

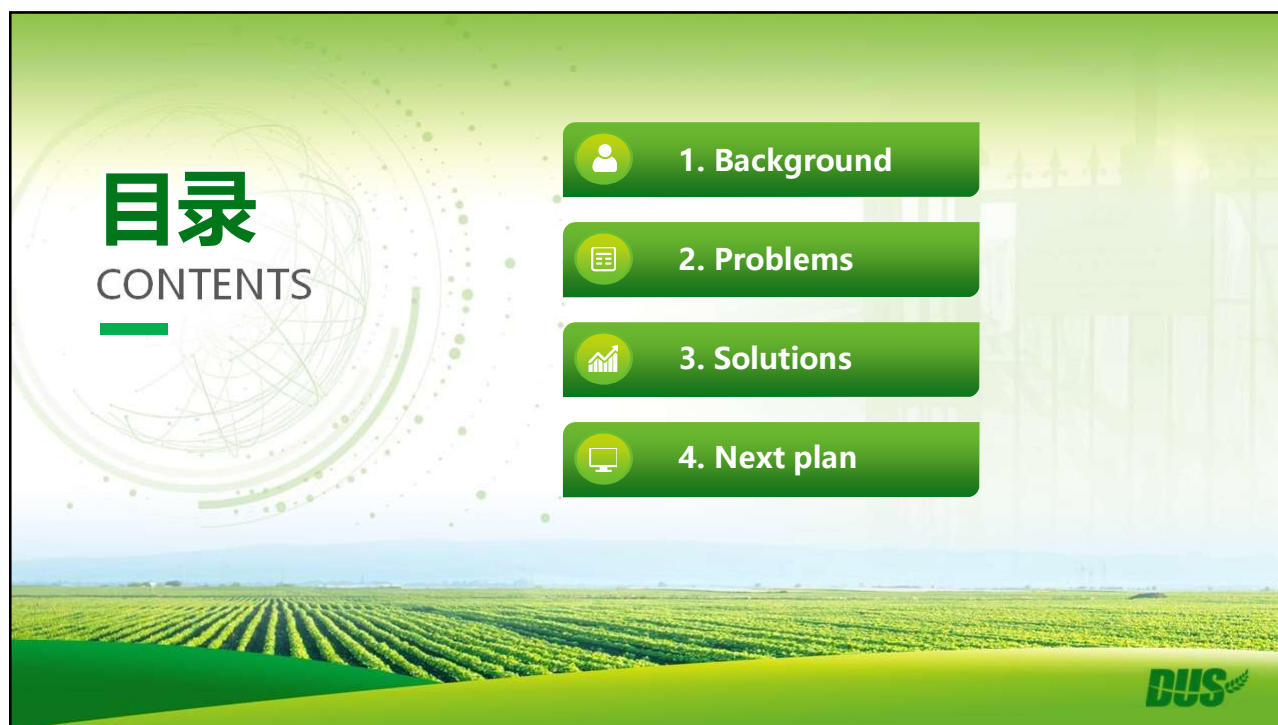
**Technical Working Party for Agricultural Crops****TWA/52/7 Add.****Fifty-Second Session****Original:** English**Virtual meeting, May 22 to 26, 2023****Date:** May 10, 2023

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**ADDENDUM TO:  
NEW TECHNOLOGIES IN DUS EXAMINATION***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 “Image analysis for Maize ear and grain”, to be made by an expert from China, at the fifty-second session of the TWA.

[Annex follows]



## 1. Background



There are 15 characteristics which occupied 34% of all morphological Chr. in Chinese Maize TGs.

No.	Characteristics name	Type
30	Ear: length	MS
31	Ear: diameter (in middle)	MS
32	Ear: number of rows of grain	MS
33	Ear: shape	VG
34	Ear: number of colors of grains	VG
35	Only varieties with ear type of grain: sweet: Grain: intensity of yellow color	VG
36	Only varieties with ear type of grain: sweet: Grain: length	VG
37	Only varieties with ear type of grain: sweet: Grain: width	VG
38	Only varieties with ear type of grain: sweet: Ear: shrinkage of top of grain	VG
39	Ear: type of grain	VG
40	Ear: color of top of grain	VG
41	Ear: color of dorsal side of grain	VG
42	Ear: shape of grain	VG
43	Ear: anthocyanin coloration of glumes of cob	VG
44	Pop: Type of popped grain	VG

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## 1. Background



Ear: color of top of grain



1白色 2浅黄 3中等黄 4橙黄 5橙色 6橙红 7红色 8紫色 9褐色 10蓝黑

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## 1. Background



Ear: shape of grain

性状42 籽粒：形状



1 圆形

2 近圆形

3 中间型

4 近楔形

5 楔形

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## 2. Problems



**2.1 large workload for measurement:**  
more than 500 varieties per year  
4 MS characteristics related ear  
20 data for each MS chr.



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## 2. Problems



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### 2.2 High error rate for VG Characteristics:

13%Chr. less than 50%cc of notes  
40%Chr. less than 80%cc of notes  
0%Chr. less than 80%cc of means  
cc: correlation coefficient

No.	Characteristics Name	Type	Mean cc	Note cc
30	Ear: length	MS	0.807567	0.768553
31	Ear: diameter (in middle)	MS	0.861055	0.857566
32	Ear: number of rows of grain	MS	0.928476	0.848275
33	Ear: shape	VG		0.697486
34	Ear: number of colors of grains	VG		1
35	Only varieties with ear type of grain: sweet: Grain: intensity of yellow color	VG		0.924713
36	Only varieties with ear type of grain: sweet: Grain: length	VG		0.571772
37	Only varieties with ear type of grain: sweet: Grain: Grain: width	VG		0.407361
38	Only varieties with ear type of grain: sweet: Ear: Ear: shrinkage of top of grain	VG		0.745897
39	Ear: type of grain	VG		0.936282
40	Ear: color of top of grain	VG		0.998323
41	Ear: color of dorsal side of grain	VG		0.991608
42	Ear: shape of grain	VG		0.292527
43	Ear: anthocyanin coloration of glumes of cob	VG		1
44	Pop: Type of popped grain	VG		1

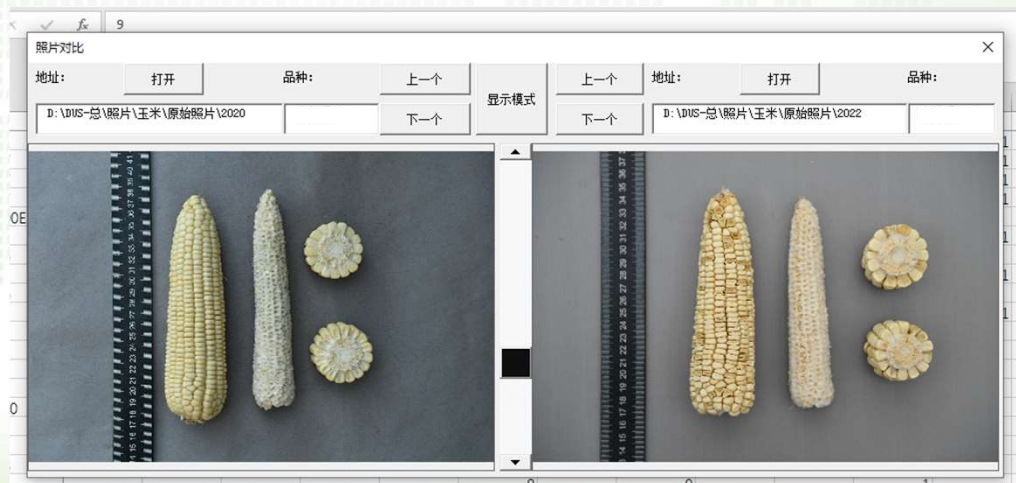
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## 3. Solutions



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### 3.1 data and image checking by DUSCEL



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### 3. Solutions



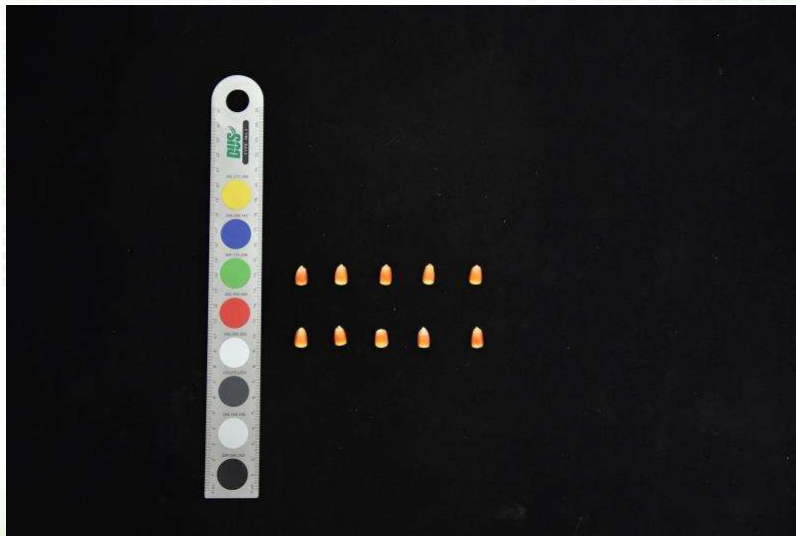
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### 3. Solutions



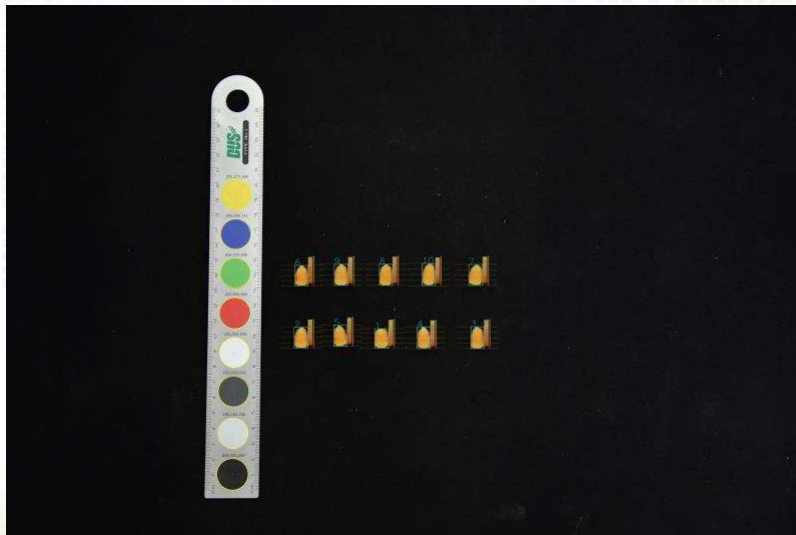
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### 3. Solutions



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### 3. Solutions

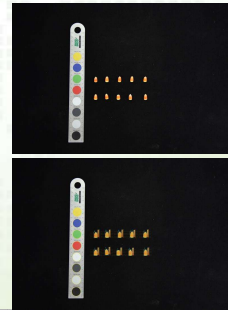


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### 3. Solutions



43 basic parameters extracted from image, which could be used to calculated all characteristics related ear.



File	Seed No.	id	side	ap	convexhull	Seed width	width(cm)	seed height	height(cm)	1/4 width	1/4 width(cm)	1/2 width	1/2 width(cm)	3/4 width	3/4 width(cm)
DSC_2283	1	15387				117	0.979079498	164	1.372384937	83	0.694500669	104	0.870292887	108	0.90376599
DSC_2283	2	15904				115	0.962343096	169	1.414225941	79	0.661067266	101	0.845186285	108	0.90376599
DSC_2283	3	16034				122	1.020920502	166	1.389121339	76	0.635983264	108	0.90376599	115	0.962343096
DSC_2283	4	16444				121	1.012552301	168	1.405857741	84	0.70292887	107	0.89539749	114	0.953974895
DSC_2283	5	16157				121	1.012552301	171	1.430962343	77	0.644351464	102	0.853556485	111	0.928870293
DSC_2283	6	15878				120	1.0041841	166	1.389121339	87	0.728033473	108	0.90376599	109	0.912133891
DSC_2283	7	15768				119	0.9958159	167	1.39748954	83	0.694500669	105	0.878661088	111	0.928870293
DSC_2283	8	15571				116	0.970711297	166	1.389121339	80	0.669450607	101	0.845186285	107	0.89539749
DSC_2283	9	15328				116	0.970711297	177	1.481171548	74	0.619246862	104	0.870292887	102	0.853556485
DSC_2283	10	15114				111	0.928870293	170	1.422594142	80	0.669450607	100	0.836820084	102	0.853556485
DSC_2292	1	11177				97	0.921615202	135	1.282660333	77	0.731591449	87	0.06950988	89	0.845605701
DSC_2292	2	10927				95	0.902612827	144	1.368171021	61	0.579572447	81	0.005506627	87	0.826603325
DSC_2292	3	11085				92	0.874109264	151	1.434679335	92	0.899703634	80	0.005506627	83	0.788598575
DSC_2292	4	10715				91	0.864608076	150	1.425178147	59	0.560570071	80	0.005320081	81	0.7695962
DSC_2292	5	10388				93	0.883610451	145	1.377672209	60	0.570071259	80	0.005416354	84	0.798099762
DSC_2292	6	10095				92	0.874109264	140	1.330166271	60	0.570071259	78	0.005416354	83	0.788598575
DSC_2292	7	10735				96	0.912114014	145	1.377672209	68	0.64608076	83	0.006138535	85	0.80760095
DSC_2292	8	10847				91	0.864608076	147	1.396674584	67	0.636579572	79	0.00646262	82	0.779097387
DSC_2292	9	11206				95	0.902612827	148	1.406175772	64	0.60807601	83	0.005777444	86	0.817102138
DSC_2292	10	10840				90	0.855106888	152	1.444180523	60	0.570071259	78	0.005416354	79	0.750593824

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### 3. Solutions



		width			error	error rate	height			error	error rate
2283	1	0.979079	0.88	-0.099079498	0.10	-11.26%	1.372384937	1.27	-0.102384937	0.10	-8.06%
	2	0.962343	0.89	-0.072343096	0.07	-8.13%	1.414225941	1.34	-0.074225941	0.07	-5.54%
	3	1.020921	0.96	-0.060920502	0.06	-6.35%	1.389121339	1.24	-0.149121339	0.15	-12.03%
	4	1.012552	0.94	-0.072552301	0.07	-7.72%	1.405857741	1.33	-0.075857741	0.08	-5.70%
	5	1.012552	0.93	-0.082552301	0.08	-8.88%	1.430962343	1.33	-0.100962343	0.10	-7.59%
	6	1.004184	0.94	-0.0641841	0.06	-6.83%	1.389121339	1.32	-0.069121339	0.07	-5.24%
	7	0.995816	0.93	-0.0658159	0.07	-7.08%	1.39748954	1.33	-0.06748954	0.07	-5.07%
	8	0.970711	0.89	-0.080711297	0.08	-9.07%	1.389121339	1.33	-0.059121339	0.06	-4.45%
	9	0.970711	0.89	-0.080711297	0.08	-9.07%	1.481171548	1.35	-0.131171548	0.13	-9.72%
	10	0.92887	0.87	-0.058870293	0.06	-6.77%	1.422594142	1.29	-0.132594142	0.13	-10.25%
2292	1	0.921615	0.84	-0.081615202	0.08	-9.72%	1.282660333	1.20	-0.082660333	0.08	-6.89%
	2	0.902613	0.82	-0.082612827	0.08	-10.07%	1.368171021	1.31	-0.058171021	0.06	-4.44%
	3	0.874109	0.8	-0.074109264	0.07	-9.26%	1.434679335	1.35	-0.084679335	0.08	-6.27%
	4	0.864608	0.78	-0.084608076	0.08	-10.85%	1.425178147	1.33	-0.095178147	0.10	-7.16%
	5	0.88361	0.78	-0.103610451	0.10	-13.26%	1.377672209	1.27	-0.107672209	0.11	-8.48%
	6	0.874109	0.78	-0.094109264	0.09	-12.07%	1.330166271	1.28	-0.050166271	0.05	-3.92%
	7	0.912114	0.83	-0.082114014	0.08	-9.89%	1.377672209	1.26	-0.117672209	0.12	-9.34%
	8	0.864608	0.77	-0.094608076	0.09	-12.25%	1.396674584	1.34	-0.056674584	0.06	-4.23%
	9	0.902613	0.83	-0.072612827	0.07	-8.75%	1.406175772	1.35	-0.056175772	0.06	-4.16%
	10	0.855107	0.76	-0.095106888	0.10	-12.51%	1.444180523	1.34	-0.104180523	0.10	-7.77%

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## 4. Next plan



4.1 Balance between efficiency and precision of image analysis.

4.2 Update bigdata platform to facilitate image analysis and modification.



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Thank you for listening.

