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THE IMPACT OF MANAGEMENT PRACTICE ON YIELD AND IRRIGATION WATER USE EFFICIENCY FOR PADDY RICE UNDER SHORTAGE ENVIRONMENT

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Presentation outlines

1. Introduction
2. Materials and Methods
3. Results and Discussions
4. Conclusion and Suggestion

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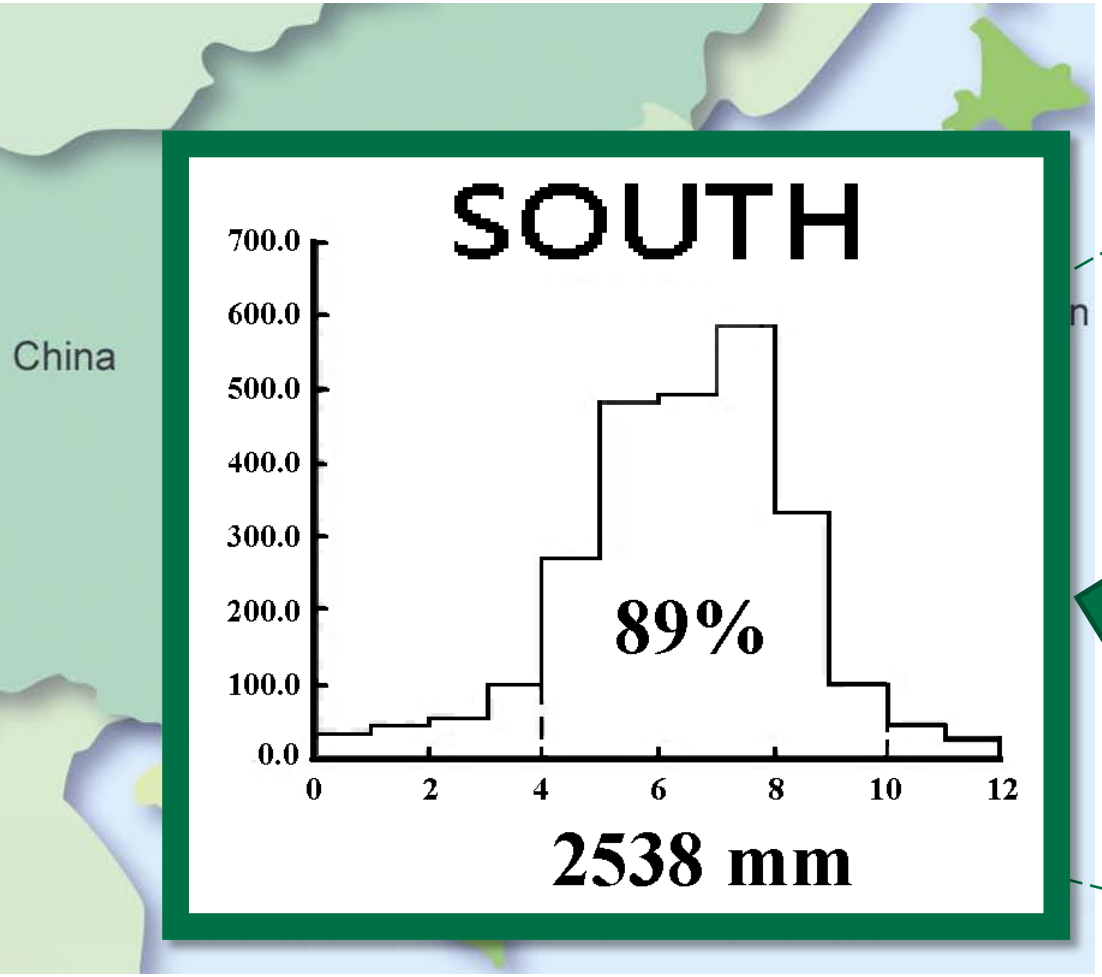
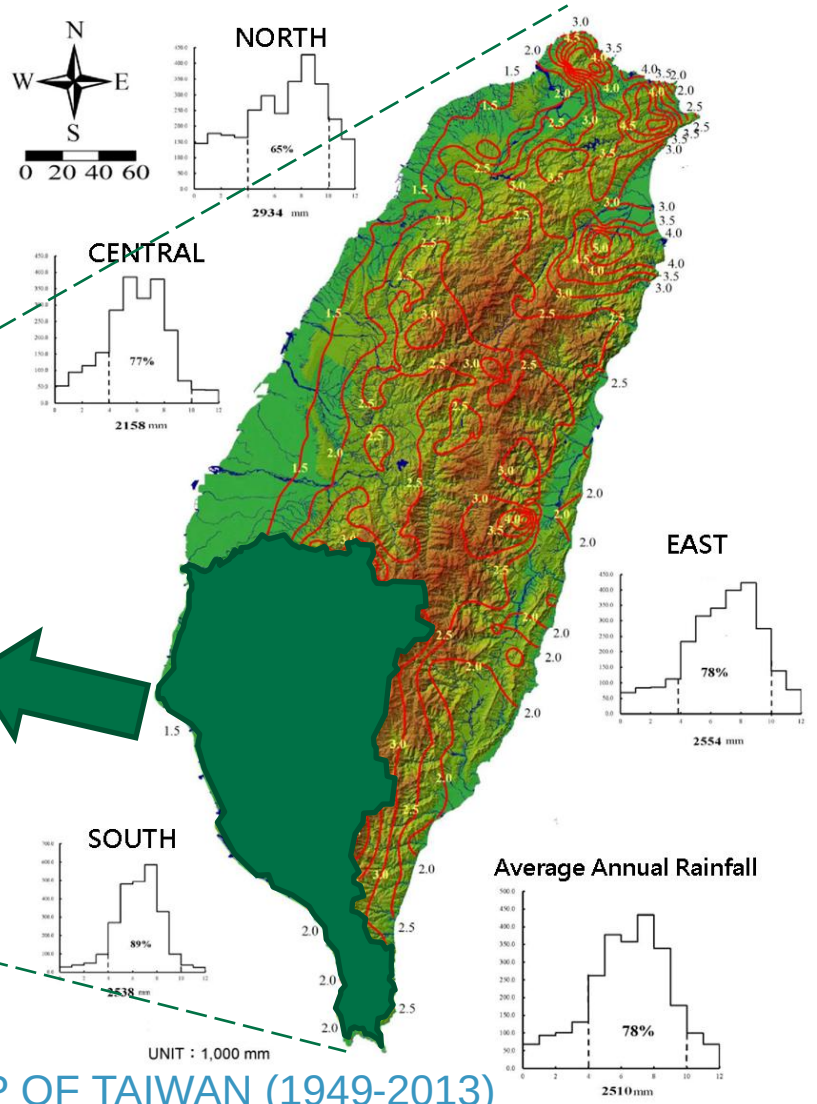
Introduction





THE AVERAGE ANNUAL ISOHYETAL MAP OF TAIWAN (1949-2013)

Introduction

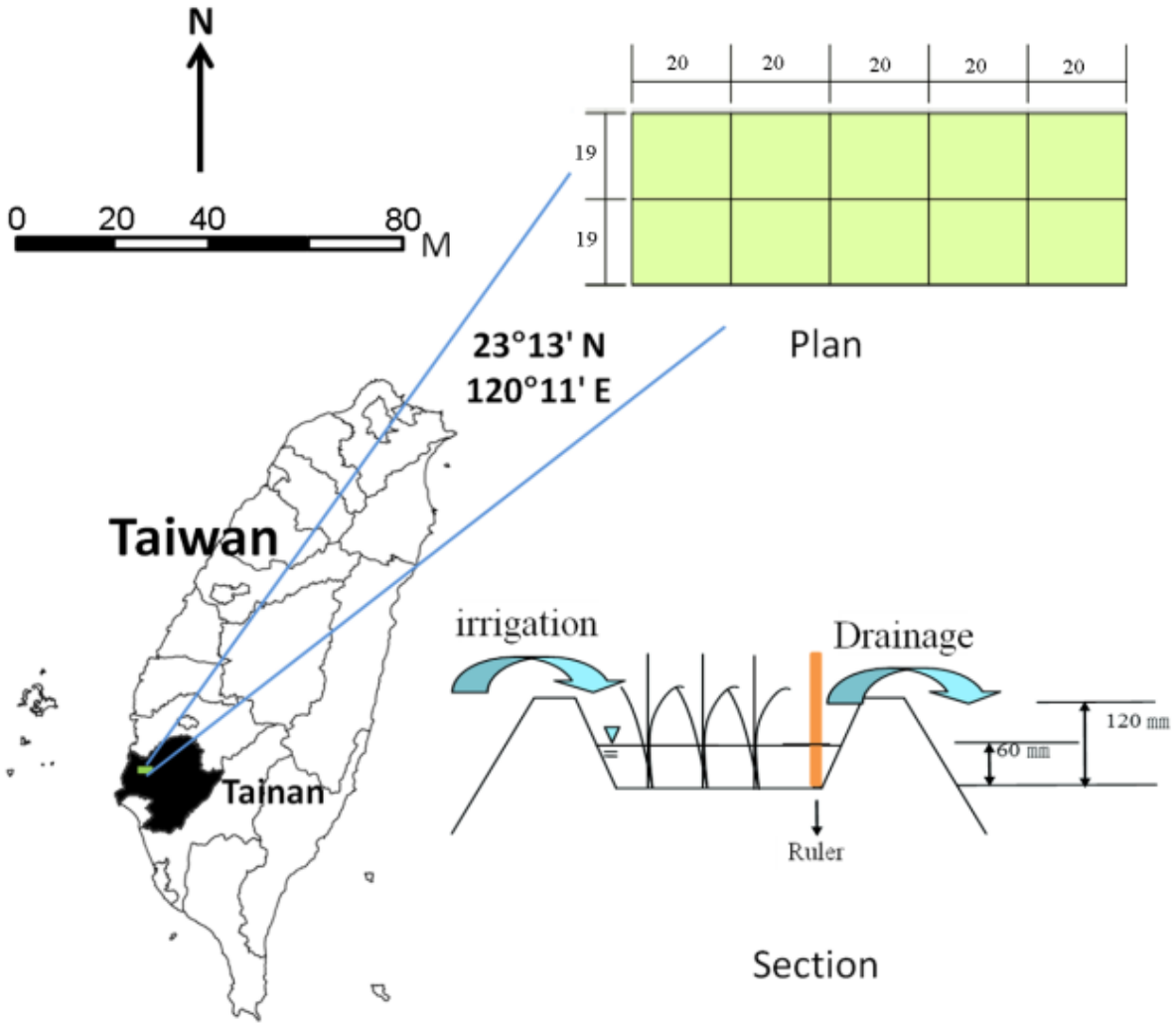
	BMP		Modify SRI	MBMP
Planting Date	January 16th	February 16th	January 16th	February 16th
Reaping Date	June 4th	June 14th	June 4th	June 14th
Growth Period	140 days	119 days	140 days	119 days

- BMP : the best water management practice.
- Modify SRI : the modify system of rice intensification.
- MBMP : conducting rotation irrigation interval of 7 days during heading stage.

Materials

Material :

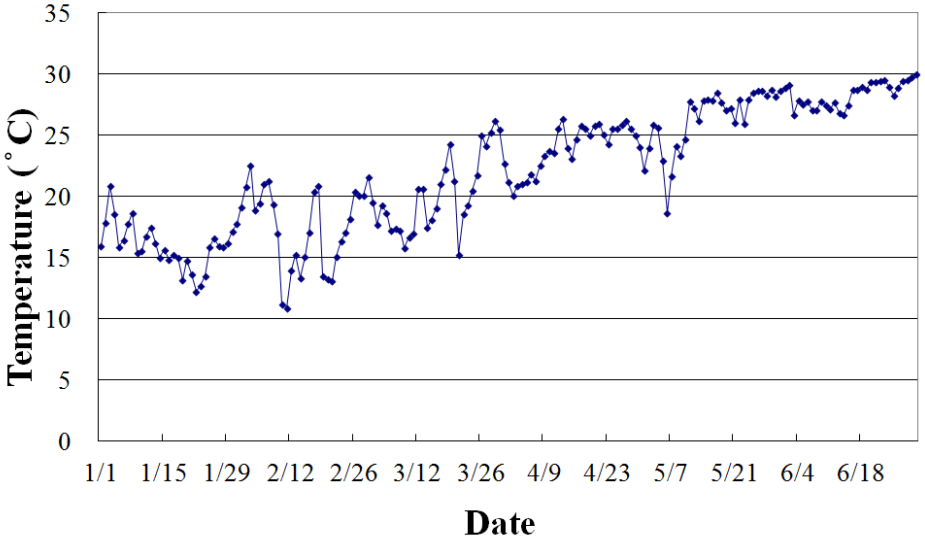
- The experiment rice variety would be Tainan No. 11, which is widely used in Taiwan with high yields.
- The soil texture of the experiment fields is sandy clay loam.



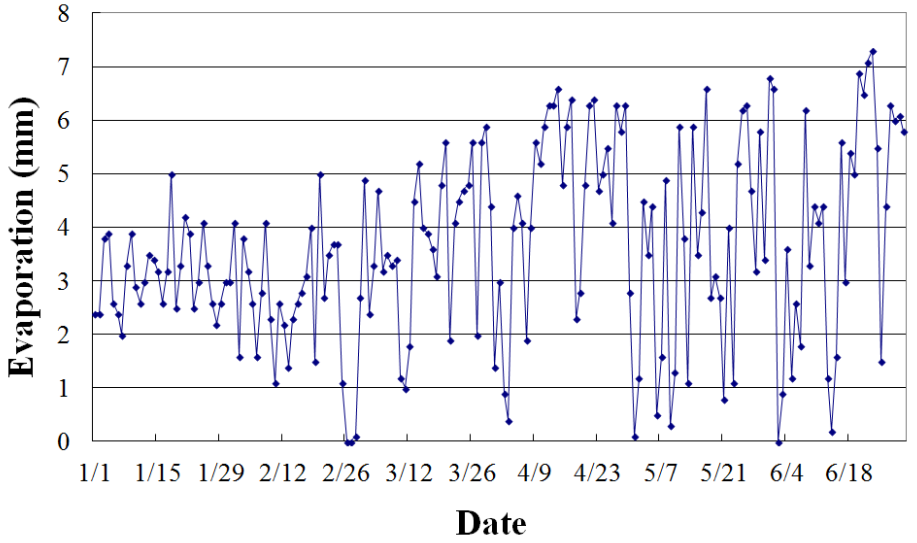
Materials

Experimental Environment

- Meteorological Information



Average Daily Temperature

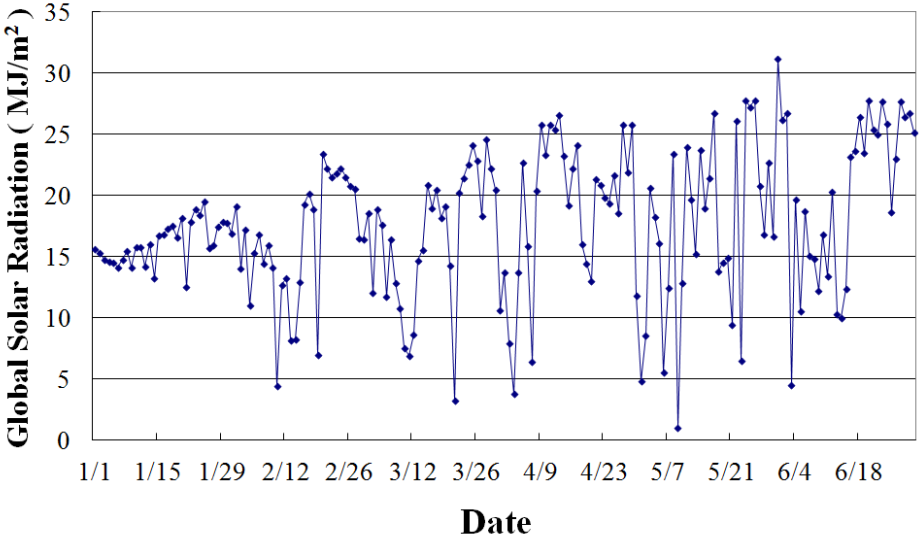


Average Daily Evaporation

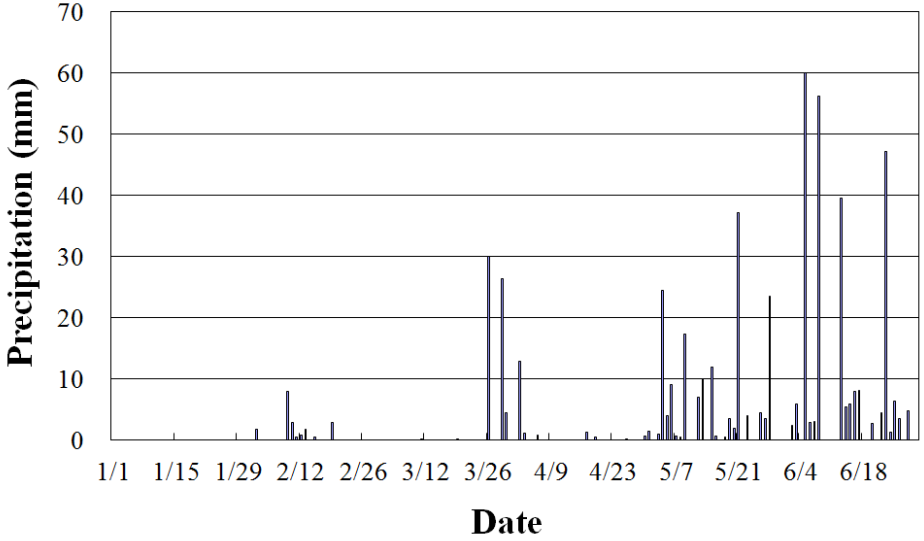
Materials

Experimental Environment

- Meteorological Information



Global Solar Radiation



Daily Precipitation

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Methods

- Analysis of Variance
- Analysis of Impact on Crop Water Requirement of Paddy Rice
- Analysis of Drought Tolerance and Water Saving Efficiency of Paddy Rice
- Water Resource Productivity Index

Methods

Analysis of Variance

- This research took analysis of variance with randomized complete block designs in hope of learning the differences in various responses to irrigation, of which by applying two different estimate variances would reach the same result as comparing various average numbers.

$$SST = SSt + SSb + SSe$$

SST :Total sum of squares

SSt : Treatment sum of squares

SSb : Block sum of squares

Sse : Error sum of squares

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Methods

Analysis of Impact on Crop Water Requirement of Paddy Rice

- This research adopts the most accurate Penman-Monteith Equation (Monteith, 1994) to calculate the reference crop water (ET_0).

$$ET_0 = \frac{0.408\ \Delta\left(R_n - S\right) + \gamma \dfrac{900}{T + 273} U_2 \left(e_a - e_d\right)}{\Delta + \gamma\left(1 + 0.34\, U_2\right)}$$

- The ET_0 of Tainan area could plus crop coefficient with various planting interval could further obtain the crop water requirement (ET_{crop})in different growth stages.

$$ET_{crop} = K_c \times ET_0$$

Methods

Analysis of Drought Tolerance

$$R_i = \left(1 - \frac{Y_i}{Y_a}\right) \times 100\%$$

R_i : the yield reduction rate (%) under different management practice

Y_i : the yield under different management practice (Kg/ha)

Y_a : the paddy rice yield in controlled area under general management practice (Kg/ha)

Methods

Analysis of Water Saving Efficiency

$$S_i = \left(1 - \frac{FIR_i}{FIR_a}\right) \times 100\ \%$$

S_i : the water saving rate (%) of first-season paddy rice under different management practice

FIR_i : the field irrigation water of first-season paddy field under different management practice (m^3/ha)

FIR_a : the field irrigation water of first-season paddy rice in controlled under general management practice(m^3/ha)

Methods

Water Resource Productivity Index

$$WB_i = \frac{Y_i}{FIR_i}$$

WB_i : the water resource productivity under various management practice (Kg/m^3)

Y_i : the productivity under various management practice (Kg/ha)

FIR_i : the field irrigation water under various management practice (m^3/ha)

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Results and Discussions

Analysis of the Impact on Management Practice to Agronomic Traits

Variable		Different Management Practice	Error
Degrees of Freedom		4	10
Mean Square	plant height	43.8**	19.1
	total tiller number per cluster	207.9**	17
	effective tiller number per cluster	205.3**	16.1
	spikelet number per spike	2580.0**	98.1
	grain number per spike	1750.5**	99
	spike weight per cluster	0.0034**	0.00022
	fertility	123.7**	9.2
	yield	1003479**	53745

Note: *and**shows significant difference on level of 5% and 1%

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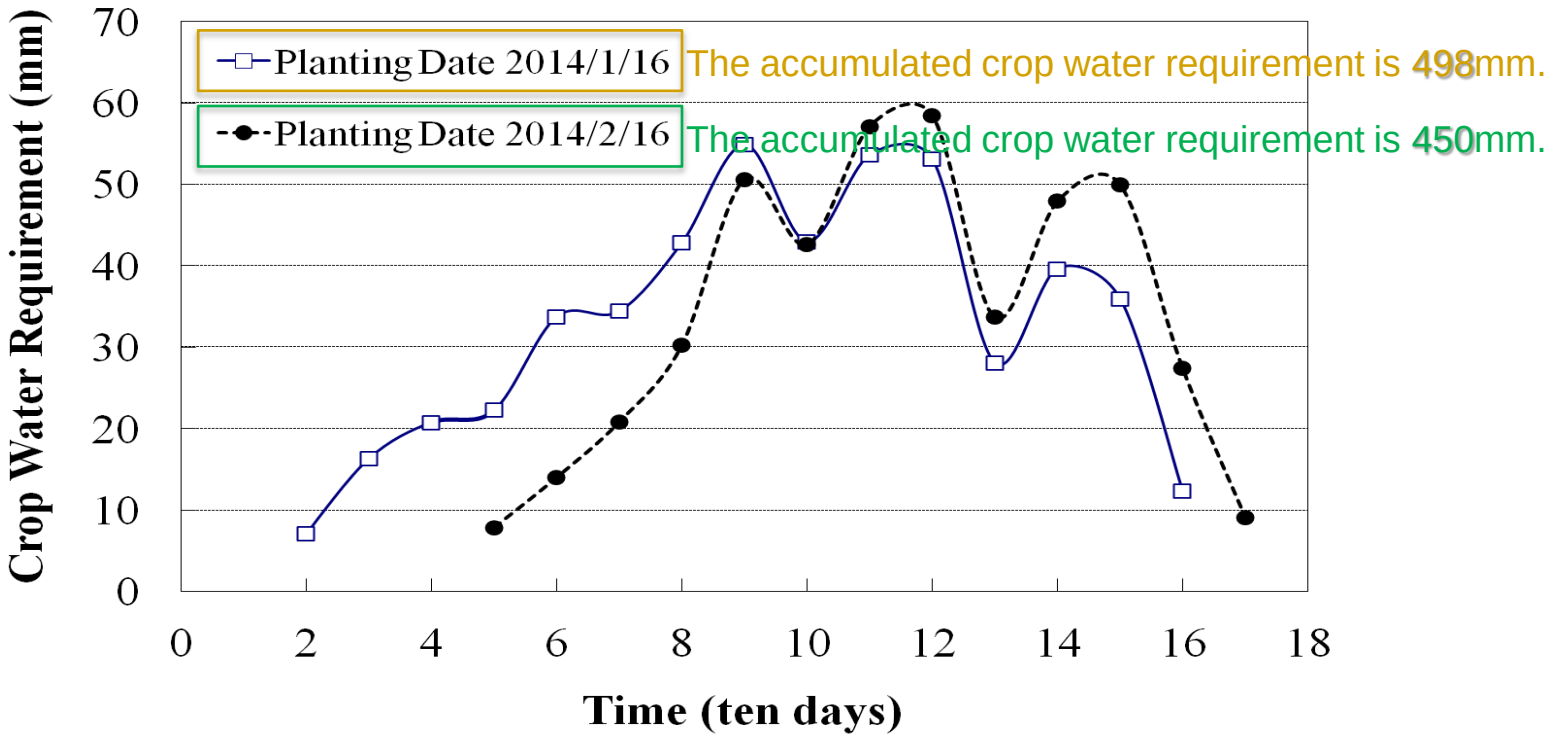
Results and Discussions

- **Analysis of Impact on Crop Water Requirement and Field Irrigation Water for Different Management Practice of Paddy Rice**



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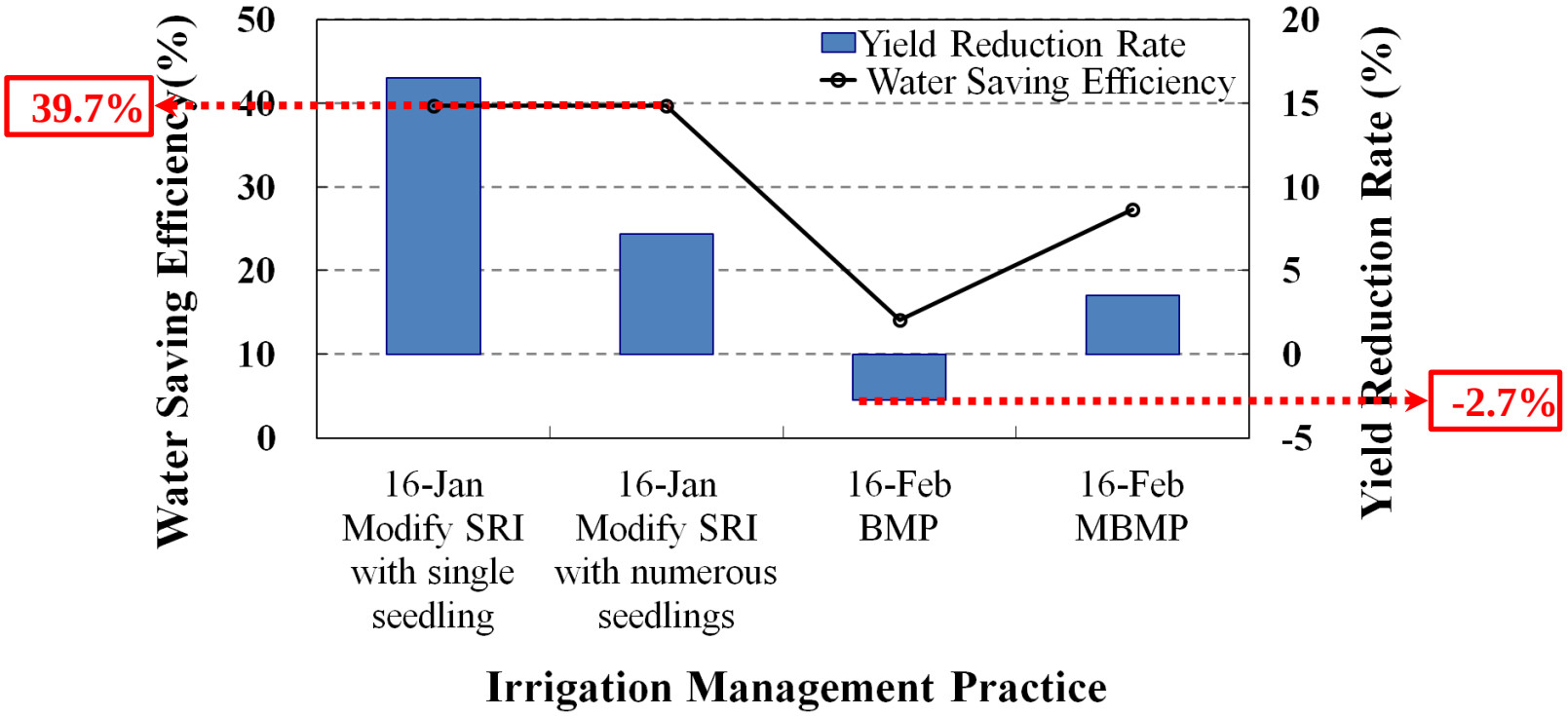
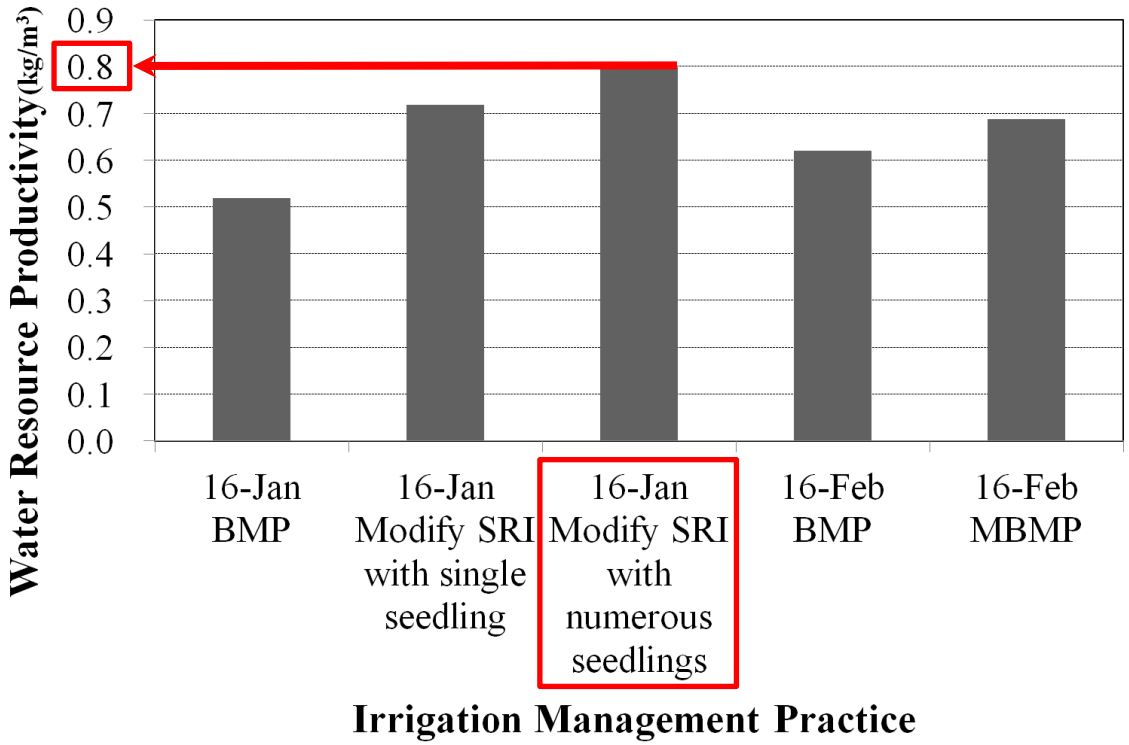
Results and Discussions

- **Analysis of the Impact on Management Practice to Yield Reduction Rate and Water Saving Efficiency**



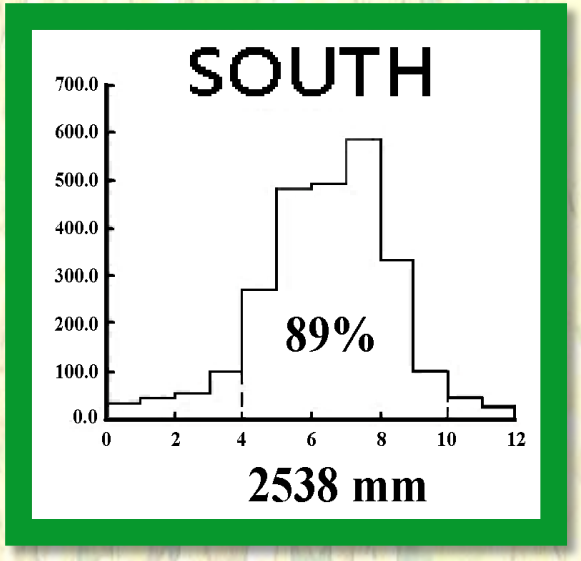
Results and Discussions

- **Analysis of the Impact on Management Practice to Water Resource Productivity**



Conclusion and Suggestion

- This research applies the irrigation experiment design that combines **regional rainfall**, physiological characteristic of crops and rotation irrigation.



Conclusion and Suggestion

- In the overall evaluation of yield reduction rate and water saving rate, the field irrigation water of first-season paddy rice planted on February 16th has reached water saving efficiency of 14.1%~27.3%, comparing with the ones planted on January 16th.

- In addition, the field irrigation water of Modify SRI on January 16th has reached water saving efficiency of 39.7%, comparing with BMP on January 16th, but has influence on yield.

- On water resource productivity, Modify SRI with numerous seedling is also the best management practice.

Conclusion and Suggestion

- To view from the growing days and crop water requirement, the plant date of first crop adjusted from January 16th to February 16th, its growing days would change from 140 days to 119 days; and the accumulated crop water requirement from 498mm to 450mm.

- The field irrigation water decreases due to the extension of rotation irrigation interval. This finding could be applied on facility preparation of paddy rice hovering stage and irrigation water use plan establishment.

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Thank you for your attention.