

**Technical Working Party on Testing Methods and Techniques****TWM/4/19****Fourth Session****Cambridge, United Kingdom, June 2 to 5, 2026****Original:** English**Date:** May 8, 2026

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**IMAGE ANALYSIS IN DUS TESTING***Document prepared by an expert from the Republic of Korea**Disclaimer: this document does not represent UPOV policies or guidance*

The annex to this document contains a presentation “Image analysis in DUS testing”, to be made by an expert from the Republic of Korea, at the fourth session of the TWM.

[Annex follows]



Korea Seed &  
Variety Service

TWM/4

# Image Analysis in DUS Testing

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DUS Examiner  
Korea Seed & Variety Service (KSVS)

The 4<sup>th</sup> Technical Working Party on Testing Method and Techniques (TWM), 2026

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TWM/4

# Overview of KSVS

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# Overview of KSVS


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- Overview of Korea Seed & Variety Service (KSVS)



- Protection of plant breeders' rights
- Enhancement of agricultural competitiveness
- Support for the development of the seed industry

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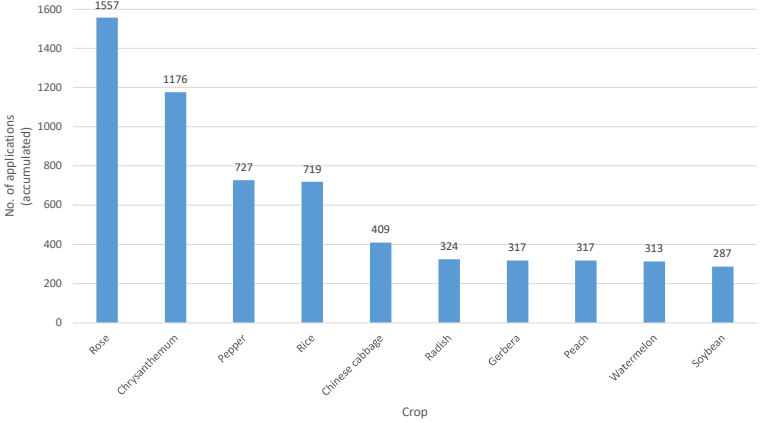

# PBR Status

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- PBR Applications in Korea


**2025**  
**Total: 582 applications**

- Agricultural crops: 525
- Forestry crops: 55
- Aquatic crops: 2



Crop	No. of applications (accumulated)
Rose	1557
Chrysanthemum	1176
Pepper	727
Rice	719
Chinese cabbage	409
Radish	324
Gerbera	317
Peach	317
Watermelon	313
Soybean	287

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# PVP System

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• Plant Variety Protection (PVP) System in Korea

Korea Seed & Variety Service	National Forest Seed & Variety Center	National Institute of Fisheries Science
<ul style="list-style-type: none"> <li>• Ministry of Agriculture, Food and Rural Affairs</li> <li>• Agricultural seed &amp; variety</li> <li>• Application(~25) 14,284 varieties</li> <li>• Registration(~25) 10,792 varieties</li> </ul>	<ul style="list-style-type: none"> <li>• Korea Forest Service</li> <li>• Forest seed &amp; variety</li> <li>• Application(~25) 780 varieties</li> <li>• Registration(~25) 453 varieties</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Oceans and Fisheries</li> <li>• Aquatic seed &amp; variety</li> <li>• Application(~25) 51 varieties</li> <li>• Registration(~25) 37 varieties</li> </ul>

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# Organization

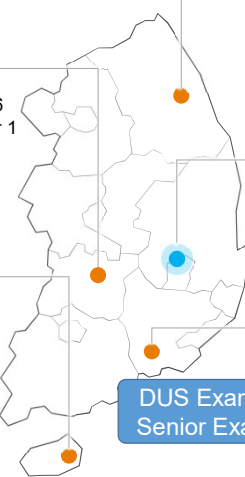
TWM/4

• Organization of KSVS (DUS Examination)


**West branch office (Iksan-si)**



DUS Examiner 6  
Senior Examiner 1




**East branch office (Pyeongchang-gun)**




DUS Examiner 3  
Senior Examiner 1

**Jeju branch office (Jeju-si)**




DUS Examiner 2  
Senior Examiner 1

**Plant variety protection Division (Gimcheon-si)**



DUS Examiner 3  
Senior Examiner 4

**Gyeongnam branch office (Milyang-si)**



DUS Examiner 4  
Senior Examiner 1

**DUS Examiner 19  
Senior Examiner 8**

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# Use cases of Image Analysis

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## Motivation

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- Why Develop Image Analysis Tools?
  - Replace of manual measurements
  - Reduction of labor-intensive and repetitive tasks
  - Time saving and mitigation of time lag (e.g. flowers that bloom for a very short time)
  - Applicability to various crops (not dependent on deep learning models)
  - Developed in collaboration with **Korea Electronics Technology Institute (KETI)**

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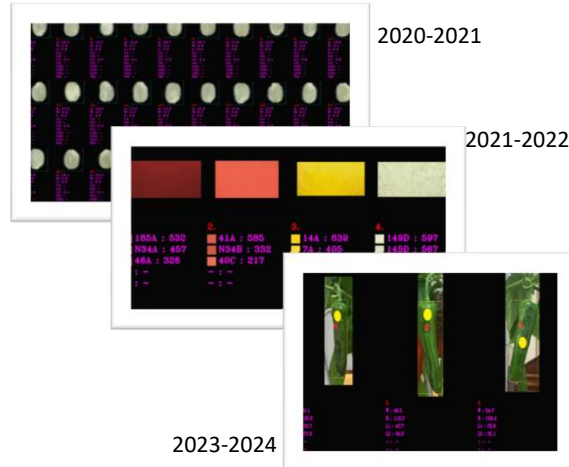
# Current Status of Image Analysis Systems<sup>TWM/4</sup>

- Composed of three software programs:

- Measurement analysis (destructive)
- Color analysis
- Measurement analysis (non-destructive)

- Development timeline:

- 2020-2021 / 2021-2022 / 2023-2024



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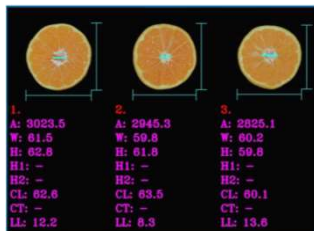
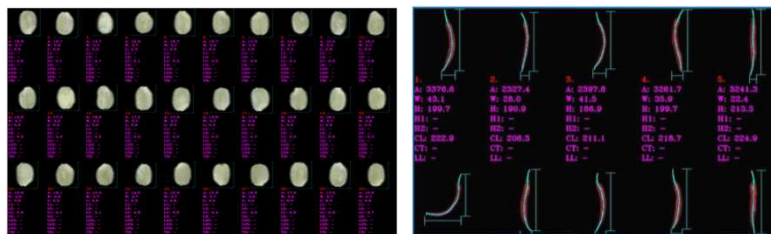
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# Core Features


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- Key Features of Measurement Analysis Software

- Any camera
- Any crop
- Any plant part





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 **Workflow (Measurement Analysis)** TWM/4

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- Step 1: Definition of marker and analysis region

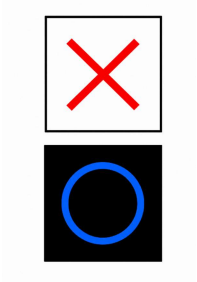
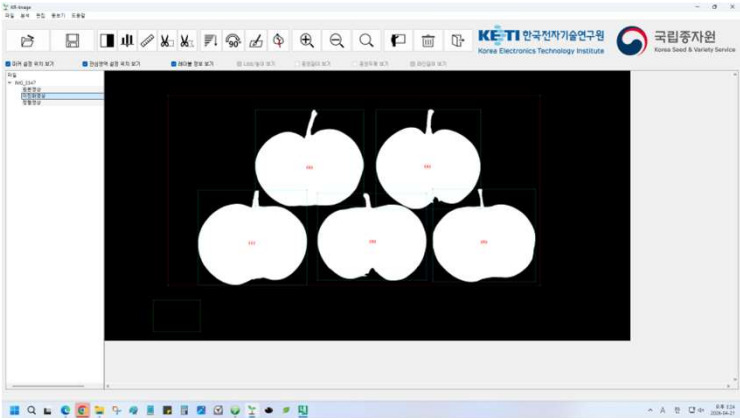


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 **Workflow (Measurement Analysis)** TWM/4


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- Step 2: Binarization



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# Improvement (Measurement)

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- Enhancement of the Measurement Analysis Software
  - Number of assessed characteristics increased (from 8 to 11)


**2023**



1.	2.	3.
A: 3023.5	A: 2945.3	A: 2825.1
W: 61.5	W: 59.8	W: 60.2
H: 62.6	H: 61.8	H: 59.8
H1: -	H1: -	H1: -
H2: -	H2: -	H2: -
CL: 62.6	CL: 63.5	CL: 60.1
CT: -	CT: -	CT: -
LL: 12.2	LL: 8.3	LL: 13.6


➔

**2026**



1.	2.	3.	4.	5.
A: 8095.3	A: 7793.7	A: 7650.8	A: 7621.7	A: 7323.8
W: 101.3	W: 101.3	W: 101.3	W: 97.2	W: 95.6
L: 114.2	L: 116.3	L: 105.4	L: 120.4	L: 112.7
L1: 21.7	L1: 31.5	L1: 18.1	L1: 30.4	L1: 22.2
L2: 92.5	L2: 84.8	L2: 87.3	L2: 90.4	L2: 90.4
LC: 130.8	LC: 142.6	LC: 41.9	LC: 122.1	LC: 129.0
LS: 8.2	LS: 15.7	LS: 14.1	LS: 11.8	LS: 13.7
LS2: 35.8	LS2: 30.4	LS2: 42.8	LS2: 31.6	LS2: 36.0
LS3: 13.0	LS3: 9.8	LS3: 15.0	LS3: 15.1	LS3: 15.5
LS4: 36.2	LS4: 36.2	LS4: 39.3	LS4: 33.1	LS4: 33.5
TH: 4.8	TH: 3.8	TH: 118.1	TH: 3.7	TH: 2.4

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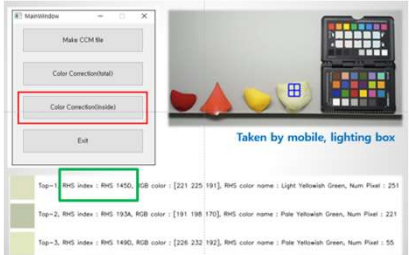
# Improvement (Color)

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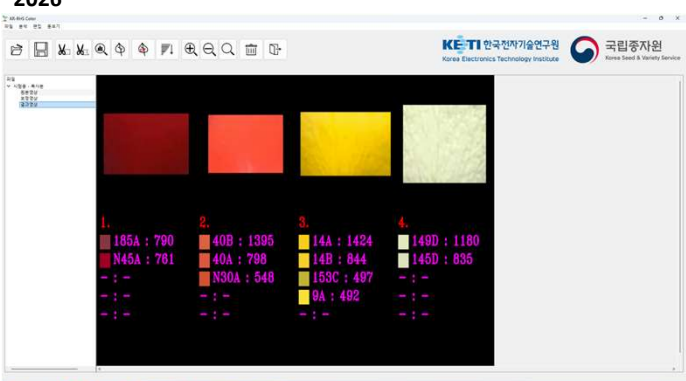
- Enhancement of Color Analysis Software
  - User-friendly interface
  - Improved color calibration
  - Capability for simultaneous analysis

**2023**




➔

**2026**





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## Color DB

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- RGB database based on RHS Color Chart: 920 colors
- Color checker for calibration: 24 colors



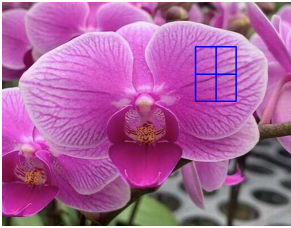
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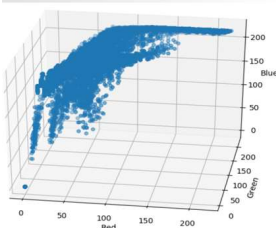
## Color Analysis Principle

TWM/4

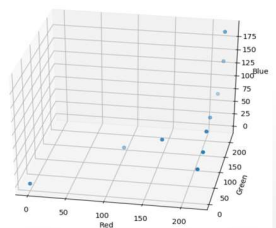
- Principle of Color Image Analysis



Designated  
Color Area



1. Extraction of RGB values from  
all pixel



2. Selection of dominant RGB  
values (top 20)

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# Color Analysis Principle

TWM/4

- Principle of Color Image Analysis

3. Matching with closest RHS color chart value

- Top-1, RHS index : RHS N80B, RGB color : [176 91 172], RHS color name : Strong Purple, Num Pixel : 1680
- Top-2, RHS index : RHS N78C, RGB color : [189 107 175], RHS color name : Deep Purplish Pink, Num Pixel : 1777
- Top-3, RHS index : RHS N78B, RGB color : [179 73 153], RHS color name : Strong Reddish Purple, Num Pixel : 1255
- Top-4, RHS index : RHS N80C, RGB color : [192 132 191], RHS color name : Light Purple, Num Pixel : 1243
- Top-5, RHS index : RHS N80D, RGB color : [203 148 203], RHS color name : Light Purple, Num Pixel : 583

4. Recommendation of representative colors (based on area proportions)

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# Workflow (Color Analysis)

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- Step 1: Color calibration

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## Workflow (Color Analysis)

TWM/4

- Step 2: Region of interest (ROI) selection



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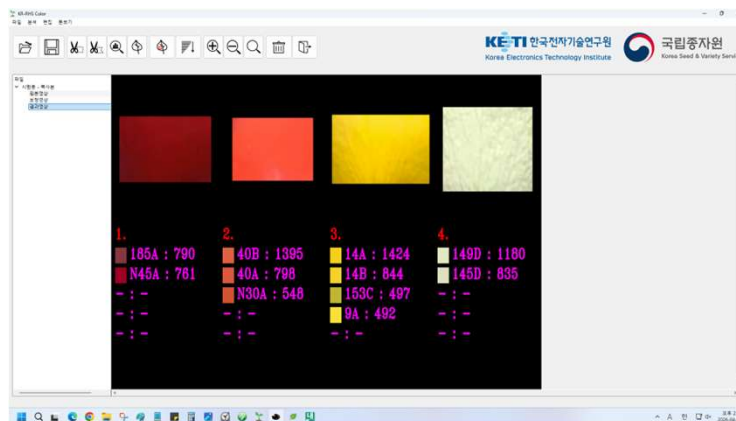


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## Workflow (Color Analysis)

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- Step 3: Output of analysis results



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## Non-destructive Tool

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- Development of Non-destructive Analysis Software
  - Individual lifecycle tracking
  - High practical applicability for breeders
  - Six-in-one measurement functionality



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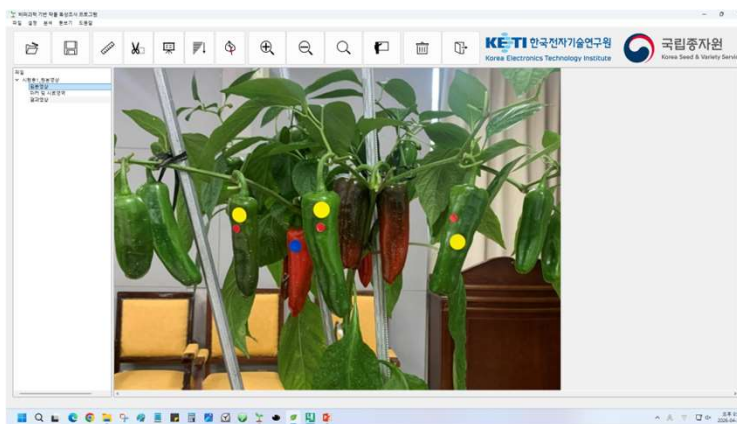


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## Workflow (Non-destructive measurement)

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- Step 1: Definition of marker



Options

1. Ruler
2. Dedicated sticker



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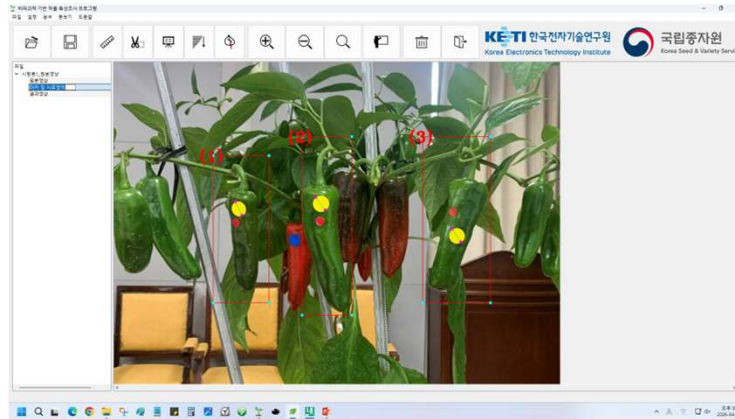


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# Workflow (Non-destructive measurement)

TWM/4

- Step 2: Definition of analysis region



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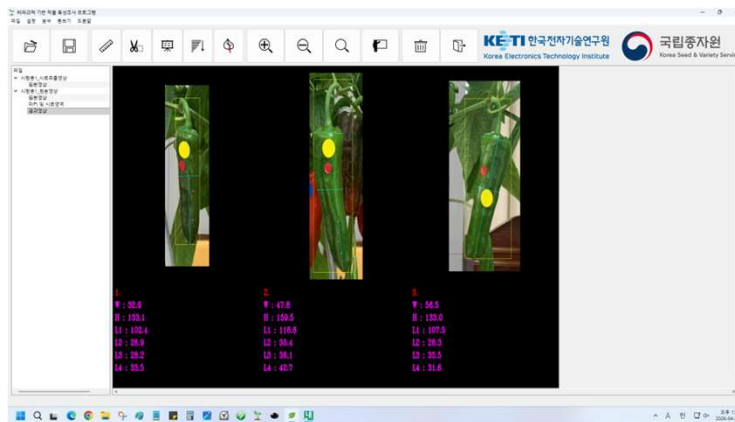


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# Workflow (Non-destructive measurement)

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- Step 3: Arrangement and analysis



Option

1. Width
2. Height
3. Custom parameter 1
4. Custom parameter 2
5. Custom parameter 3
6. Custom parameter 4

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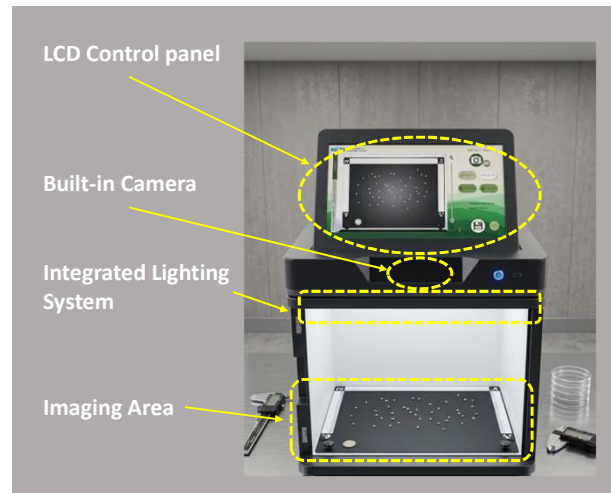


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## Hardware Integration

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- Integrated Measurement Platform
  - Custom-built measurement box
  - Controlled environment (including lighting)
  - Supports measurement analysis
  - Scalable for future system integration
  - All-in-one capture and analysis



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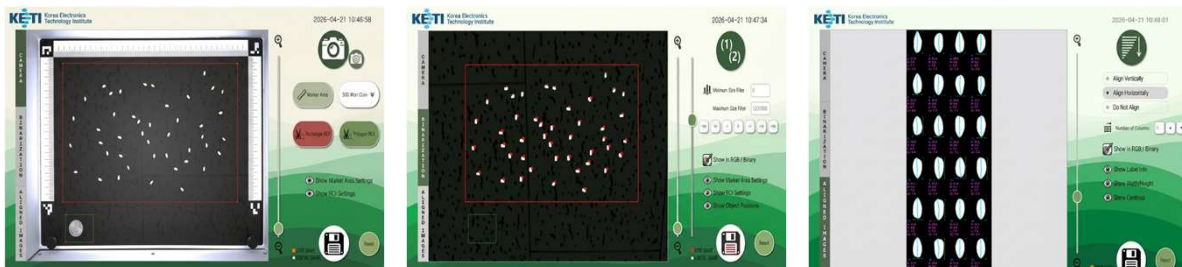


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## Simplified Workflow

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- Simplified Processing Pipeline
  1. Selection → 2. Binarization → 3. Arrangement and analysis



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# Dissemination of Image Analysis

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## Dissemination

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- A total of 246 organizations,  
including seed companies and breeding research institutes



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## International Workshop

TWM/4

- International Workshop on Image Analysis
  - Date: December 2, 2021
  - Participation: Over 300 experts, From 22 countries (virtual meeting)



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# Thank you for your attention

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