Role of Yield Potential and Yield-Gap Analyses on Resource-Use Efficiency Improvement

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Background

- Low rice yields – average at 3.3 t ha^{-1} in Myanmar
- Rice yields vary across Asia from 2 t ha^{-1} to 15 t ha^{-1} due to variety and location
- Rice yields of 3.1 t ha^{-1} to 6.4 t ha^{-1}, without any N fertilizer application (Aung et al., 2017)
- Yield - outcome of the effect and interactions of
  - genotype,
  - environment (climate and soil), and
  - management.
- Myanmar -wide range of agro-environments

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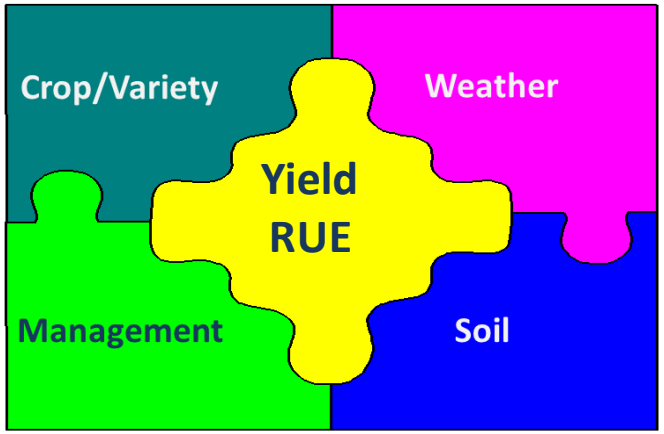
Objectives



- Insights into the relative importance of
  - genotype,
  - environment, and
  - management

  critical for improved yields, increased resource use efficiency, and reduced nutrient losses.
- Yield potential, yield-gap, and management decisions are site- and season-specific
- Achieving agricultural intensification with increased yield potential and reduced yield-gap

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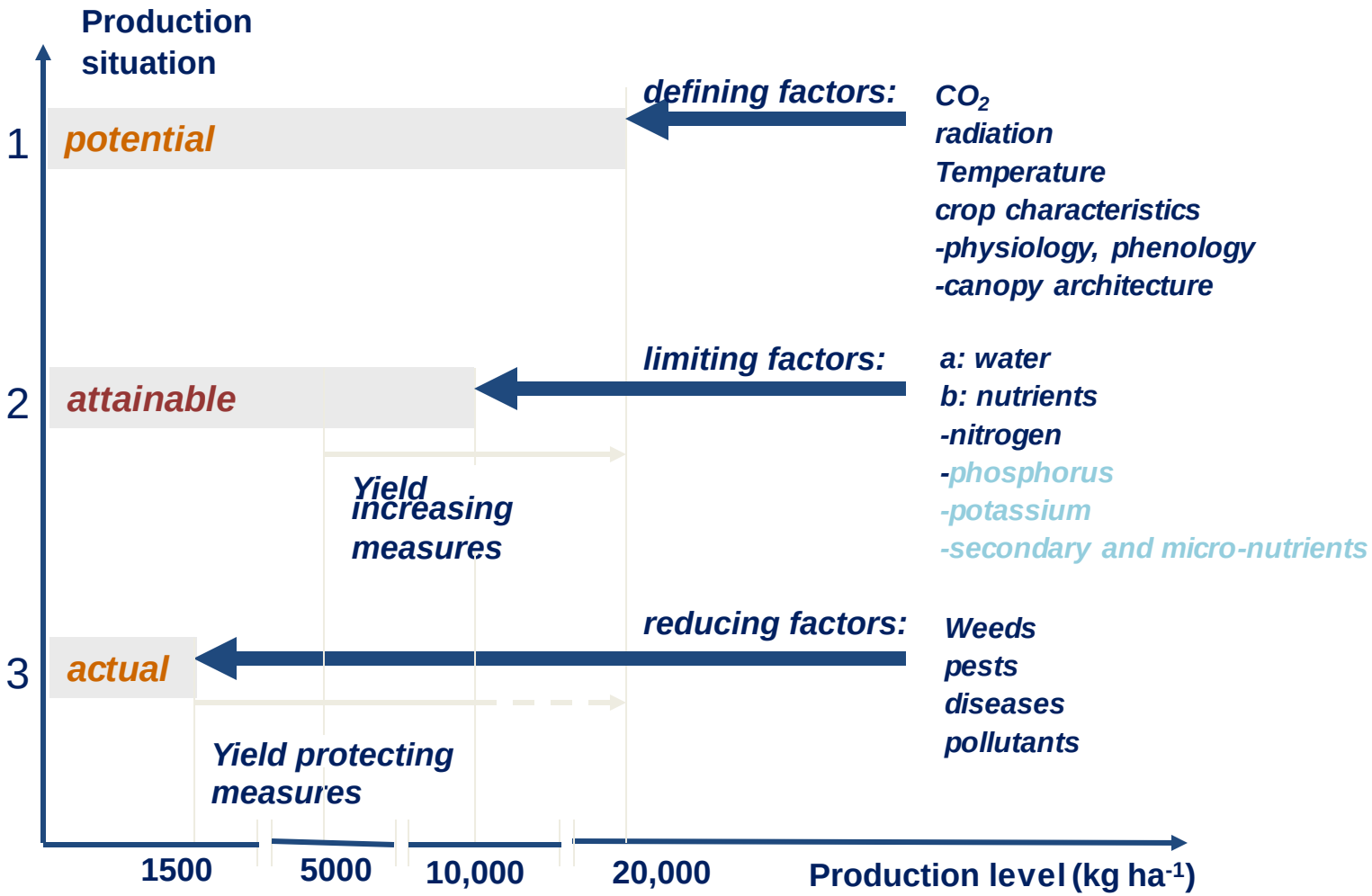
Defining Production



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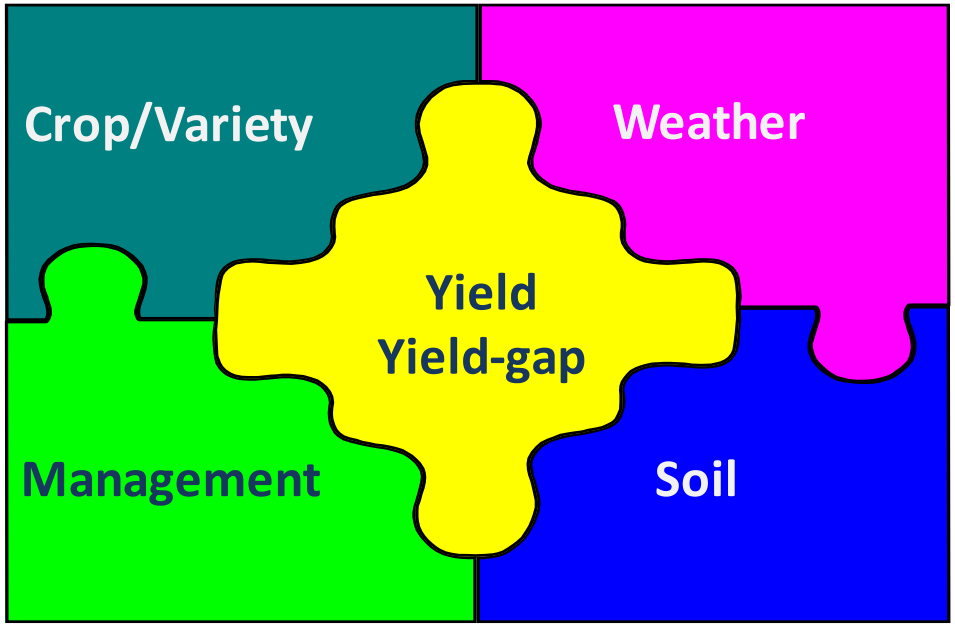
Methodology

- Computer simulation modeling approach using the CERES-Rice and CERES-Maize models.
- 18 locations representing the FSI and LIFT projects' field sites



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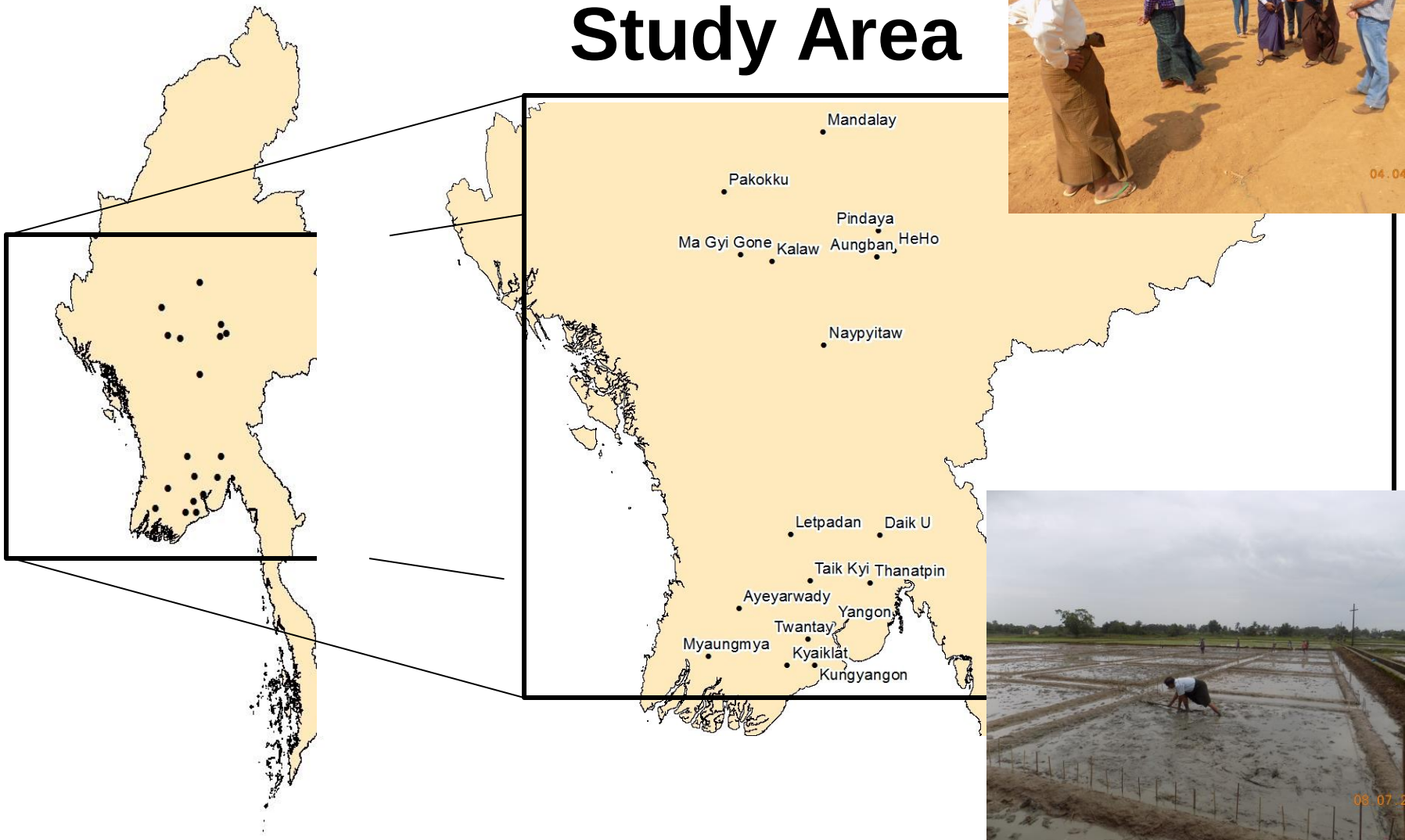
Study Area



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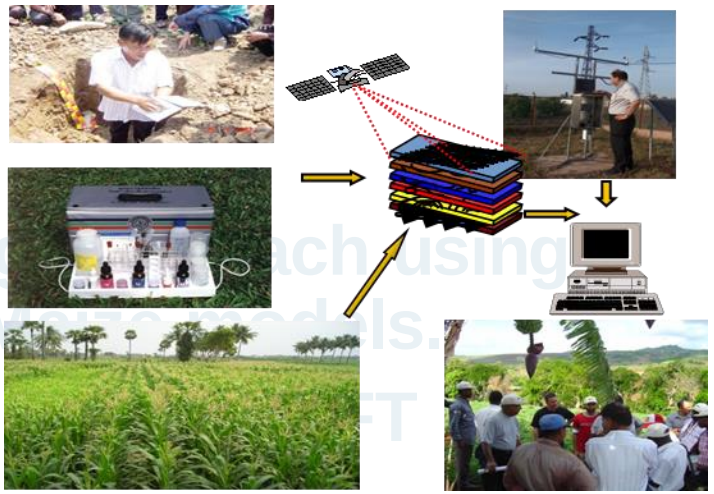
Methodology



- Computer simulation modeling approach using the CERES-Rice and CERES-Maize models.
- 18 locations representing the [illegible]T projects' field sites
- **Soils data was obtained from harmonized world soil database of ISRIC**
- **Rainfall, maximum temperature, and minimum temperature - Myanmar Meteorology Department and the solar radiation from NASA Power data**
- **Potential yield, rainfed-potential yield and N response yield generated for wet and dry season using 18 (1997-2015) weather years**

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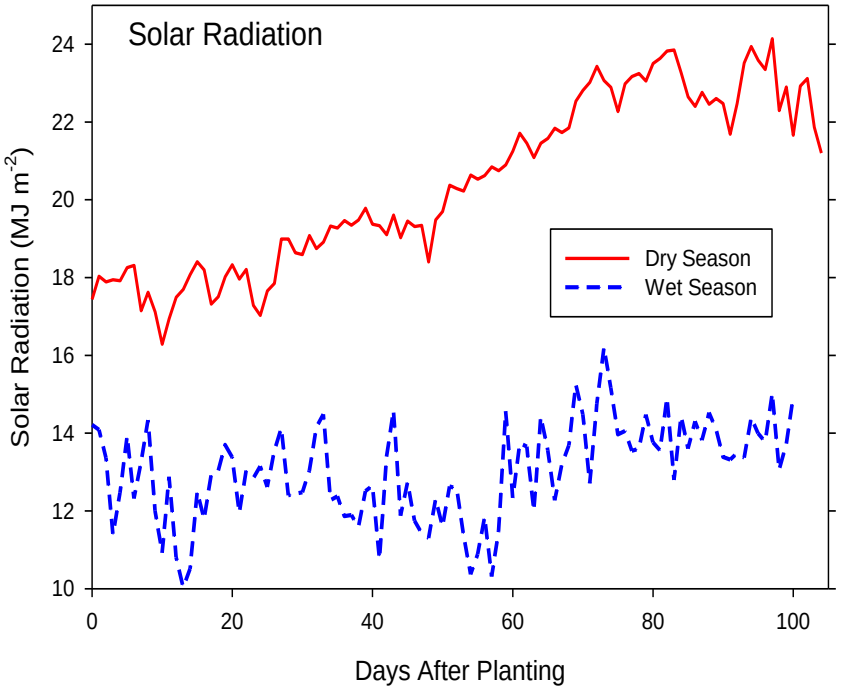
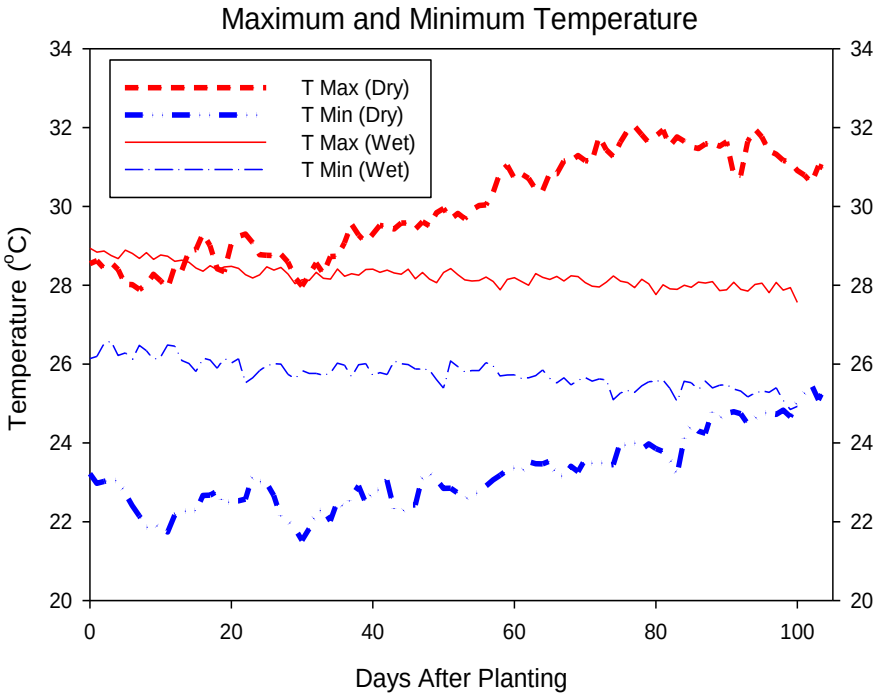
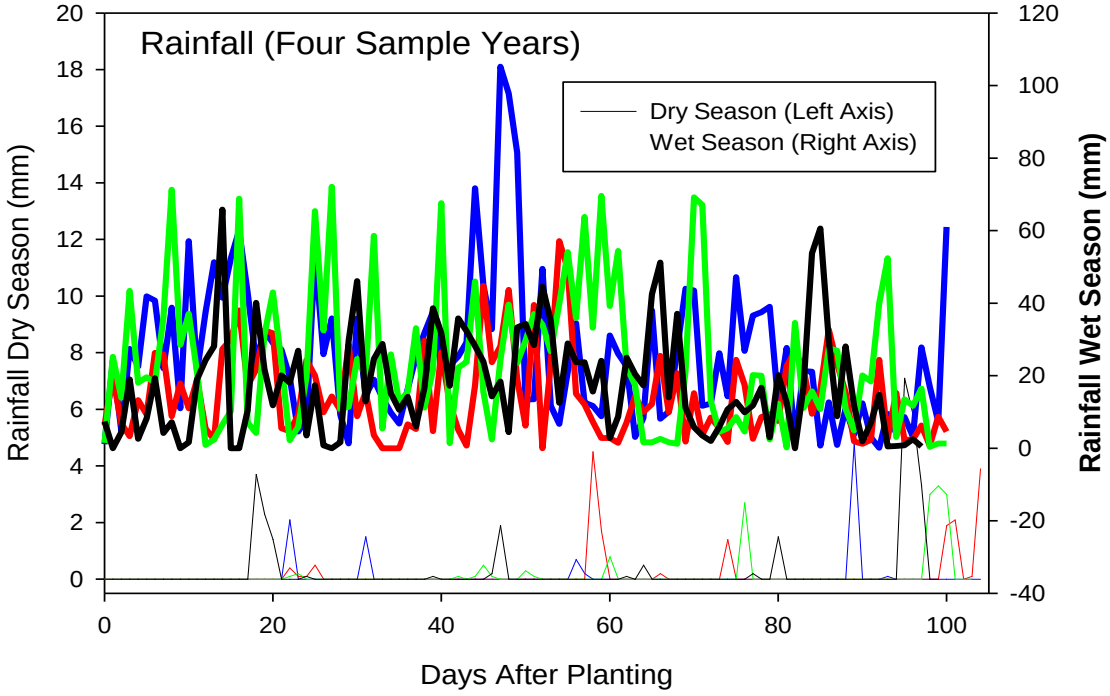
Yangon Weather







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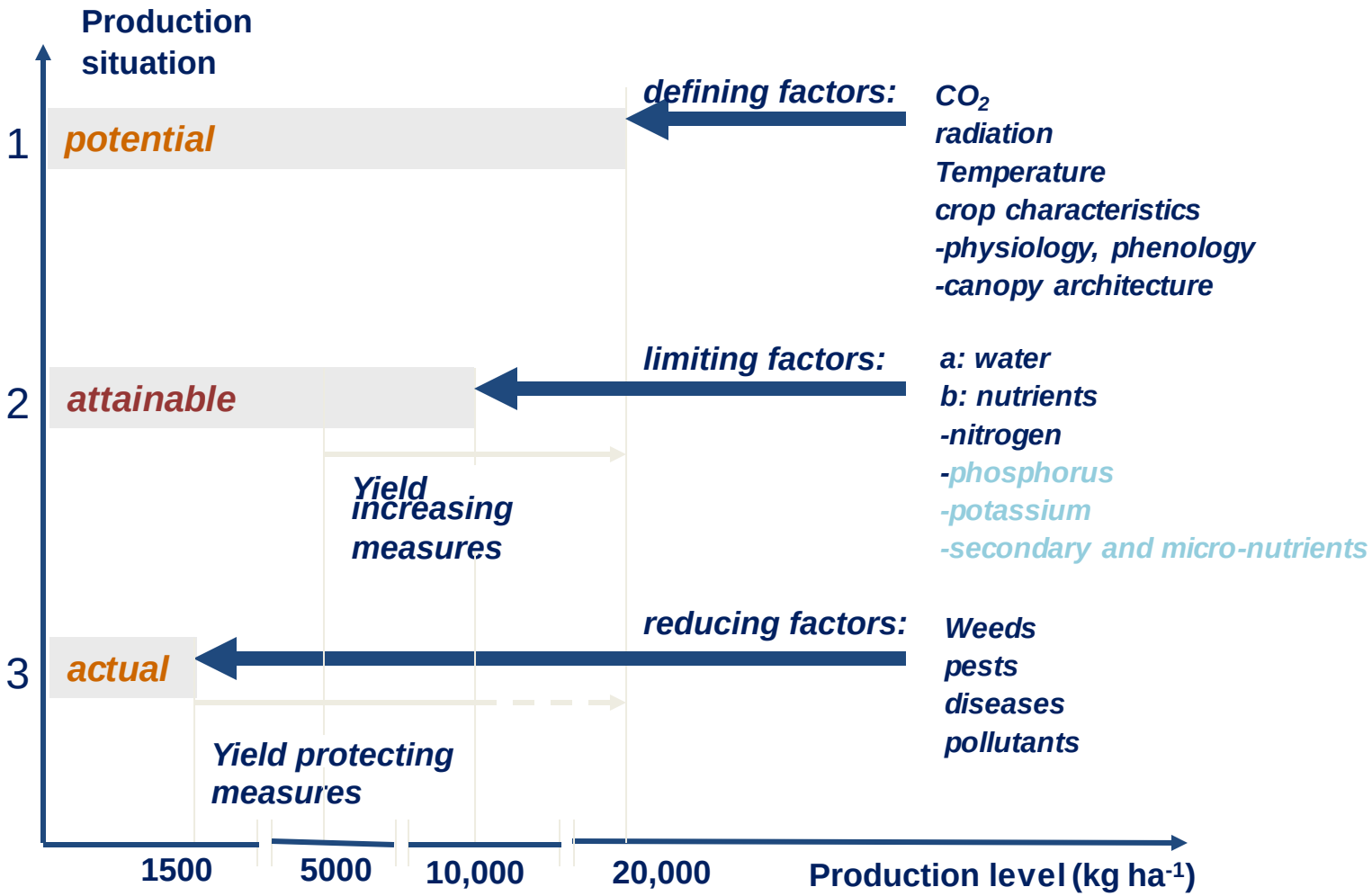
Defining Production



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Results

Wet Season – Rainfed Potential Yield of Rice					
	Yield (t ha^{-1})	Rainfall (mm)	Solar Radiation (MJ m^{-2} day^{-1})	Max Temperature (^oC)	Min Temperature (^oC)
Delta Region	6.5-7.3	1590	13.1	28.2	25.7
CDZ and Shan	9.4-10.3	845	16.5	28.7	23.3
Dry Season – Potential Yield of Rice					
	Yield (t ha^{-1})	Rainfall (mm)	Solar Radiation (MJ m^{-2} day^{-1})	Max Temperature (^oC)	Min Temperature (^oC)
Delta Region	10.2-11.3	30	20.5	30.3	23.3
CDZ and Shan	9.9-13.5	112	22.1	30.4	20.0

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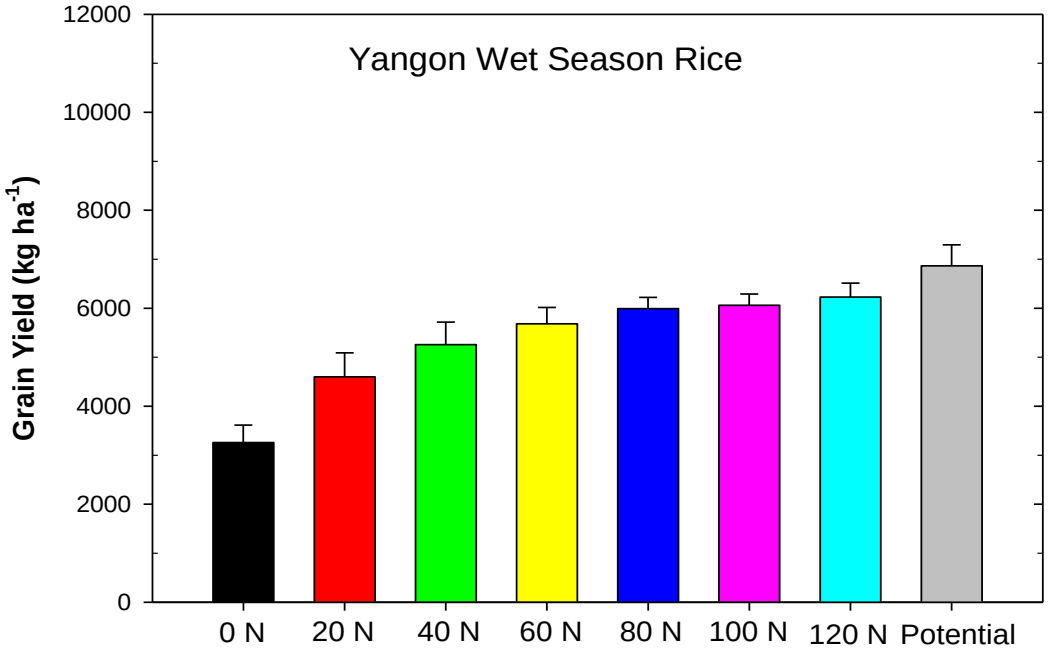
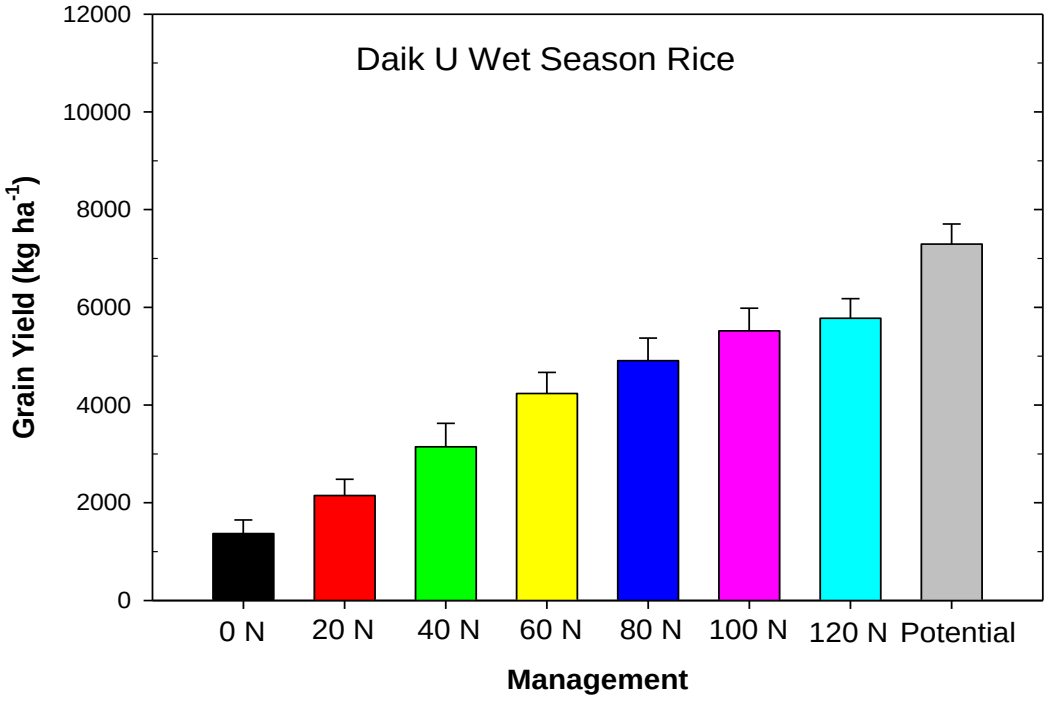
Wet Season Rice – Delta Region





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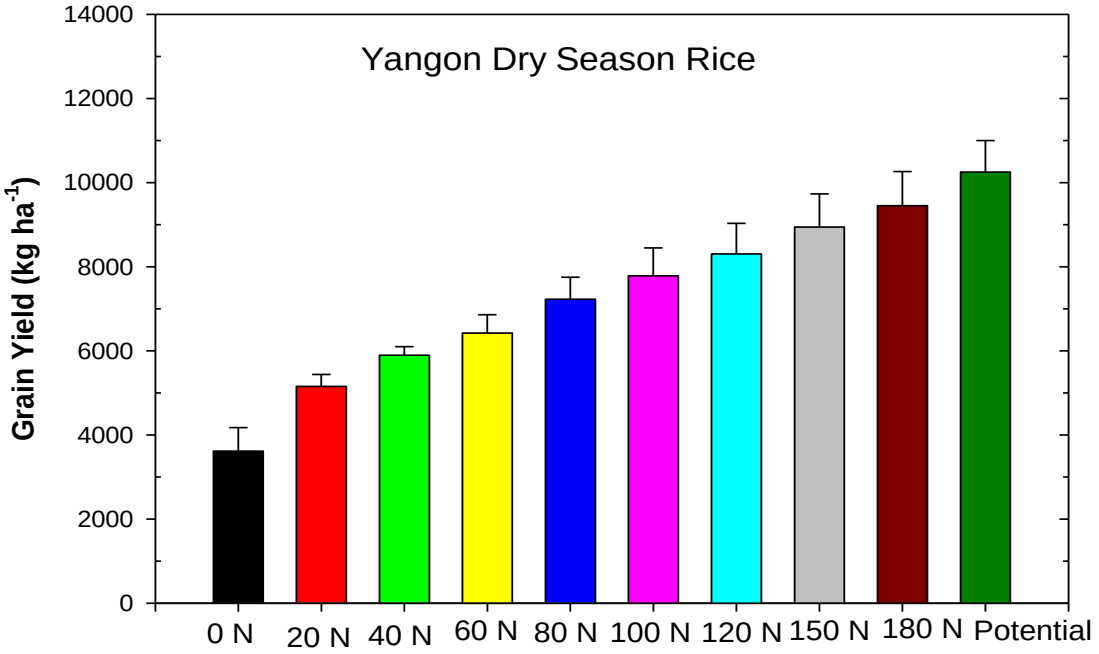
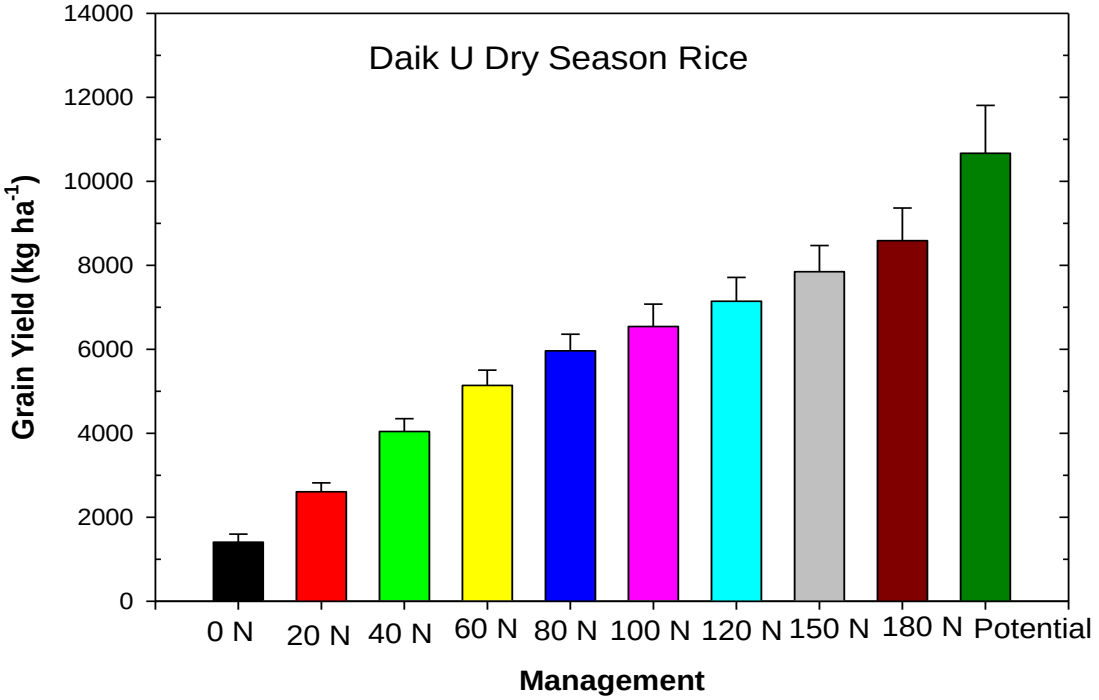
Dry Season Rice – Delta Region





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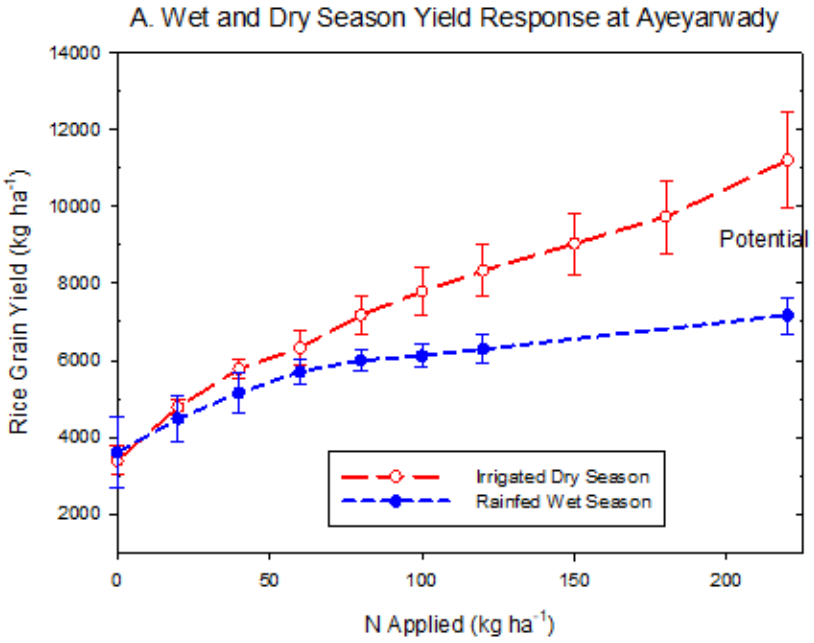
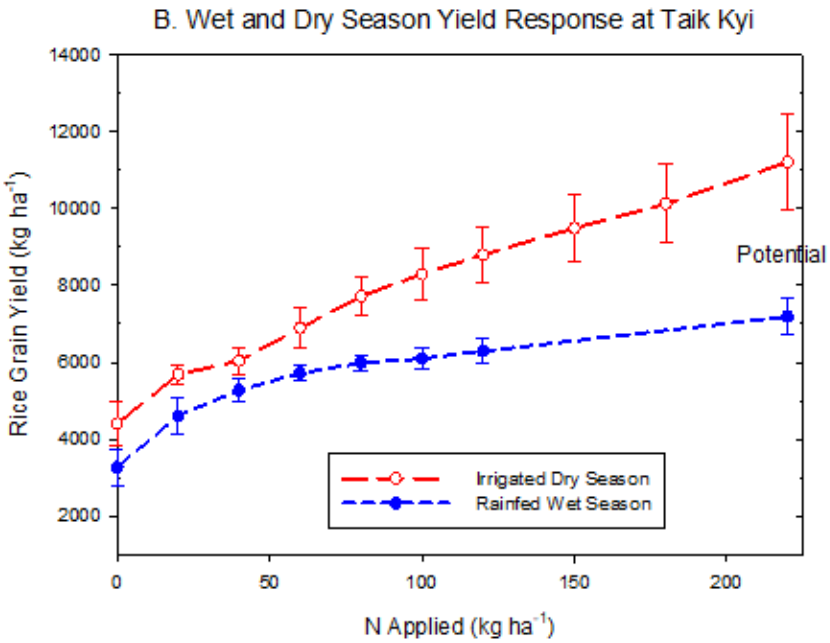
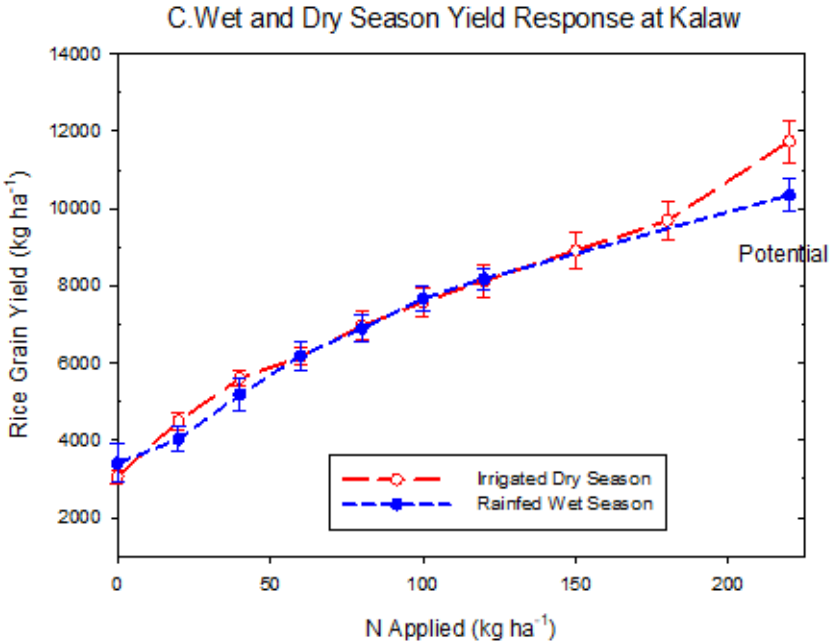
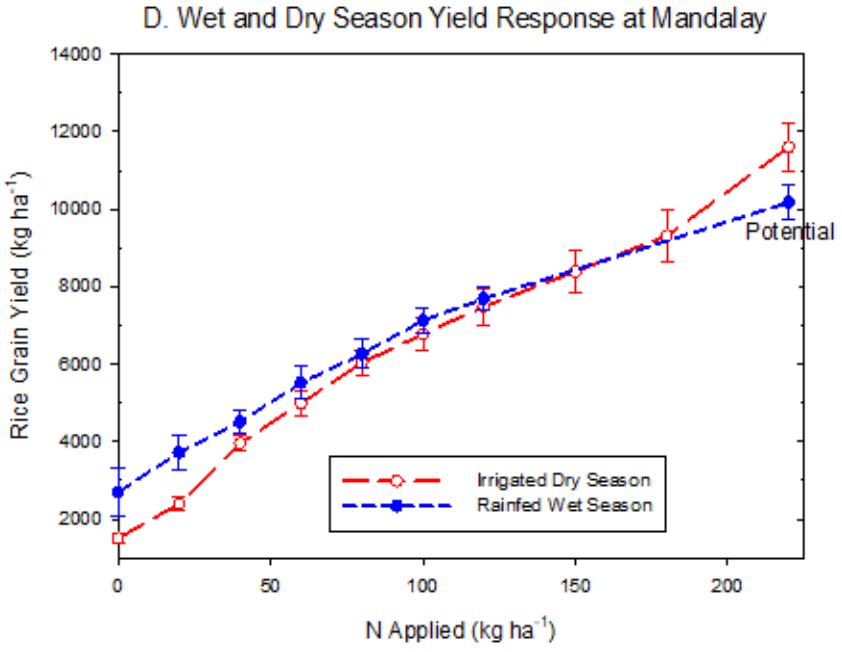
Factors Affecting Yield Gap: Site and Season

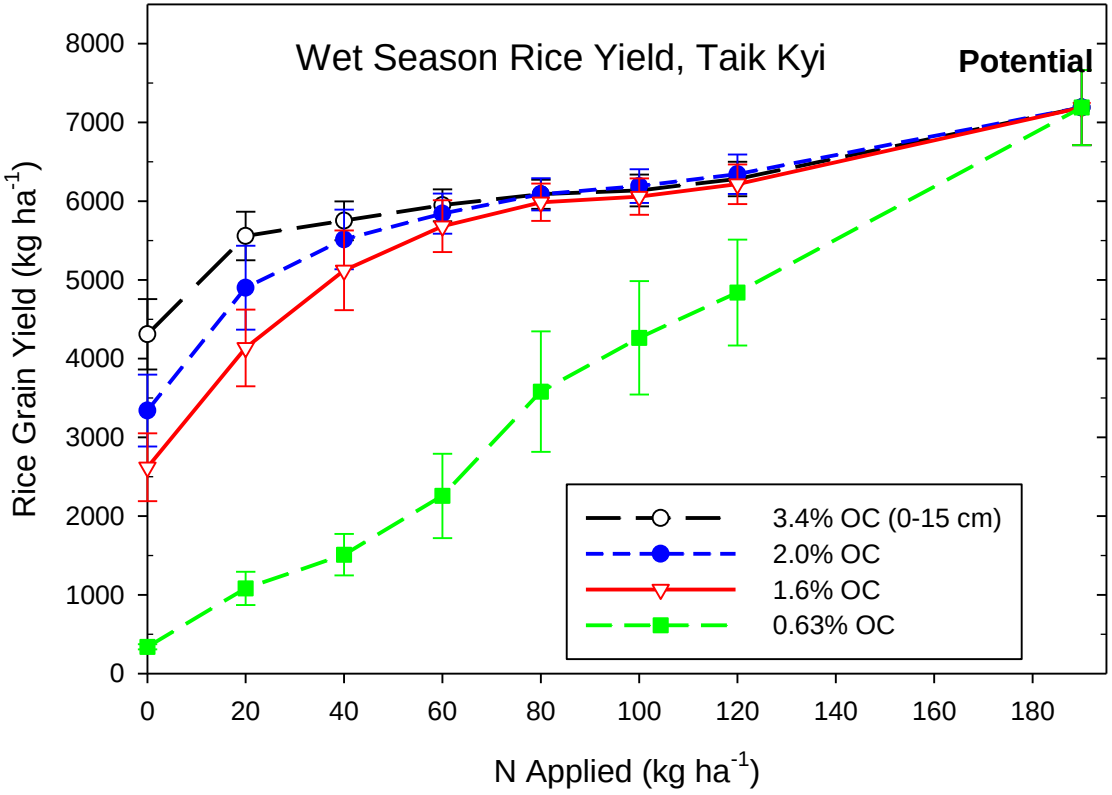








Factors Affecting Yield Gap: Soil Fertility



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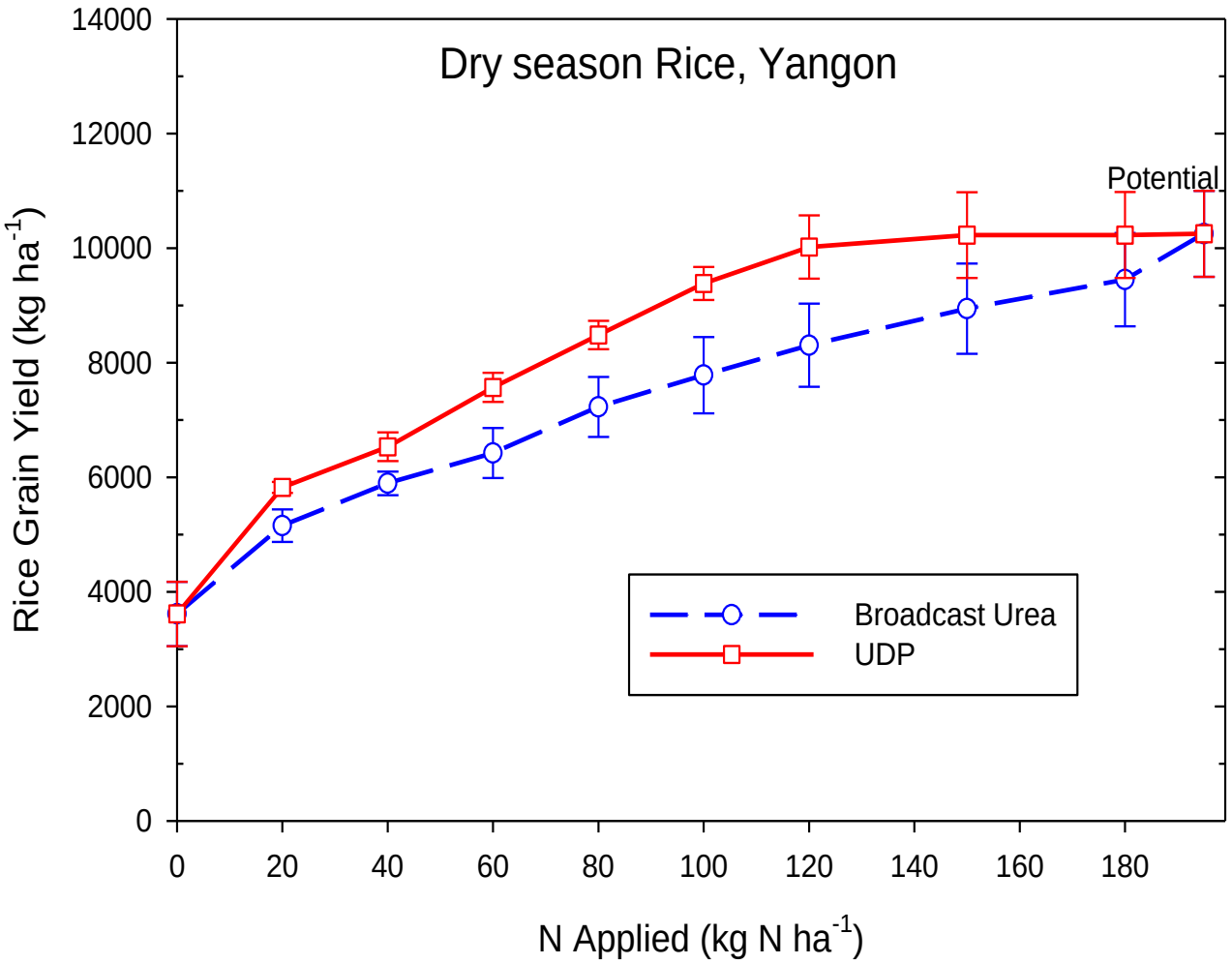
Factors Affecting Yield Gap: Technology



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Conclusion and Recommendations

- Potential yield determination provides the opportunities and constraints for growing a crop in a given environment
- Yield-gap ➔ intensification
  ➔ yield-limiting constraints.
- Large differences in yield potential for wet vs dry season rice in the Delta Region than reported ➔ identify limiting factors and reduce the yield-gap for dry season rice
- Changes in N response function was dictated by both the yield potential and the native soil fertility

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Conclusion and Recommendations

- The importance of soil testing for providing current and reliable soils data for fertilizer recommendations is amply evident
- Effective agricultural intensification therefore requires a concerted effort to incorporate site-specific soils and weather data
- Decision support tools can improve the efficiency of agricultural research and technology transfer; however, as with any other tools, they need to be evaluated under Myanmar conditions.