UPOV

International Union for the Protection of New Varieties of Plants

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**Technical Working Party for Agricultural Crops**

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# REVISED ADDENDUM TO NEW METHOD TO GUARANTEE MINIMUM DISTANCE BETWEEN VARIETIES IN MEASURED QUANTITATIVE CHARACTERISTICS FOR DISTINCTNESS AND HARMONIZATION BETWEEN UPOV MEMBERS

*Document prepared by the Office of the Union*

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The Annex to this document contains a copy of a presentation on “New method to guarantee minimum distance between varieties in measured quantitative characteristics for distinctness and harmonization between UPOV members”, prepared by an expert from the Republic of Korea that was made at the forty-sixth session of the Technical Working Party for Agricultural Crops (TWA).

[Annex follows]

ANNEX

NEW METHOD TO GUARANTEE MINIMUM DISTANCE BETWEEN VARIETIES IN MEASURED QUANTITATIVE CHARACTERISTICS FOR DISTINCTNESS AND HARMONIZATION BETWEEN UPOV MEMBERS"

Presentation prepared by an expert from the Republic of Korea

# New Method to Guarantee Minimum Distance between Varieties in Measured Quantitative Characteristics for Distinctness and Harmonization between UPOV Members

Republic of Korea

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## To be distinct

- More than Minimum distance in any characteristics
  - QL: 1note
  - QN: 2notes, 1% level of significant difference

## Minimum distance of QN

- is not well justified,

  but depends to examiner's experience

## In assessing distinctness

- Everybody agrees that
  visually observed notes method is
  better than statistical method in QN !

**Why ?**

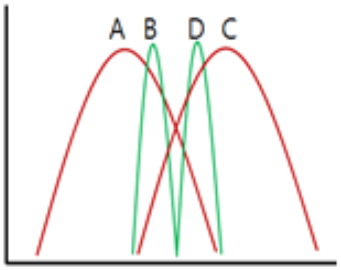
Fatal defect in statistical method

## Statistical significance test

- Reliability to be significantly different

  1% > 5%

Always clearly distinct in visual or two notes difference?




- Significance level depends to
  - Number of sample
  - Variation of sample (within, between)

## In statistical method

Significance level does not accord to minimum distance

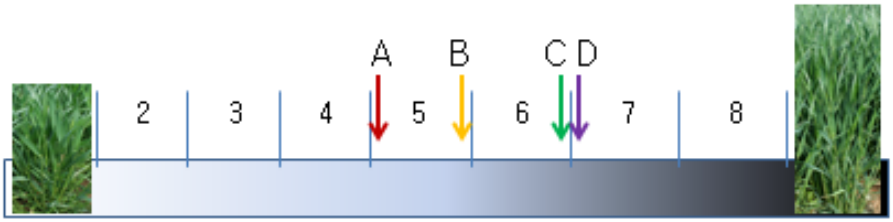
causes

- Errors in assessment of distinctness (Non-sense assessment of distinctness)

## Notes is for Grouping or Distinctness?

Grouping of expression (Example varieties, notes table) ≠ Distinctness decision (Minimum distance)


## Two notes difference: minimum distance




0 note difference ⟷ A-B

1 note difference ⟷ C-D, B-C, A-C

2 note difference ⟷ B-D, A-D

## In notes method

Lack of standard minimum distance
about 'how much of real difference'

causes

- Inconsistent assessment of distinctness
- Errors in assessment of distinctness

## Two errors in assessment of distinctness

- **Type I error**

  distinct in visual but deny to have distinctness

- **Type II error**

  not-distinct in visual but accept to have distinctness

# How to set minimum distance for distinctness decision

## 3 Premises

1. Bigger size, bigger within varietal variation
2. Bigger size, bigger real minimum difference
3. Consistent minimum distance

## Equation for comparison

- Difference ratio (DR, %)

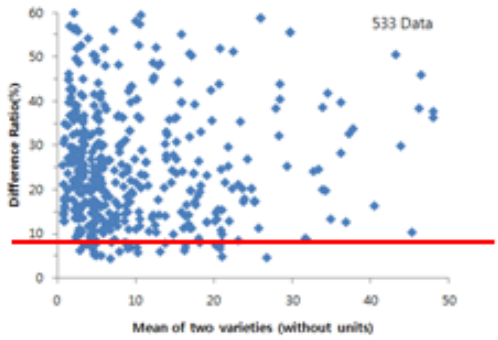
$$\frac{|A-B|}{(A+B)/2} \times 100$$

(A and B: average of variety A and B, respectively)

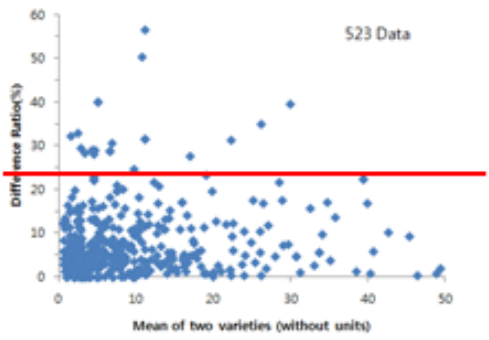
- Similar to Coefficient of Variation: $\frac{S \times 100}{\bar{X}}$
- possible to compare regardless of different units or digits

## Data mining

Distinct




Not-distinct



## As the result of data mining

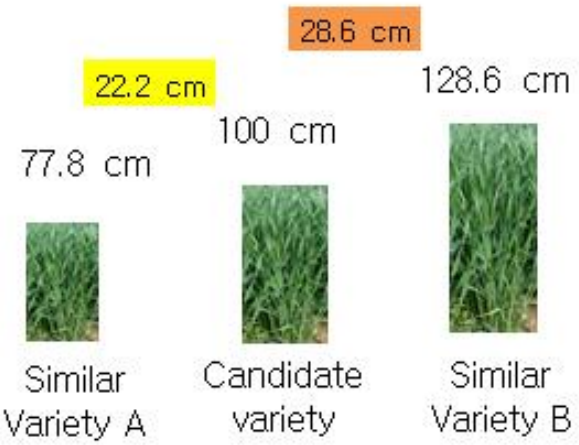
- 2 note difference: more than 20% of DR
- 1 note difference: 10 ~ 20% of DR
- 0 note difference: less than 10% of DR
- Considered variation of data: by significance level
- Considered boundary zone: as 5% of DR

➢ To have clear distinctness in QN:

More than 25% of DR in 1% level of significance

More than 30% of DR in 5% level of significance

➢ 25% of Difference Ratio (DR)




Plant height

➢ In notes method, notes is in same interval

• 1 note range: 9.0 cm

| Note | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Range (cm) | ~ 18.9 | 19.0 ~ 27.9 | 28.0 ~ 36.9 | 37.0 ~ 45.9 | 46.0 ~ 54.9 | 55.0 ~ 63.9 | 64.0 ~ 72.9 | 73.0 ~ 81.9 | 82.0 ~ |
| Median | 14.5 | 23.5 | 32.5 | 41.5 | 50.5 | 59.5 | 68.5 | 77.5 | 86.5 |
| DR (%) | | 47.4 | 32.1 | 24.3 | 19.6 | 16.4 | 14.1 | 12.3 | 11.0 |

Severe ← Minimum distance → Weak

# New rules of minimum distance

| rule | Statistical significant level (t-test) | Difference Ratio (%) | Distinctness |
|---|---|---|---|
| 1 | 1%, 5%, 10% | < 20% | No |
| 2 | 1% | 20 ≦ < 25% | No (2nd trial required) |
| 3 | 1% | ≧ 25% | Yes |
| 4 | 5% | 20 ≦ < 30% | No (2nd trial required) |
| 5 | 5% | ≧ 30% | Yes |
| 6 | 10% | 20 ≦ < 35% | No (2nd trial required) |
| 7 | 10% | ≧ 35% | Yes |

✓ Lower significance needs bigger DR to have distinctness

✓ Additional adoption of rules 4, 5, 6, 7 decreases type I and II errors

# Verification

## Comparison of 3 Methods

- Notes method: More than 2 notes difference to be distinct
- Statistical method: 1% of significance to be distinct
- New method

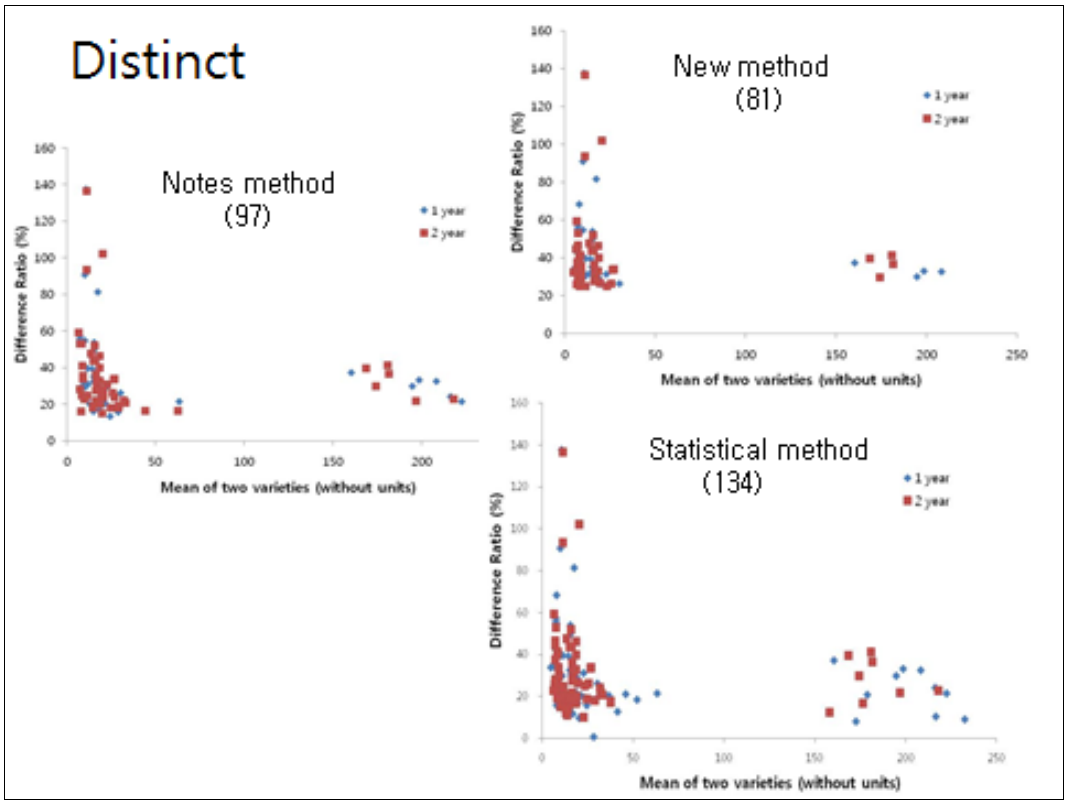
| Statistical significant level (t-test) | Difference Ratio (%) | Distinctness |
|---|---|---|
| 1% | ≧ 25% | Yes |
| 5% | ≧ 30% | Yes |

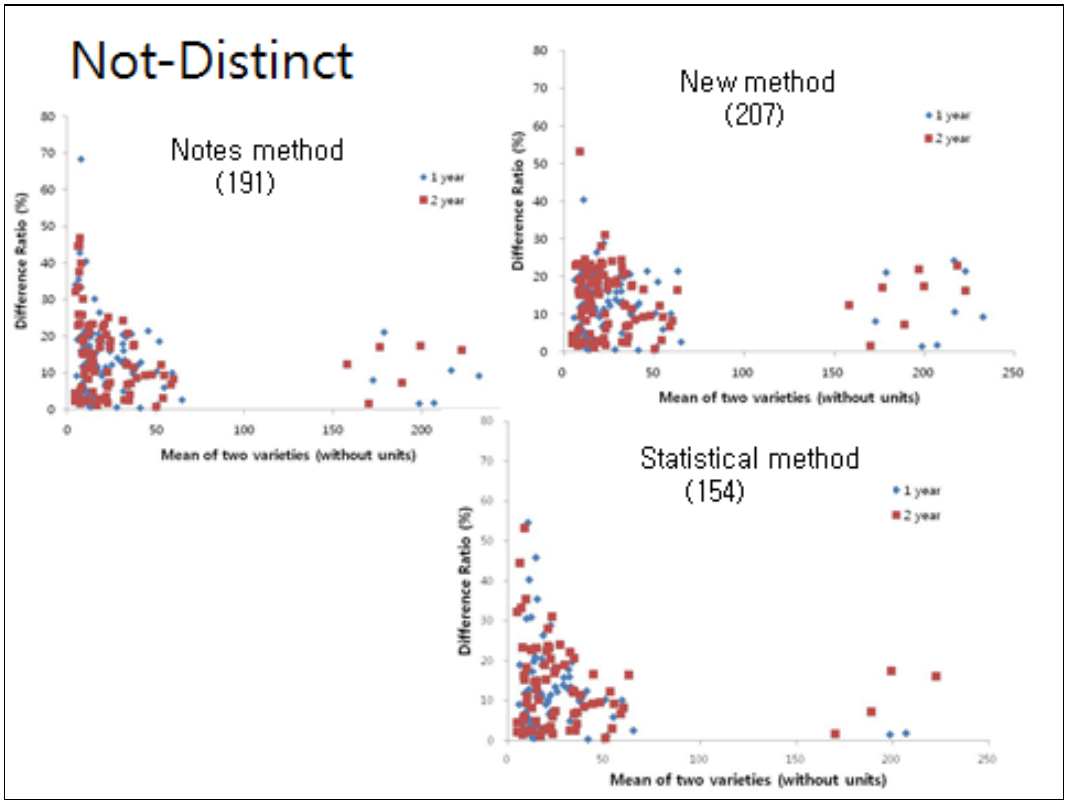
# Measured data of corn in 2009, 2010

- 12 candidate varieties(1 and 2 year each)
- 12 characteristics of QN

(Tassel: number of primary lateral branches, Tassel: density of spikelets, Tassel: length of main axis above lowest lateral branch, Tassel: length of main axis above highest lateral branch, Tassel: length of lateral branch, Plant: length, Plant: ratio height of insertion of peduncle of upper ear to plant length, Leaf: width of blade, Peduncle: length, Ear: length, Ear: diameter, Ear: number of lows of grain)

- Total 288 of measured data
- Converted to notes for distinctness






## Corn: summary

| | Notes method | Statistical method | New method |
|---|---|---|---|
| Distinct | 97 | 134 | 81 |
| Not-distinct | 191 | 154 | 207 |
| Total | 288 | 288 | 288 |

Distinct => ... Distinct: 9
Not-distinct => ...tinct: 62

# Plant length of Chrysanthemum

- Total 284data in 2012~2016
- Notes table for conversion(2012~2016)

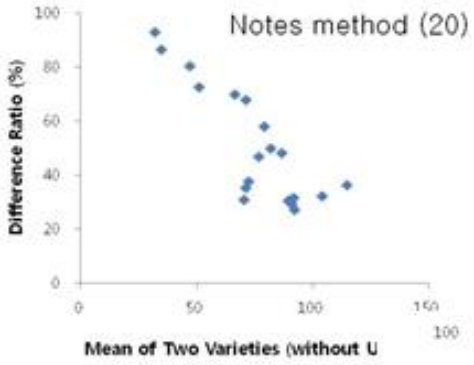
❖ Standard type

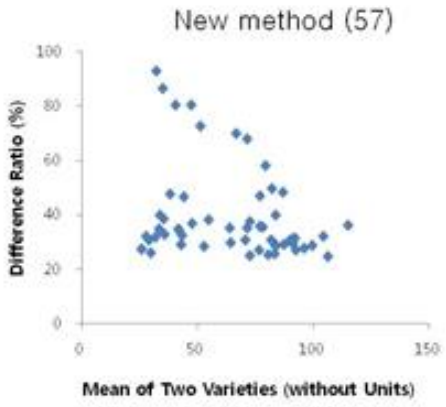
| Notes | From (cm) | To (cm) |
|---|---|---|
| 1 | 0 | 19.99 |
| 2 | 20 | 39.99 |
| 3 | 40 | 59.99 |
| 4 | 60 | 79.99 |
| 5 | 80 | 99.99 |
| 6 | 100 | 119.99 |
| 7 | 120 | 139.99 |
| 8 | 140 | 159.99 |
| 9 | 160 | 179.99 |

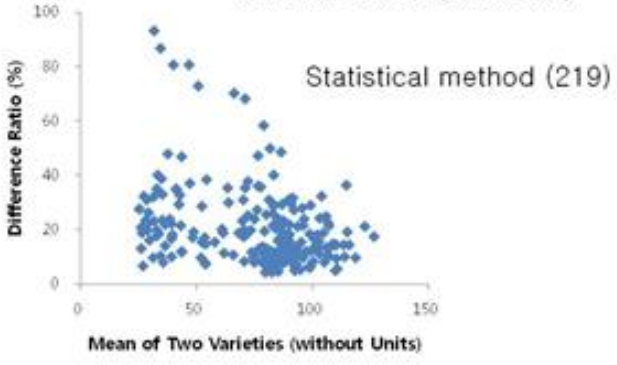
❖ Spray type

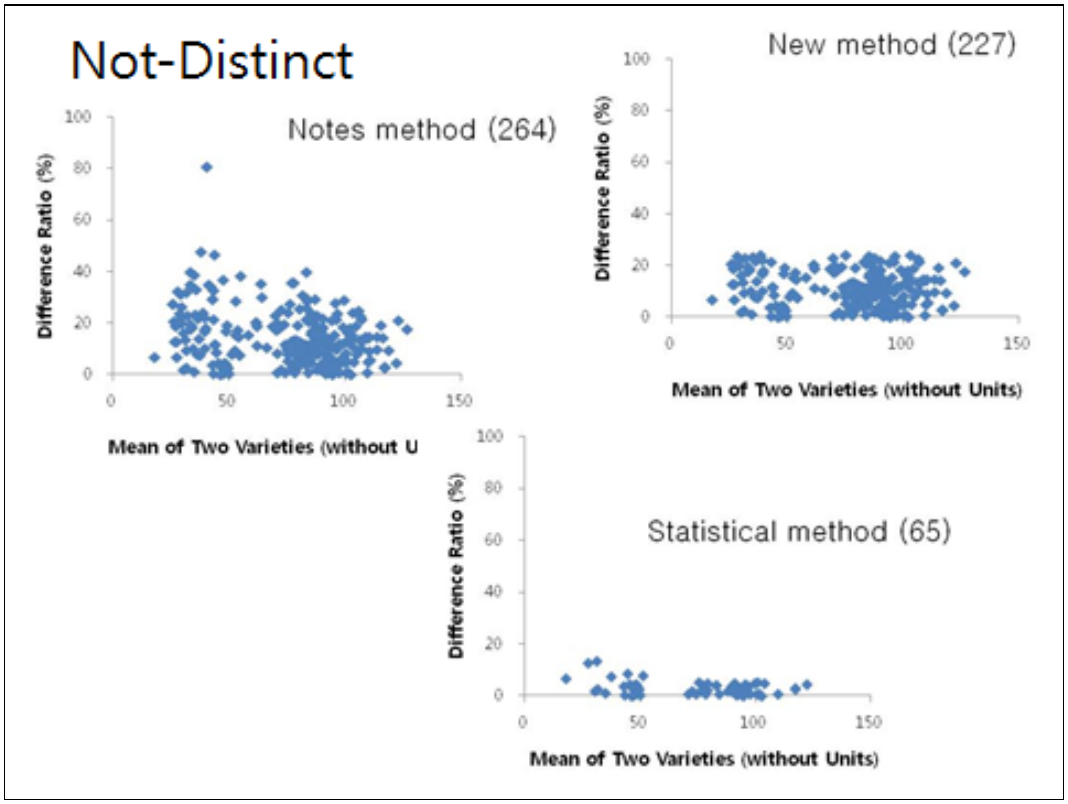
| Notes | From (cm) | To (cm) |
|---|---|---|
| 1 | 0 | 7.99 |
| 2 | 8 | 15.99 |
| 3 | 16 | 23.99 |
| 4 | 24 | 31.99 |
| 5 | 32 | 39.99 |
| 6 | 40 | 47.99 |
| 7 | 48 | 55.99 |
| 8 | 56 | 63.99 |
| 9 | 64 | 71.99 |

# Distinct






# Plant length of Chrysanthemum

| | Notes method | Statistical method | New method |
|---|---|---|---|
| Distinct | 20 | 219 | 57 |
| Not-distinct | 264 | 65 | 227 |
| Total | 284 | 284 | 284 |

## New method

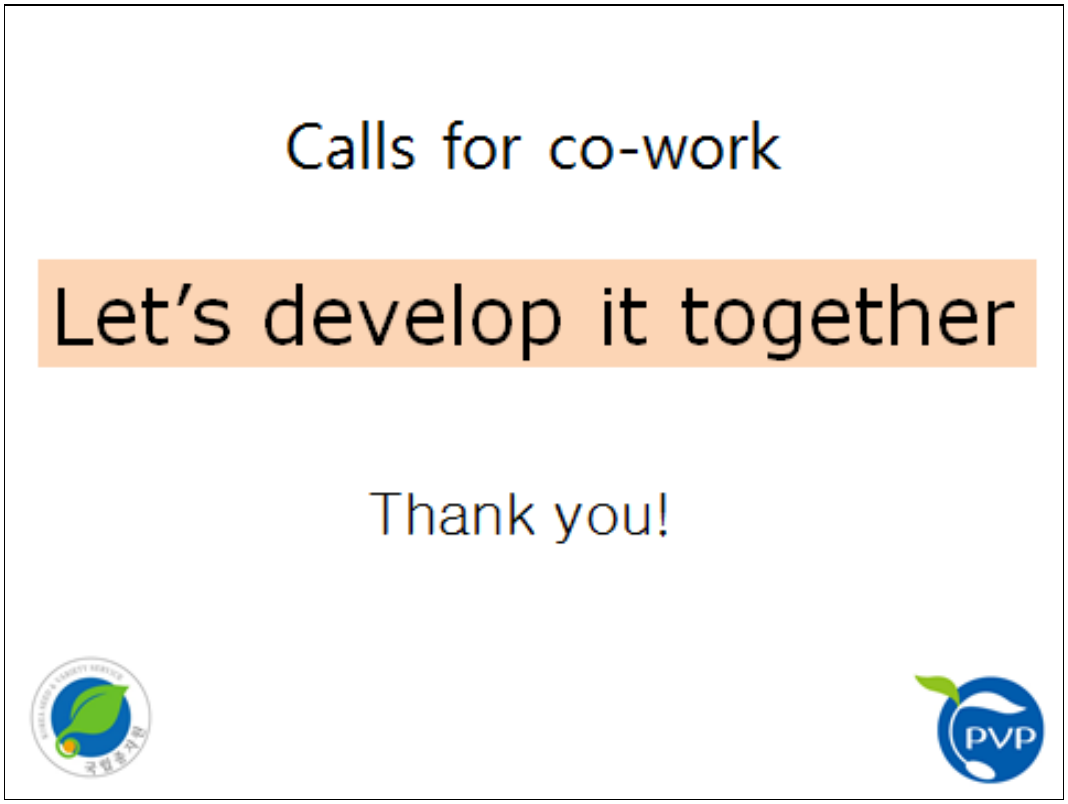
Much closer to notes method

than statistical method

Whether used to many characteristics or one characteristic

## Conclusions

- Difference ratio is effective for minimum distance
- Universal minimum distance can be applicable
- Consistent minimum distance can be applicable
- Harmonized assessment can be improved

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