

An Environment Friendly Approach for Saving Irrigation Water and Fertilizer In Paddy Field

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Lodging



Conventional farming



SPRI

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Introduction



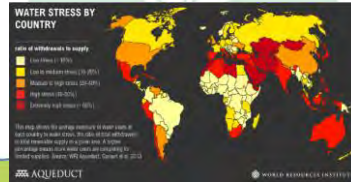
- Rice (*Oryza sativa* L.) is a major staple food for much of the world's population and the largest consumer of water in the agricultural sector.
- About 75% of total rice production over the world comes from irrigated lowlands.

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Introduction

- With increasing water scarcity, the sustainability, food production, and ecosystem services of rice fields are threatened. Therefore, various water-saving techniques and methods have been developed for rice producers to minimize water demand and maintain acceptable yield.

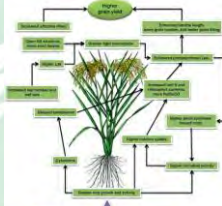


This map shows the average amount of water used in each country to produce rice. It is based on the 2010 rice production data. A country's water stress level is determined by the amount of water used to produce rice. Source: IECI reported Global 4 in 2010. AQUEDUCT WORLD RESOURCES INSTITUTE

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System of Rice Intensification (SRI)

- An agro-ecological, climate-smart rice production methodology.
 - ✓ Early and healthy plant establishment
 - ✓ Minimize competition between plants
 - ✓ Build fertile soils rich in organic matter and soil biota
 - ✓ Manage water carefully, avoid flooding and water stress, create aerated soil



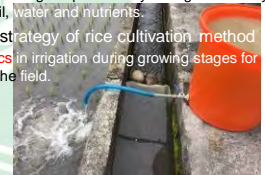
Single, young seeding, wide spacing, intercultivation, organic fertilization, AWD water management

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System of Probiotic and Rice Intensification (SPRI)

- Modified from SRI (system of rice intensification)
 - an agro-ecological methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients.
- An environment concerned & novel strategy of rice cultivation method
 - which use the SRI and different probiotics in irrigation during growing stages for improving microorganism activation in the field.



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System of Probiotic and Rice Intensificaion (SPRI)

Alternative Wetting and Drying (AWD)

- Reduced and controlled water application
 - Only a minimum of water is applied during the vegetative growth period
- Keeping moist rather than continuously saturated in the field soil
 - minimizing anaerobic conditions
 - improving root growth
 - supports the growth and diversity of aerobic soil organisms.
- favoring soil microbial development
 - The soil can be able to hold more nutrients in the rooting zone



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System of Probiotic and Rice Intensificaion (SPRI)

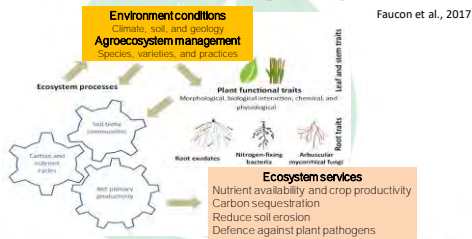
Probiotics

- Increasing microbial diversity in soil
 - Solving the problem that fertilizer application resulted in microbial diversity in the field.
- More nutrients can be hold in the rooting zone of the soils
 - Nitrogen Fixation
 - Nutrients could be released when the plants need
- Affecting the ecosystem through root exudates, nitrogen-fixing bacteria, and mycorrhizal fungi



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Relationships between plant functional traits, ecosystem processes, and services in agroecosystems



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water-saving experiment

- Experimental Site: National Pingtung University of Science and Technology (NPUST) in Southern Taiwan.
- Treatments: SRI management practices applied with 2, 3, 4, and 5 cm water depths ponded.
- Conclusion: Treatment with 3 cm water depth applied in SRI practice could save 30 % water with 0.40 kg/m³ total water productivity.



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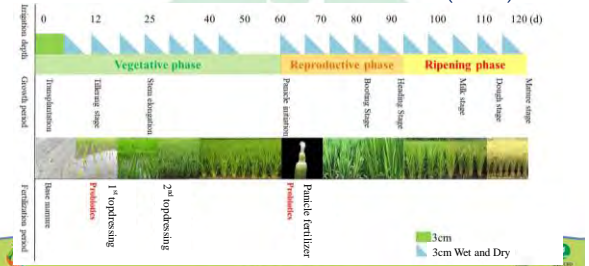
Fertilizer experiment

- Experimental Site: The experimental field in Taitung, Taiwan, located at 23.11° (N) latitude, 121.17° (E) longitude, where is known for producing fine rice.
 - Treatment
- | Treatment | Cultivation method | Chemical fertilizer | probiotic |
|-----------|----------------------|---------------------|-----------|
| 1 | Conventional farming | 100% | - |
| 2 | SRI | 50% | + |
| 3 | SRI | 25% | + |
- Probiotics were added with irrigation water at tillering and panicle initiation stages.



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The Cultivation Management System of Probiotic and Rice Intensificaion (SPRI)



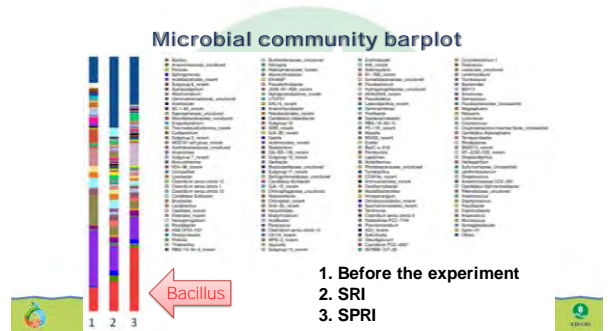
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Result

	T1	T2	T3	p
Dry biomass (g)	75.42 ± 4.1 ^{bc}	86.98 ± 3.63 ^{ab}	92.28 ± 4.01 ^a	*
Panicle number per hill (no.)	18.83 ± 1.21 ^a	17 ± 0.94 ^a	20.97 ± 0.82 ^a	ns
Ratio of productive tiller (%)	87.31 ± 5.6 ^a	77.26 ± 2.03 ^a	90.41 ± 2.44 ^a	ns
Average Panicle length (cm)	16.69 ± 0.36 ^a	16.65 ± 0.05 ^a	16.83 ± 0.12 ^a	ns
Grain weight (g)	32.29 ± 1.83 ^a	37.91 ± 1.28 ^a	38.12 ± 2.12 ^a	ns
Grain weight per panicle (g)	1.83 ± 0.1 ^b	2.35 ± 0.09 ^a	1.92 ± 0.05 ^b	*
Grain numbers (no.)	1860.33 ± 111.99 ^b	1911.83 ± 73.99 ^{ab}	2246.83 ± 79.58 ^a	*
Grain number per panicle (no.)	100.73 ± 4.54 ^a	113.62 ± 3.83 ^a	109.05 ± 2.1 ^a	ns
Thousand-grain weight (g)	20.6 ± 0.11 ^a	21.6 ± 0.1 ^a	20.4 ± 0.06 ^a	ns
Total milled-rice weight (g)	16.68 ± 0.94 ^{ab}	20.37 ± 1.92 ^b	23.52 ± 1.59 ^a	*
Milled-rice nitrogen content (%)	5.7881 ± 0.2796 ^a	5.4673 ± 0.2329 ^a	5.3035 ± 0.2064 ^a	ns
Leaf nitrogen content (%)	1.8312 ± 0.0399 ^b	1.5406 ± 0.0399 ^a	1.6095 ± 0.0318 ^a	ns
Leaf Chlorophyll content (mg/g)	1.0453 ± 0.0608 ^a	0.8227 ± 0.0356 ^b	0.6336 ± 0.0243 ^b	*
Grain yield (ton/ha)	5.093	8.429	7.639	-




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Advantages of SPRI

- Producing high quantity and quality rice crops
- The yield increase percentage of about **30%**
- Saving at least **15%** of the total national water consumption
- Reducing around **50%** nitrogen fertilizer application
- Friendly environment cultivation mode in rice



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Thank you for your attention!

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