Success of Wide Hybridization on the Genetic Improvement of Indica Rice

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Key words: Rice (Oryza sativa L.), Indica Group, IR 64, Japonica Group, Wide hybridization, Introgression lines, yield potential
Rice yields, 2014
Average yields in paddy rice, measured in tonnes per hectare.

(Bangladesh: ~3.5)
**Goal:** Yield potential improvement of Indica variety, IR 64*

**Hypothesis:** NPT lines might be useful as gene source (Parents from tropical Japonica)

### Indica varieties
- Semi-dwarf, good grain quality

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### Tropical japonica
- Large panicle, Large leaves, few unproductive tillers, vigor root system

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*one of the most popular cultivars (mega variety), Good taste, quality grain, short duration

**Limitations:** Low nitrogen use efficiency; Susceptible to Drought and Fe toxicity; Tungro and Blast diseases

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P.C. Ishimaru et al. 2013

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Fujita et al (2009) FCR

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Evaluation of agronomic characteristic
(Days to heading, Culm length, Panicle length, Tiller number, etc.)

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INL: Introgression Line, NIL: Near Isozygous Line

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P.C. Ishimaru et al. 2013
Objectives: Characterize (Agronomic & genetic) the lines under various environments (Temperate, Irrigated lowland and upland) & finding useful traits/gene(s)

# Materials and Methods

- A total of 333 INLs (Fujita et al. 2009) were grown at JIRCAS (Japan) under irrigated and upland fields & 10 agronomic traits were investigated. Association & QTL analy

(Results)

Variation of yield components of INLs

§ All 333 INLs were classified into 6 groups, A-I, A-II, B-II, B-III, C-III and C-IV, finally.

Characterization of cluster groups

Bold character traits indicate higher values in cluster group than those of whole. Underline traits indicated the lower values in cluster group than those of whole.
Characterization of 6 groups based on the 10 traits and responses in irrigated lowland and upland

<table>
<thead>
<tr>
<th>Traits</th>
<th>AI</th>
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<th>CI</th>
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<tr>
<td>DH</td>
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<td>PW</td>
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<td>P/T</td>
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</table>

+ and – indicate the increasing and decreasing mean values of traits in compared with those of whole, respectively.

- INLs were classified based on the variations from low to high yielding traits combinations, and responses to different cultivation conditions.
- INLs in A-I and A-II increased several traits positively under lowland and upland, and these of A-III were stable.
- INLs in B-II and B-III were similar with the means values of trait of whole.
- INLs in C-III and C-IV were complete different than other four groups and low yielding type.

QTLs detected by association analysis

- A total, of166 QTLs for 10 traits were detected on all chrs., except for 3 and 10.
- Among them, 81 QTLs for DH, CL, PL, PW, P/T, PN, FS and TS, were new detections.
- Many QTLs were detected on common 10 regions on chrs. 1, 4 (3), 5, 6, 7 (2), 9 and 12 with high effects.
- Three regions on chrs. 2, 7 and 12 were detected only in upland, and might play the important roles for adaptation for upland condition or differentiation between lowland and upland.

Relationship between QTLs detected and cluster groups

- QTLs detected by association analysis might contribute the characters of INLs in each cluster groups.
- All group consisted of INLs from YP5 and YP11.
- Many QTLs were detected on common regions on chrs. 4 and 9.

- Key detected QTLs were confirmed and two genes *Itn2* and *SPIKE* were identified.
Conclusions & Perspectives:

- Introgressive hybridization was successful & IR 64 was improved by modifying plant architecture and fertility by NPTs.

- These INLs are now being used as breeding materials to improve Indica Group variety such as BR11 [6], and genetic studies to identify genetic factor(s) for yield improvement.

- Increased yield under upland condition indicate that these materials might be suitable for our Aus season as well as hilly areas and recommended for further trials.

- NSU and the JIRCAS has initiated research collaboration to use these INLs, made standard material transfer agreement (SMTA) and brought the seeds in Bangladesh. New breeding scheme is being taken to improve the current BD varieties for grain quality traits.

Thank you!