UPOV
International Union for the Protection of New Varieties of Plants

E

Technical Working Party for Vegetables

TWV/57/24

Fifty-Seventh Session
Antalya, Türkiye, May 1 to 5, 2023

Original: English
Date: April 13, 2023

IMAGE ANALYSIS OF VEGETABLE CROPS

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 tomato fruit”, to be made by an expert from China, at the fifty-seventh session of the TWV.

[Annex follows]

Image analysis for tomato fruit

Kun Yang

Beijing Sub-center of New Plant Variety Tests, MARA, China

Fifty-Seventh Session of Technical Working Party for Vegetables

May 1 to May 5, 2023 (Antalya, Türkiye)

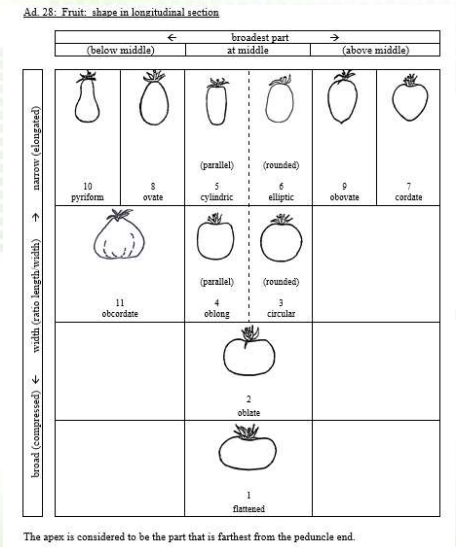
目录
CONTENTS

1. Background

There are 20 characteristics which occupied 50% of all morphological Chr. in Chinese Tomato TGs.

No.	Characteristics name	Type
17	Fruit: green shoulder (before maturity)	VG
18	Fruit: extent of green shoulder (before maturity)	VG
19	Fruit: intensity of green color of shoulder (before maturity)	VG
20	Fruit: intensity of green color excluding shoulder (before maturity)	VG
24	Fruit: ratio length/diameter	MS
25	Fruit: shape in longitudinal section	VG
26	Fruit: ribbing at peduncle end	VG
27	Fruit: shape in longitudinal section	VG
28	Fruit: size of peduncle scar	MS
29	Fruit: size of peduncle scar	MS
30	Fruit: depression at peduncle end	VG
31	Fruit: color of skin	VG
32	Fruit: size of blossom scar	VG
33	Fruit: shape at blossom end	VG
34	Fruit: diameter of core in cross section in relation to total diameter	VG
35	Fruit: thickness of pericarp	MS
36	Fruit: number of locules	VG
37	Fruit: color (at maturity)	VG
38	Fruit: color of flesh (at maturity)	VG
39	Fruit: color of epidermis	VG

1. Background



Fruit: shape in longitudinal section

1. Background

BEIJING SUB-CENTER

Fruit: color (at maturity)

性状37*果实：成熟时颜色

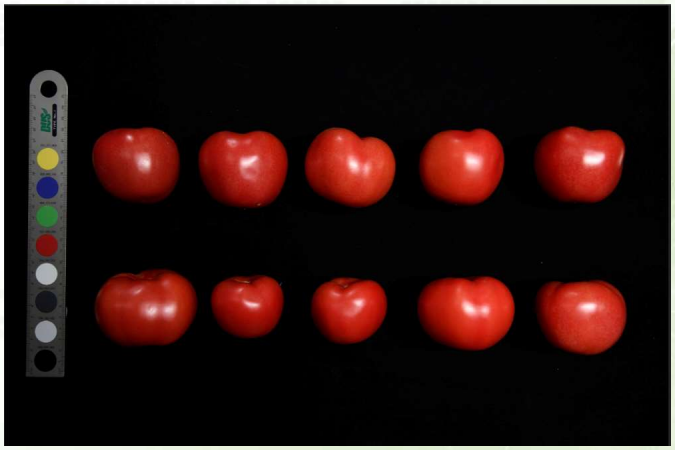
1奶油色　2绿色　3黄色　4黄绿色　5橙色

6粉红色　7红色　8粉紫色　9棕紫色　10多色

2. Problems

BEIJING SUB-CENTER

2.1 large workload for measurement:
more than 400 varieties per year
4 MS characteristics related fruit
10 data for each MS chr



Beijing Sub-center of New Plant Variety Tests, MARA, China

2. Problems

BEIJING SUB-CENTER

2.2 High error rate for VG Characteristics:

35% Chr. less than 50% cc of notes

50% Chr. less than 80% cc of notes

25% Chr. less than 80% cc of means

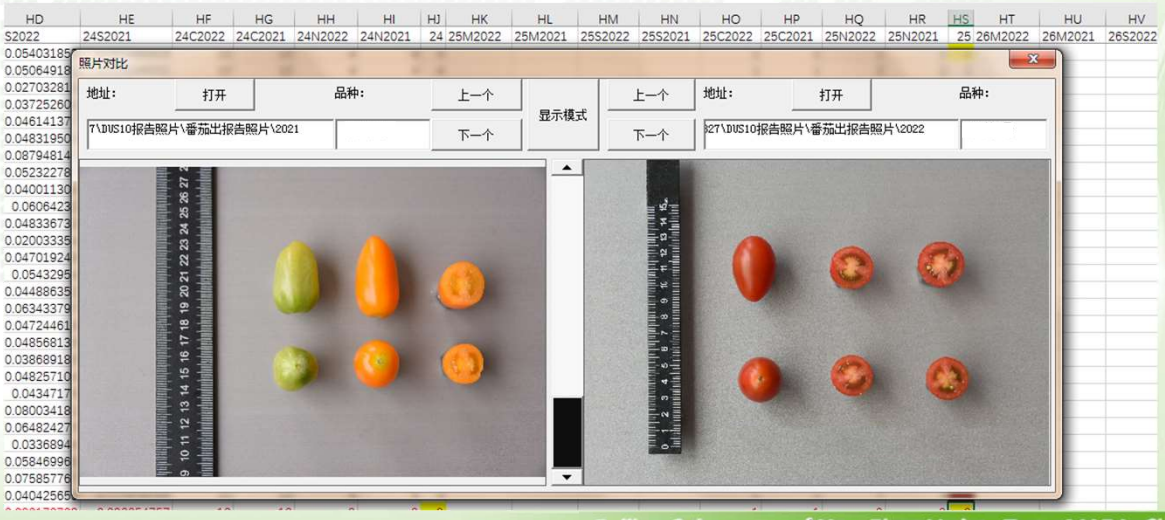
cc=correlation coefficient

No.	Characteristics name	Type	Mean cc	Note cc
17	Fruit: green shoulder (before maturity)	VG		0.955752
18	Fruit: extent of green shoulder (before maturity)	VG		0.02857
19	Fruit: intensity of green color of shoulder (before maturity)	VG		0.118737
20	Fruit: intensity of green color excluding shoulder (before maturity)	VG		-0.033
24	Fruit: ratio length/diameter	MS	0.94787	0.922219
25	Fruit: shape in longitudinal section	VG		0.841837
26	Fruit: ribbing at peduncle end	VG		0.207728
27	Fruit: shape in longitudinal section	VG		0.237595
28	Fruit: size of peduncle scar	MS	0.917308	0.845186
29	Fruit: size of peduncle scar	MS	0.79436	0.835732
30	Fruit: depression at peduncle end	VG		0.595135
31	Fruit: color of skin	VG		0.955752
32	Fruit: size of blossom scar	VG		0.683079
33	Fruit: shape at blossom end	VG		0.484575
34	Fruit: diameter of core in cross section in relation to total diameter	VG		0.738356
35	Fruit: thickness of pericarp	MS	0.910789	0.89212
36	Fruit: number of locules	VG		0.837258
37	Fruit: color (at maturity)	VG		0.886163
38	Fruit: color of flesh (at maturity)	VG		0.800743
39	Fruit: color of epidermis	VG		0.491332

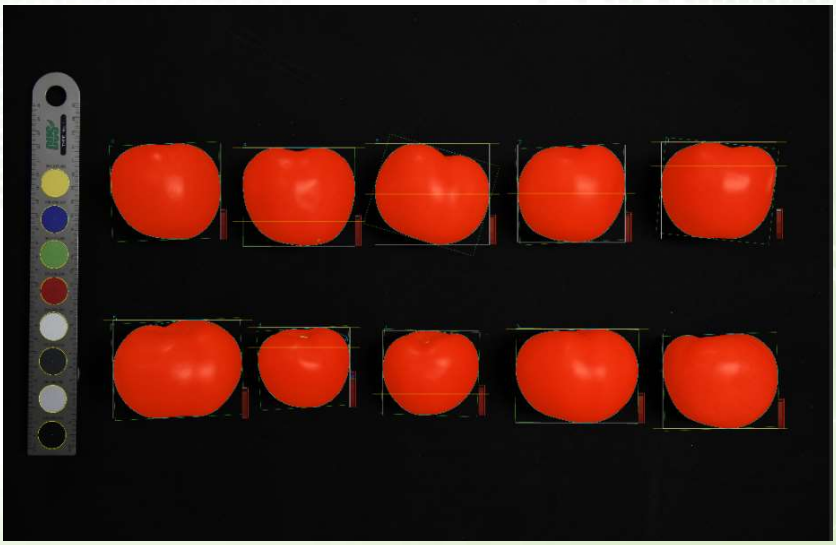
3. Solutions

BEIJING SUB-CENTER

3.1 data and image checking by DUSCEL

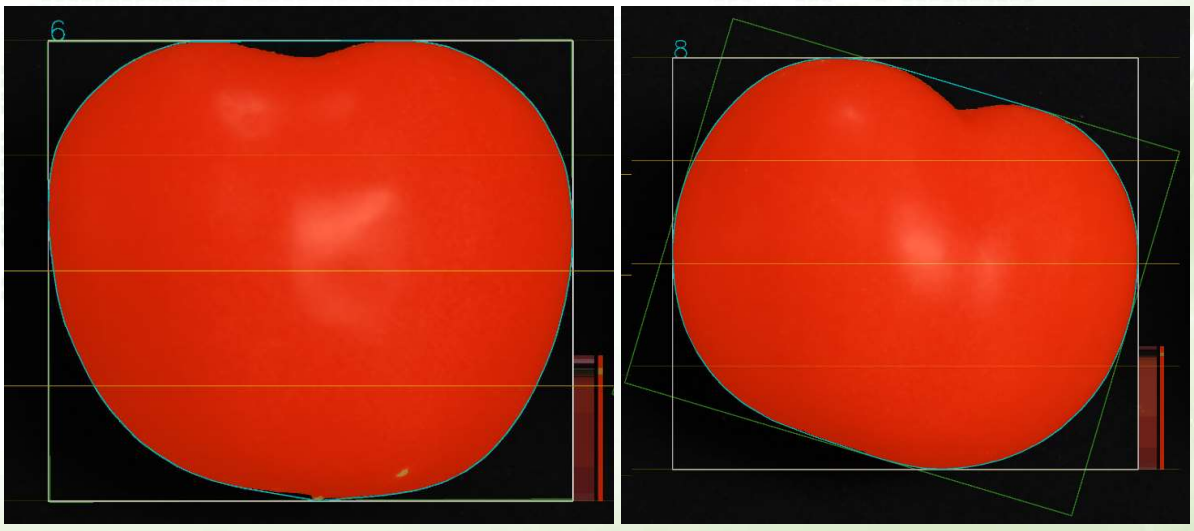


3. Solutions



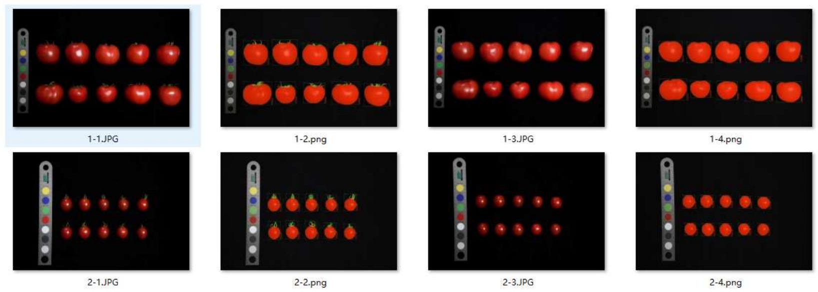
Beijing Sub-center of New Plant Variety Tests, MARA, China

3. Solutions



Beijing Sub-center of New Plant Variety Tests, MARA, China

3. Solutions



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	File	No.	Side area	moments.X	moments.Y	Convexhull area	1/4' width	1/2' width	3/4' width	midWidth.X	midWidth.Y	maxWidth.X	maxWidth
2	_DSC0339	1	953863	7321.391113	4016.618164	1020248	1057	1155	988	7320	4015	7319.5	4015
3	_DSC0339	2	700490	4386.969727	3953.149658	775930	830	984	856	4392	3925	4391.62793	3928.0434
4	_DSC0339	3	641465	3049.105225	3980.347656	711686	699	925	830	3042	3911	3038.862549	3958.8793
5	_DSC0339	4	992777	5849.258789	3970.053711	1046455	1066	1246	1099	5845	3936	5845.279785	3937.0263
6	_DSC0339	5	1108813	1731.533325	3966.526367	1140181	1138	1326	1203	1728	3930	1736.058105	3980.6347
7	_DSC0339	6	937721	4423.858398	2143.355713	962219	1019	1161	1051	4424	2123	4424.479004	2135.0146
8	_DSC0339	7	905385	5842.085938	2111.097412	926907	994	1106	976	5843	2094	5834.283203	2107.781
9	_DSC0339	8	962209	[illegible]	[illegible]	[illegible]	944	1153	1024	7247	2066	7273.627441	2138.395
10	_DSC0339	9	925379	1664.183838	2097.779297	1015494	879	1121	1005	1654	2032	1665.03418	2078.3417
11	_DSC0339	10	991226	3025.6875	2084.91748	1075770	935	1147	1025	3018	2028	3018.455078	2038.2873
12	_DSC0350	1	887567	7172.62375	3859.445313	897042	1109	1127	958	7168	3882	7171.213379	3886.6943
13	_DSC0350	2	645665	4279.867676	3785.035889	649101	900	948	786	4282	3800	4280.218262	3801.1005
14	_DSC0350	3	934018	5745.134277	3812.806885	939499	1157	1215	1030	5740	3832	5739.19043	3830.5983
15	_DSC0350	4	591522	3024.28833	3733.478271	598133	872	900	763	3017	3746	3022.751221	3752.0156
16	_DSC0350	5	1023952	1757.150635	3764.043701	1034194	1172	1281	1122	1757	3765	1757.85376	3763.1918
17	_DSC0350	6	907352	2971.115479	2025.36499	917193	1080	1102	942	2967	2047	2967.497314	2046.9526
18	_DSC0350	7	849593	5687.711914	2002.72876	856379	996	1066	923	5684	2012	5686.558594	2019.7453
19	_DSC0350	8	884561	4293.215332	2020.953613	895870	1014	1138	991	4298	2019	4290.187988	2027.4644
20	_DSC0350	9	863059	1647.309937	1976.914551	867539	1040	1087	933	1637	1991	1638.848633	1995.5635
21	_DSC0350	10	907364	7150.700195	1975.056152	917603	1099	1117	988	7153	1981	7139.201172	1987.0219

50 basic parameters extracted from image, which could be used to calculated all characteristics related longitudinal section.

Beijing Sub-center of New Plant Variety Tests, MARA, China

3. Solutions

cc between analysis and mannual	height	width
350	0.779646552	0.909239014
362	0.359155656	0.495091026

		analysis		mannual		error		error rate	
		height	width	height	width	height	width	height	width
350	1	8.007332722	7.010082493	6.98	5.91	-1.02733272	-1.10008249	-14.72%	-18.61%
	2	8.190650779	7.186067828	7.31	6.01	-0.88065078	-1.17606783	-12.05%	-19.57%
	3	8.359303391	6.804766269	7.4	5.93	-0.95930339	-0.87476627	-12.96%	-14.75%
	4	7.882676444	7.046746104	6.73	6.09	-1.15267644	-0.9567461	-17.13%	-15.71%
	5	8.285976169	7.024747938	7.02	5.94	-1.26597617	-1.08474794	-18.03%	-18.26%
	6	9.444546288	7.054078827	7.97	5.86	-1.47454629	-1.19407883	-18.50%	-20.38%
	7	6.702108158	5.778185151	7	5.14	0.297891842	-0.63818515	4.26%	-12.42%
	8	6.980751604	6.181484876	6.1	5.2	-0.8807516	-0.98148488	-14.44%	-18.87%
	9	8.960586618	6.856095325	7.53	5.69	-1.43058662	-1.16609533	-19.00%	-20.49%
	10	8.381301558	6.907424381	6.84	5.55	-1.54130156	-1.35742438	-22.53%	-24.46%
		analysis		mannual		error		error rate	
362	1	3.601173021	3.307917889	2.78	3.32	-0.52791789	-0.28117302	-18.99%	-8.47%
	2	3.431085044	3.331378299	3.05	3.2	-0.2813783	-0.23108504	-9.23%	-7.22%
	3	3.37829912	3.120234604	2.8	3.14	-0.3202346	-0.23829912	-11.44%	-7.59%
	4	3.360703812	3.049853372	2.77	3.04	-0.27985337	-0.32070381	-10.10%	-10.55%
	5	3.272727273	3.26686217	2.8	2.95	-0.46686217	-0.32272727	-16.67%	-10.94%
	6	3.337243402	3.120234604	2.81	3.31	-0.3102346	-0.0272434	-11.04%	-0.82%
	7	3.436950147	3.249266862	2.91	3.26	-0.33926686	-0.17695015	-11.66%	-5.43%
	8	3.507331378	3.231671554	2.92	3.3	-0.31167155	-0.20733138	-10.67%	-6.28%
	9	3.202346041	3.114369501	2.84	2.97	-0.2743695	-0.23234604	-9.66%	-7.82%
	10	3.237536657	3.002932551	2.69	2.97	-0.31293255	-0.26753666	-11.63%	-9.01%

Beijing Sub-center of New Plant Variety Tests, MARA, China

4. Next plan

4.1 Reduce influence of irregular shape and incorrect placement.

4.2 Ballance between efficiency and precision of image analysis.

4.3 Update bigdata platform to facilitate image analysis and modification.

Beijing Sub-center of New Plant Variety Tests, MARA, China

Thank you for listening.

yangkun@caas.cn

[End of Annex and of document]