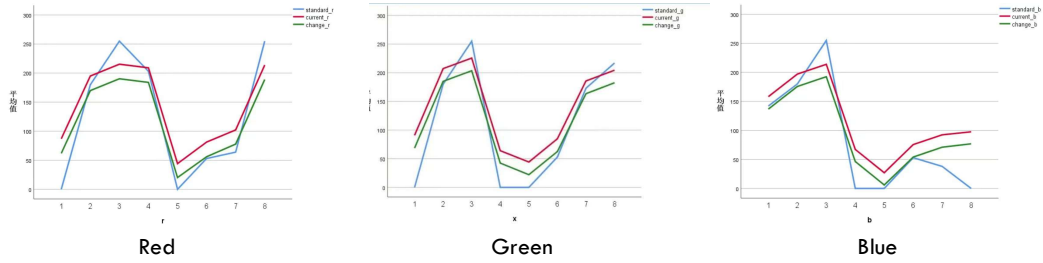
RHS1	RHS2	RGB DIST	GROUP DIST
22B	23C	1	2
203C	203D	1.732050808	0
17A	21A	2	0
17D	18A	2.236067977	0
62D	65D	2.236067977	0
8D	159D	25	33
14B	17A	25	0
22D	28D	25	1
45A	53B	25	3
45D	53C	25	0
10C	23C	45	4
13D	155D	45	9
15D	160A	45	33
18C	193D	45	37
29C	73C	45	3
19B	25C	75	2
23A	30C	75	8
26D	76C	75	16
32C	62A	75	26
34D	169B	75	0
2A	94C	195	22
3A	58A	195	16
21B	106D	195	21
N57B	198D	195	25
N57D	114D	195	15
N81A	110D	195	9

COMPARISON BETWEEN IMAGE ANALYSIS AND VISUAL OBSERVATION



Ruler	IMA1	IMA2	IMA3	IMA4	IMA5	IMA6	VO
yellow	153D	8A	2B	154B	154B	160A	153D
blue	95B	99B	N95D	96B	96B	N95B	94A
green	143A	135C	140C	140B	140B	141D	140A
red	45A	45A	43C	42C	42B	175B	45A
white	198D	155A	69D	192D	192D	112D	155A
dark grey	203D	202B	189A	N92D	N137A	N92A	202B
light grey	201D	202D	97D	202D	202D	190C	202D
black	202A	202A	203D	203C	203D	202A	202A

FITTING CORRECTION



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DUSCEL5.0

◆ 1. New TG format for convenience of maintenance.

Crop	ChrNo	ChrName	State	Note	Min	Mean	StVar	ValueT type	Value Range	Value Unit	Dg Dits	ChrPo wer	NotesP over	Group	Image	GAAP air	GAAP stjue	Expos tjue	Close tjue	Close vstjue
1	幼葉	第一叶頂部形	尖尖到圓頂	圓頂到扁形	1.2,4,5	0.151533545	1.2,4,5	KH932	序列	15	0	0	1	1		PQ	VG	13		
2	幼葉	第一叶輪花青素	无或低	低到高	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9	KH932	序列	19	0	0	2	1		QN	VG	14		
3	叶片	绿色程度	深至浅		1,2,3	0.2,2,5	1,2,3	KH932	序列	13	0	0.5	2	2		QN	VG	51-59		
4	*新梢	根平	早到早	早到中	1.2,4,5,6,7,8,9	0.4751555963677175	40.444852566	KH932	参数	4080	d	0	1	2	1	QN	MG	65		
5	抽穗期	根平	早到早	早到中	1.2,4,5,6,7,8,9	0.6771757983879195	42.475155596	KH932	参数	4885	d	0	1	2	3	QN	MG	65		
6	穗粒	上部	小	小到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9	KH932	序列	19	0	1	2	2		QN	VG	65-69		
7	叶片	弯曲程度	无或低	低到高	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	0	2	2		QN	VG	65-69		
8	叶片	边缘花青素	无或低	低到高	1,9	0.5	1,9		序列	19	0	0	2	2		QL	VG	65-69		
9	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	1	2	2		QN	VG	65		
10	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	1	2	2		QN	VG	65		
11	穗粒	小或大	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9	KH932	序列	19	0	0	2	2		QN	VG	61-69		
12	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	1	2	2		QN	VG	65-69		
13	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	0	2	2		QN	VG	65-69		
14	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	1	2	2		QN	VG	65-69		
15	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	0	2	2		QN	VG	65-69		
16	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9	KH932	序列	19	0	0	2	2		QN	VG	69		
17	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		任何值	155	cm	1	0	2	4	QN	MG	71-75		
18	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9	KH932	任何值	145	cm	1	0	2	4	QN	MG	71-75		
19	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		参数	140	0	0	2	4	QN	MG	71-75			
20	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		任何值	140	cm	1	0	2	4	QN	MG	71-75		
21	叶片	*之字形程度	无或低	低到高	1,2,4	0.1515335	1,2,4		序列	14	0	0	2	2		QN	VG	65-71		
22	叶片	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	0	2	2		QN	MG	65-75		
23	叶片	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.6646873577841915155657585	0.6646873577841915155657585		任何值	28124	cm	1	0	2	2	QN	MG	75		
24	叶片	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.6575859591011121314	0.6575859591011121314		任何值	28124	cm	1	0	2	2	QN	MG	75		
25	叶片	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	19	0	0	2	2		QN	MG	71-75		
26A	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.281513647791901200121022030405060708091011121314	0.281513647791901200121022030405060708091011121314		任何值	20180	cm	1	0	2	2	QN	MG	75		
26B	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.57575857591011121314	0.57575857591011121314		任何值	20180	cm	1	0	2	2	QN	MG	75		
27A	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.14016018020022030405060708091011121314	0.14016018020022030405060708091011121314		任何值	60380	cm	1	0	2	2	QN	MG	75		
27B	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.1375138140142014401460148015001520154015601580160016201640166016801700172017401760178018001820184018601880190019201940196019802000	0.1375138140142014401460148015001520154015601580160016201640166016801700172017401760178018001820184018601880190019201940196019802000		任何值	120400	cm	1	0	8	2	QN	MG	75		
28A	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.02780290300310320330340350360370380390400410420430440450460470480490500510520530540550560570580590600	0.02780290300310320330340350360370380390400410420430440450460470480490500510520530540550560570580590600		任何值	0.23065	0	0	2	2	QN	MG	75			
28B	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.02780290300310320330340350360370380390400410420430440450460470480490500510520530540550560570580590600	0.02780290300310320330340350360370380390400410420430440450460470480490500510520530540550560570580590600		任何值	0.23065	0	0	2	2	QN	MG	75			
29	新梢	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		序列	15	0	0	2	2		QN	VG	65		
30A	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.811313517192123	8101234567891011121314151617181920212224		任何值	10228	cm	1	0	2	6	QN	MG	95		
30B	*穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.811313517192123	8101234567891011121314151617181920212224		任何值	10228	cm	1	1	2	6	QN	MG	95		
31	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		任何值	10228	cm	1	1	2	6	QN	MG	95		
32	穗粒	无或低	低到高	高到中	1.2,4,5,6,7,8,9	0.15153354555657585	1.2,4,5,6,7,8,9		任何值	10228	cm	1	1	2	6	QN	MG	95		

DUSCEL5.0

◆ 2. New data format for convenience of calculation.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH		
1	Data Index	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	
2	BM3802010	5.9	1.1	3.3	48.48	50.50	5.5	5.5	1.1	1.1	1.1	5.5	1.1	1.1	1.1	7.7	3.3	41.1	31.05	12.65	22.2	2.3	1.1	70.95	0.475	1.1	64.6	6.218	2.0	2.95	3.3	23.12	5.281	18.5	12.2
3	BM41922010	4.4	1.1	2.2	48.48	51.51	5.5	5.5	1.1	1.1	1.1	5.5	1.1	1.1	1.1	5.5	1.1	36.67	26.75	17.45	10.5	1.2	1.1	75.2	70.9	1.1	81.2	6.217	4.0	3.73	3.3	21.5	5.421	18.8	12.2
4	BM4922010	3.3	1.1	2.2	40.40	45.22	7.7	5.5	1.1	1.1	1.1	5.5	1.1	1.1	1.1	7.7	3.3	37.05	26.35	19.25	10.3	1.2	1.1	74.35	0.825	1.1	72.35	100.2	3.683	3.3	22.25	5.07	5.17	12.2	
5	BMB4582010	5.5	1.1	3.3	58.58	60.60	5.5	5.5	1.1	1.1	1.1	5.5	1.1	1.1	1.1	7.7	3.3	51.85	32.65	20.9	2.31	2.2	1.1	80.75	11.51	1.1	115.4	275.4	4.410	3.3	23.62	4.885	20.0	11.1	
6	BTN18892010	3.3	3.3	3.3	59.50	60.60	3.3	3.3	1.1	6.6	5.5	6.6	1.1	4.4	1.1	5.5	5.5	41.15	25.55	29.35	21.85	1.1	1.1	85.1	11.04	1.1	106.1	240.0	0.441	4.4	20.67	4.50	14.4	11.1	
7	CHY18892010	4.4	4.4	2.2	57.57	58.58	3.3	2.2	1.1	7.7	7.7	4.4	1.1	6.6	6.6	3.3	1.1	41.05	28.55	7.85	12.41	1.1	5.5	83.5	10.7	1.1	122.3	274.2	0.445	3.3	20.92	4.305	16.2	12.2	
8	GHY9892010	4.4	2.2	2.2	58.58	57.57	3.3	2.2	1.1	1.1	3.3	4.4	1.1	5.5	1.1	4.4	1.1	40.62	18.2	19.2	9.2	0.7	3.3	84.85	10.57	1.1	116.0	276.3	0.410	2.2	20.05	4.665	17.3	12.2	
9	CZ10912010	2.2	2.2	2.2	55.55	56.56	5.5	7.7	9.9	8.8	4.4	4.4	1.1	1.1	1.1	4.4	1.1	42.42	24.3	13.85	25.37	1.1	2.2	81.81	0.9	1.1	110.9	250.2	0.443	2.2	20.9	3.205	15.35	12.2	
10	CZ119122010	3.3	3.3	2.2	54.54	55.55	3.3	5.5	9.9	6.6	1.1	6.6	1.1	1.1	2.2	8.8	2.2	40.22	24.35	16.8	12.4	1.2	2.2	71.85	10.27	1.1	102.7	227.1	0.452	2.2	20.1	3.315	14.7	12.2	
11	DB19432010	4.4	3.3	2.2	60.60	62.62	3.3	3.3	9.9	7.7	4.4	6																							



THANK YOU FOR YOUR ATTENTION!

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