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CHRYSANTHEMUM PETAL COLOR TEST BY IMAGE ANALYSIS METHOD

Document prepared by an expert from China

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The annex to this document contains a presentation “Chrysanthemum petal color test by image analysis method”, to be made by an expert from China, at the fifty-eighth session of the TWO.

[Annex follows]

CHRYSANTHEMUM PETAL COLOR TEST BY IMAGE ANALYSIS METHOD

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TWO58, July 6 to 9, 2026

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1. BACKGROUND


Cut Chrysanthemum


Groundcover Chrysanthemum

- Chrysanthemums originated in China and have a history of over three thousand years, making them one of the world's earliest ornamental plants.
- Based on cultivation and management methods, they are mainly divided into cut-flower chrysanthemums and ground-cover chrysanthemums.

Year	PVP application	Proportion
2001-2015	251	15.8%
2016-2025	1334	84.2%
Total	1585	100%

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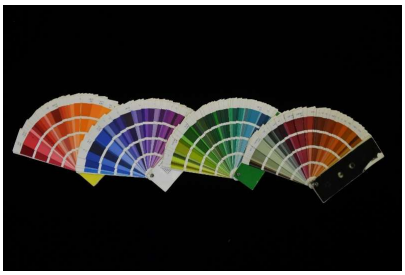
1. BACKGROUND



- The traditional method for chrysanthemums DUS testing involves testers collecting flower petals and using RHS color charts as reference standards to record and describe the color characteristics.
- However, this traditional approach requires testers to compare multiple colour charts to determine an accurate color, resulting in lower efficiency.

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2. MATERIALS AND METHODS

- Fifty-one varieties were used in this study, and these varieties could match 10 colors on the RHS color charts.
- Ten fully opened flowers were collected from each variety during the peak flowering period, ensuring they were of uniform size.
- One outermost petal from each flower was selected for manual observation and photography.

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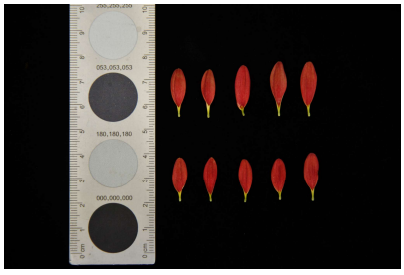
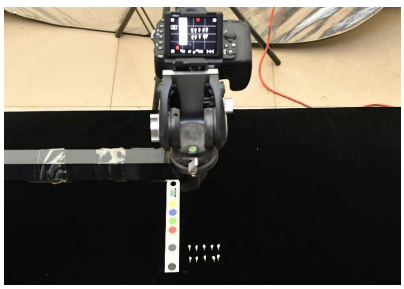
2. MATERIALS AND METHODS





- Photographs were taken of the inner and outer sides of chrysanthemum petals with a black background board and an eight-color ruler.

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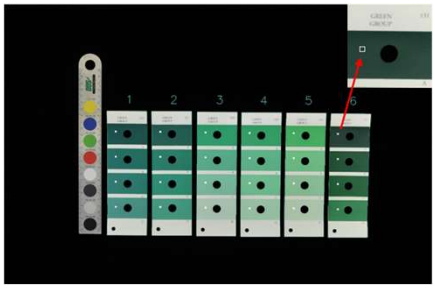
2. MATERIALS AND METHODS



RHS	RHS:A	RHS:B	RHS:C	RHS:D	Group
126	34. 81. 77	39. 109. 101	49. 123. 114	73. 144. 134	GREEN
127	36. 91. 80	45. 125. 107	51. 141. 117	70. 151. 128	GREEN
128	49. 154. 106	88. 171. 139	121. 183. 156	166. 191. 173	GREEN
129	53. 156. 101	94. 177. 136	111. 186. 144	149. 190. 162	GREEN
130	69. 170. 96	108. 185. 130	133. 186. 145	170. 192. 169	GREEN
131	39. 63. 55	39. 84. 57	36. 93. 57	56. 125. 81	GREEN

- Photographs were taken of all the RHS color charts with a black background board and an eight-color ruler.
- Firstly, the color correction of image used the black-white calibration method, and then the RGB values of each RHS color chart were extracted.
- A database linking RHS color chart numbers to RGB values was established.

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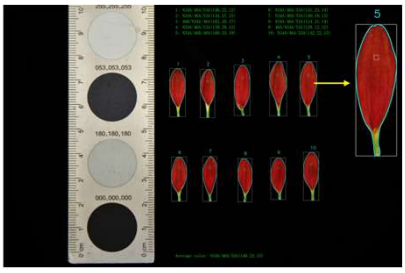
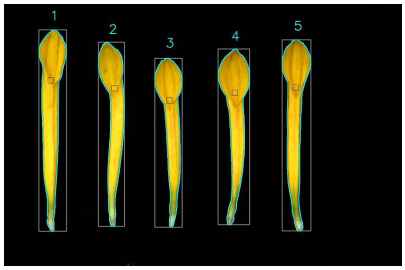
2. MATERIALS AND METHODS





- Firstly, the color correction of image used the black-white calibration method, and then the RGB values of each petals were extracted at the upper quarter, which ensured color extraction for most types of petals.

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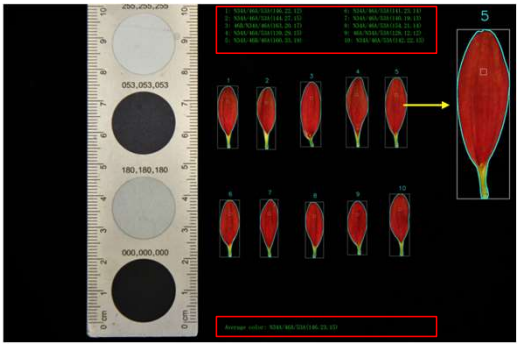
2. MATERIALS AND METHODS



- We retrieved in the database using the RGB value of each petal or the average RGB value of ten petals.
- The top three RHS color chart numbers were generated by color distance in ascending order using the following formula.

$$D_{0,1} = \sqrt{(R_0 - R_1)^2 + (G_0 - G_1)^2 + (B_0 - B_1)^2}$$

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3. RESULTS AND ANALYSIS

Number of Varieties	RHS No. of manual	RHS No. of Image Analysis-1	RHS No. of Image Analysis-2	RHS No. of Image Analysis-3	RHS colour classification
JH5002	157D	158D	157D	158C	Green White
JH6063	157D	158D	158C	157D	Green White
JH7024	N163A	N163A	N172A	N172B	Greyed Orange
JH7037	N163C	N163C	N163D	N163B	Greyed Orange
JH7041	172D	172D	167A	171C	Greyed Orange
JH7054	N172A	N172A	N163A	N172B	Greyed Orange
JH7059	N163D	N163D	N25D	163B	Greyed Orange
JH7001	N34A	N34A	46A	53A	Orange Red
JH7013	N34A	N34A	46A	53A	Orange Red
JH7015	N34A	N34A	46A	53A	Orange Red
JH7039	N34A	N34A	46A	53A	Orange Red
JH7040	N34A	N34A	46A	46B	Orange Red
JH7047	N34A	N34A	46A	46B	Orange Red
JH7069	N34A	N34A	46A	46B	Orange Red
JH8041	76D	76D	76D	76C	Purple
JH8086	76A	77D	77C	75A	Purple
JH7034	46A	46A	53A	N34A	Red
JH7066	46B	46B	45A	53B	Red
JH8138	49D	73D	49D	56C	Red
JH5018	72D	72D	72C	74C	Red Purple
JH5040	70C	70C	186C	181D	Red Purple
JH8010	N74D	N74D	75A	77C	Red Purple
JH8042	69C	69C	69D	69B	Red Purple
JH8058	69B	69B	69C	75D	Red Purple
JH8065	73B	73B	65A	N74D	Red Purple
JH8067	69A	69A	56B	52D	Red Purple
JH8070	N74C	N74C	73A	N66D	Red Purple
JH8074	69B	69B	69A	56D	Red Purple
JH8100	70B	70B	N78B	71D	Red Purple
JH8107	64A	187D	53A	46A	Red Purple
JH8114	70B	70B	72B	74A	Red Purple
2025-JH10	N155B	N155B	69D	56D	White
JH5025	N155B	158D	N155B	157D	White
JH5031	N155B	N155B	158D	157D	White
JH5032	N155B	N155B	N155C	56D	White
JH5044	N155B	N155B	69D	N155A	White
JH5048	N155B	N155B	69D	N155A	White
JH10015	9A	9A	12A	6A	Yellow
JH6004	6D	6D	5D	4C	Yellow
JH6045	9A	9A	12A	6A	Yellow
JH6083	6A	6A	9A	12A	Yellow
JH6113	11C	11C	9D	12D	Yellow
JH6117	9A	9A	12A	6A	Yellow
JH6120	6A	6A	12A	9A	Yellow
JH3015	N144C	N144C	144C	N144A	Yellow Green
JH3017	144C	N144A	144C	N144C	Yellow Green
JH3020	N144C	144C	N144C	144B	Yellow Green
JH3023	144D	144D	145B	145C	Yellow Green
JH6032	14A	14A	13A	14B	Yellow Orange
JH6061	14A	14A	17B	14B	Yellow Orange
JH6103	14A	14A	13A	17B	Yellow Orange

- In the identification of inner side color of 51 varieties, image recognition achieved a 98% match rate compared to manual observation, with 86% of the results matching with the first RHS color card number from image recognition.

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3. RESULTS AND ANALYSIS

Number of Varieties	RHS No. of manual	RHS No. of Image Analysis-1	RHS No. of Image Analysis-2	RHS No. of Image Analysis-3	RHS colour classification
JH6063	157D	158D	157D	158C	Green White
JH7024	167B	167B	N167D	170B	Greyed Orange
JH7054	167D	167D	N167C	167C	Greyed Orange
JH7037	N167C	N167C	167C	167B	Greyed Orange
JH7047	169A	169A	N172B	171A	Greyed Orange
JH7001	N170B	N170B	173C	174C	Greyed Orange
JH6113	N170D	N170D	35D	179D	Greyed Orange
JH7069	171A	171A	N170A	178D	Greyed Orange
JH7040	172D	172D	N167D	N170B	Greyed Orange
JH6120	N172D	N172D	167A	163A	Greyed Orange
JH8100	186C	186C	70C	74C	Greyed Purple
JH6041	186D	186D	77D	84B	Greyed Purple
JH7013	178D	45A	171A	178D	Greyed Red
JH7015	178D	178D	180B	181B	Greyed Red
JH7066	179A	178C	179A	180A	Greyed Red
JH7038	180B	178D	180B	181B	Greyed Red
JH7041	181C	174C	181C	177D	Greyed Red
JH8067	75B	75B	63D	75C	Purple
JH8070	75B	75B	84B	75C	Purple
JH8010	75B	75B	63D	70D	Purple
JH5040	75C	50D	38D	36B	Purple
JH8086	75C	75C	69A	73D	Purple
JH8114	N75C	N75C	74C	72D	Purple
JH7034	53B	53B	179A	180A	Red
JH8065	62C	62C	65B	68D	Red Purple
JH8058	69B	69B	69C	75D	Red Purple
JH8074	69B	69B	56D	69A	Red Purple
JH8042	69B	69B	69C	69D	Red Purple
JH8138	70D	70D	74D	63D	Red Purple
JH8107	71C	71C	71B	74A	Red Purple
JH5018	N74C	186C	N86D	N74C	Red Purple
2025-JH10	N155B	N155B	69D	56D	White
JH5025	N155B	158D	N155B	157D	White
JH5031	N155B	N155B	56D	69D	White
JH5032	N155B	N155B	158D	69D	White
JH5044	N155B	N155B	69D	56D	White
JH5048	N155B	N155B	69D	N155A	White
JH10015	4A	12B	4A	5B	Yellow
JH6004	4D	13D	4D	18D	Yellow
JH6083	6A	6A	6B	3A	Yellow
JH6045	6A	6A	12A	9A	Yellow
JH6117	6A	6A	6B	3A	Yellow
JH6061	12A	12A	9A	13A	Yellow
JH6032	13B	13B	12A	15B	Yellow
JH3020	144B	144B	N144C	144C	Yellow Green
JH3017	144C	144C	N144D	N144A	Yellow Green
JH3015	N144D	N144D	145A	N144B	Yellow Green
JH3023	145B	145B	144D	150C	Yellow Green
JH6103	17A	17A	21A	21B	Yellow Orange
JH7059	22A	22A	20A	26B	Yellow Orange
JH5002	158D	158D	157D	158C	Yellow White

- In the identification of outer side color of 51 varieties, image recognition achieved a 98% match rate compared to manual observation, with 82% of the results matching with the first RHS color card number from image recognition.

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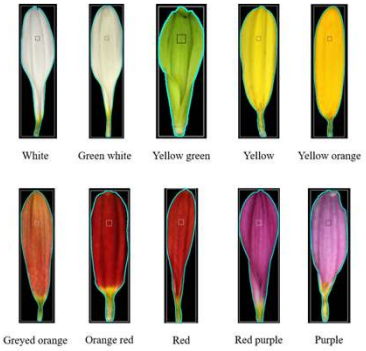
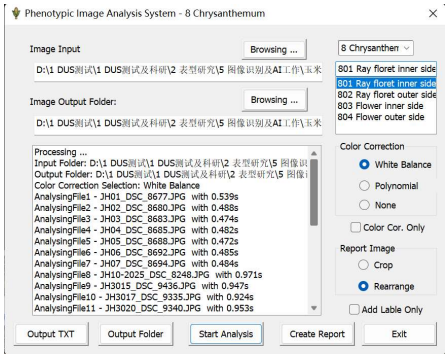
3. RESULTS AND ANALYSIS





- Manual observation of each petal took about 1-2 minutes, and observing 10 petals per variety took about 10-20 minutes. Photographing took about 2 minutes, and identifying one image only required 0.5 seconds, significantly increasing testing efficiency by 5-10 times.

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3. RESULTS AND ANALYSIS

Number of Varieties	RHS No. of manual	RHS No. of Image Analysis-1	RHS No. of Image Analysis-2	RHS No. of Image Analysis-3	RHS colour classification
JH5002	187D	158D	187D	158C	Green White
JH6063	187D	158D	158C	187D	Green White
JH7024	N163A	N163A	N172A	N172B	Greyed Orange
JH7037	N163C	N163C	N163D	N163B	Greyed Orange
JH7047	172D	172D	187A	172C	Greyed Orange
JH7054	N172A	N172A	N163A	N172B	Greyed Orange
JH7059	N163D	N163D	N25D	163B	Greyed Orange
JH7001	N34A	N34A	36A	32A	Orange Red
JH7013	N34A	N34A	36A	32A	Orange Red
JH7015	N34A	N34A	36A	32A	Orange Red
JH7039	N34A	N34A	38A	32A	Orange Red
JH7040	N34A	N34A	38A	36B	Orange Red
JH7047	N34A	N34A	46A	36B	Orange Red
JH7069	N34A	N34A	36B	36B	Orange Red
JH6041	78D	78D	78D	78C	Purple
JH6066	78A	77D	77C	78A	Purple
JH7024	46A	46A	32A	N34A	Red
JH7066	46B	46B	32A	32B	Red
JH8138	49D	72D	49D	58C	Red
JH5018	72D	72D	72D	N74C	Red Purple
JH5040	70C	70C	186C	181D	Red Purple
JH8010	N74D	N74D	73A	77C	Red Purple
JH5042	69C	69C	69D	69B	Red Purple
JH8058	69B	69B	69C	73D	Red Purple
JH8065	72B	72B	65A	N74D	Red Purple
JH8067	69A	69A	58B	62D	Red Purple
JH8070	N74C	N74C	72A	N66D	Red Purple
JH8074	69B	69B	69A	58D	Red Purple
JH8100	70B	70B	N73B	72D	Red Purple
JH8107	64A	187D	53A	46A	Red Purple
JH8114	70B	70B	73C	N74A	Red Purple
2025-JH10	N155B	N155B	69D	58D	White
JH5025	N155B	158D	N155B	157D	White
JH5031	N155B	N155B	158D	157D	White
JH5032	N155B	N155B	N155C	58D	White
JH5044	N155B	N155B	69D	N155A	White
JH5048	N155B	N155B	69D	N155A	White
JH10015	9A	9A	12A	8A	Yellow
JH6004	6D	6D	5D	4C	Yellow
JH6045	9A	9A	12A	6A	Yellow
JH6083	6A	6A	9A	12A	Yellow
JH8113	11C	11C	9D	12D	Yellow
JH8117	9A	9A	12A	8A	Yellow
JH8120	6A	6A	12A	9A	Yellow
JH2015	N144C	N144C	144C	N144A	Yellow Green
JH2017	144C	N144A	144C	N144C	Yellow Green
JH2020	N144C	144C	N144C	144B	Yellow Green
JH2023	144D	144D	145B	145C	Yellow Green
JH6092	14A	14A	13A	14B	Yellow Orange
JH6061	14A	14A	17B	14B	Yellow Orange
JH6103	14A	14A	13A	17B	Yellow Orange

inner side color

Number of Varieties	RHS No. of manual	RHS No. of Image Analysis-1	RHS No. of Image Analysis-2	RHS No. of Image Analysis-3	RHS colour classification
JH6063	187D	158D	187D	158C	Green White
JH7024	167B	167B	N167D	170B	Greyed Orange
JH7054	167D	167D	N167C	167C	Greyed Orange
JH7037	N167C	N167C	167C	167B	Greyed Orange
JH7047	169A	169A	N170B	173A	Greyed Orange
JH7001	N170B	N170B	173C	174C	Greyed Orange
JH6113	N170D	N170D	35D	179D	Greyed Orange
JH7069	171A	171A	N170A	178D	Greyed Orange
JH7040	172D	172D	N167D	N170B	Greyed Orange
JH6120	N172D	N172D	167A	183A	Greyed Orange
JH8100	186C	186C	70C	N74C	Greyed Purple
JH6041	186D	184D	77D	84B	Greyed Purple
JH7013	178D	45A	171A	178D	Greyed Red
JH7015	178D	178D	180B	181B	Greyed Red
JH7066	179A	178C	178C	179A	Greyed Red
JH7039	180B	178D	180B	181B	Greyed Red
JH7041	181C	174C	181C	177D	Greyed Red
JH8067	75B	75B	63D	75C	Purple
JH8070	76B	75B	84B	75C	Purple
JH8010	76B	75B	63D	70D	Purple
JH5040	76C	58D	38D	36B	Purple
JH8066	76C	76C	69A	73D	Purple
JH8114	N78C	N78C	N74C	72D	Purple
JH7034	63B	63B	178A	180A	Red
JH8065	63C	63C	65B	68D	Red Purple
JH8058	69B	69B	69C	75D	Red Purple
JH8074	69B	69B	58D	69A	Red Purple
JH8042	69B	69B	69C	69D	Red Purple
JH8138	70D	70D	N74D	63D	Red Purple
JH8107	71C	71C	71B	N74A	Red Purple
JH5018	N74C	186C	N66D	N74C	Red Purple
2025-JH10	N185B	N185B	69D	58D	White
JH5025	N185B	158D	N185B	157D	White
JH5031	N185B	N185B	58D	69D	White
JH5032	N185B	N185B	158D	69D	White
JH5044	N185B	N185B	69D	58D	White
JH5048	N185B	N185B	69D	N155A	White
JH10015	4A	12B	4A	5B	Yellow
JH6004	4D	12D	4D	18D	Yellow
JH6083	6A	6A	6B	3A	Yellow
JH6045	6A	6A	12A	9A	Yellow
JH6117	6A	6A	6B	3A	Yellow
JH6061	12A	12A	9A	13A	Yellow
JH6032	13B	13B	12A	15B	Yellow
JH3020	144B	144B	N144C	144C	Yellow Green
JH2017	144C	144C	N144D	N144A	Yellow Green
JH3015	N144D	N144D	145A	N144B	Yellow Green
JH3023	145B	145B	144D	150C	Yellow Green
JH6103	17A	17A	21A	21B	Yellow Orange
JH7059	22A	22A	20A	26B	Yellow Orange
JH5002	158D	158D	157D	158C	Yellow White

outer side color

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4. DISCUSSION

- The mismatch between manual testing results and image analysis results may be due to ununiform petal colors within a variety or ununiform color distribution on the same petal.
- There is still room for improvement in petal color extraction and color classification distance.

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4. DISCUSSION

- The results of this study indicate that image analysis has high accuracy in identifying chrysanthemum petal colors and can be used in DUS testing.
- For the mismatch varieties or for special types such as spatulate petal varieties, we need to continue optimizing algorithm.

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THANK YOU FOR YOUR ATTENTION!

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[End of Annex and of document]