

## Climate resilience in crop rice: advancing the germplasm for submergence tolerance

F. M. Junkeer<sup>1</sup>, G. D. A. Priyantha<sup>2</sup>, W. D. P. Weerasinghe<sup>2</sup>, D. M. R. G. Mayakaduwa<sup>1\*</sup>, D. M. Withanawasam<sup>2</sup>, R. A. N. M. S. Senanayake<sup>3</sup>

<sup>1</sup>Department of Plant Sciences, University of Colombo, Sri Lanka, <sup>2</sup>Regional Rice Research and Development Centre, Bombuwala, Sri Lanka, <sup>3</sup>Rice Research and Development Institute, Bathalagoda, Ibbagamuwa, Sri Lanka

### INTRODUCTION & AIM

Rice provides food and livelihood to nearly half of the world's population. Flooding is a severe natural disaster that poses a major threat to rice production all over the world, leading to significant economic losses (Oladosu et al., 2020). Approximately 40 million hectares are cultivated in worldwide rainfed lowland areas that are prone to seasonal flooding (Panda & Barik, 2021). Therefore, the development of submergence tolerance rice varieties has become crucial. The AFACI SHR project is a collaborative effort aimed at screening rice entries for short-term submergence tolerance. The study was conducted at the Rice Research and Development Centre in Bombuwala, Sri Lanka. The present study evaluated a total of 138 rice entries, including both locally and internationally developed lines and varieties for submergence tolerance under artificially induced submergence conditions. Further analysis was performed to identify the morphological, physiological, biochemical, and anatomical changes that occur in the selected rice entries during submergence.

### METHODOLOGY- Phase I

#### Preparation of seed samples

- ✓ Pre-germinated seeds
- ✓ Trays filled with paddy soil
- ✓ 15 entries in one tray
- ✓ 10 seeds per row
- ✓ 3 replicates for each entry
- ✓ CRD
- ✓ Three checks, IRR1 119 (tolerant), IR 42 and BG 360 (Susceptible)
- ✓ Maintained for 21 days

#### Submergence screening

- ✓ Placed in concrete tank
- ✓ Increasing water (pH 7.1; EC 0.125 mScm<sup>-1</sup>; T 26.5 °C) level up to 1 m
- ✓ De-submergence (when standard susceptible variety started to disintegrate) after 18 days
- ✓ Allowed to recover until 7 days

$$SP = \frac{\text{number of recovered plants 7 days after desubmergence}}{\text{number of germinated seedlings prior to submergence}} \times 100$$

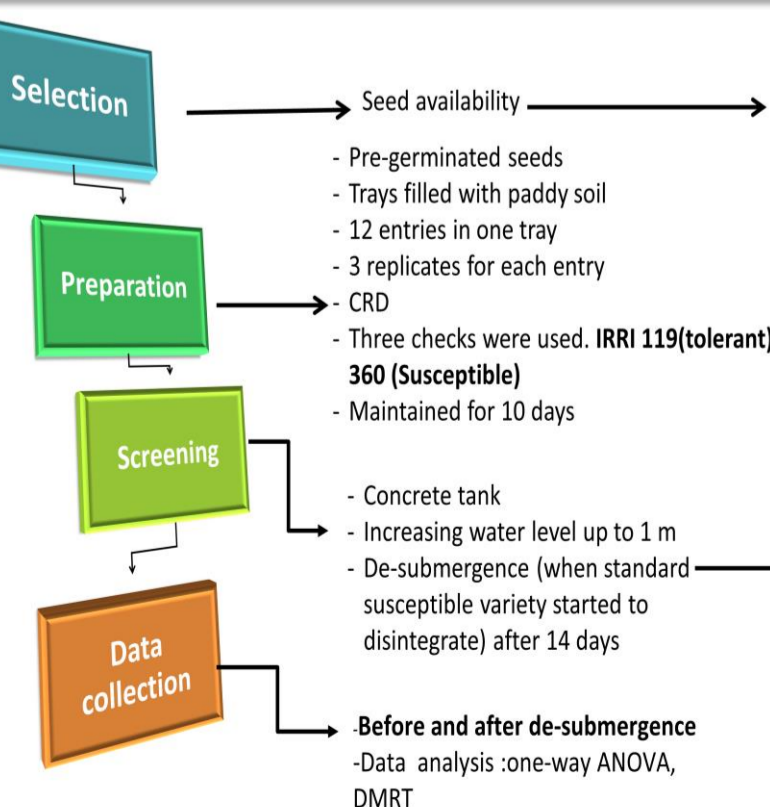
#### Data analysis

- ✓ Entries were categorized based on survival percentages (SP)
- ✓ Used SES (Standard Evaluation System) for rice (IRRI, 2013)

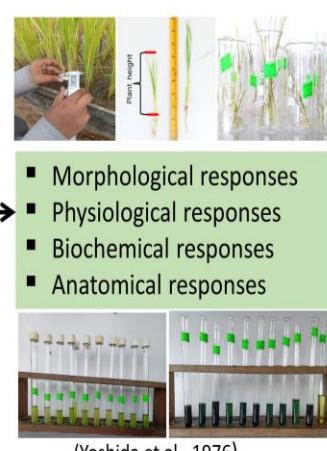
1. Highly Tolerant (HT)
2. Tolerant (T)
3. Moderately Tolerant (MT)
4. Moderately Susceptible (MS)
5. Susceptible (S)



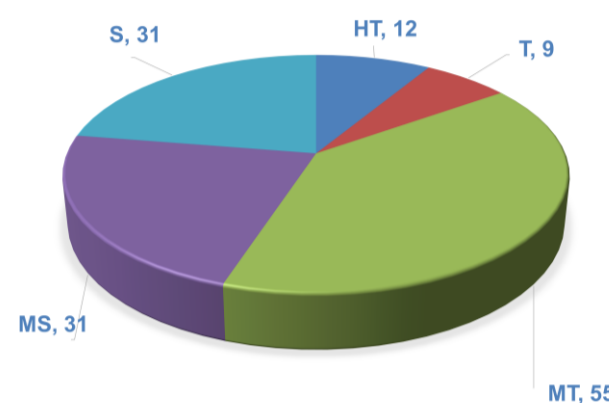
### METHODOLOGY- Phase II



HT	BW 364, Ciherang-sub1
T	BWNP 14-7-5
MT	IR16A4085, IR16A3891, BG 379-2, BG21-3725, NPBLB72-1
S	IRRI 154



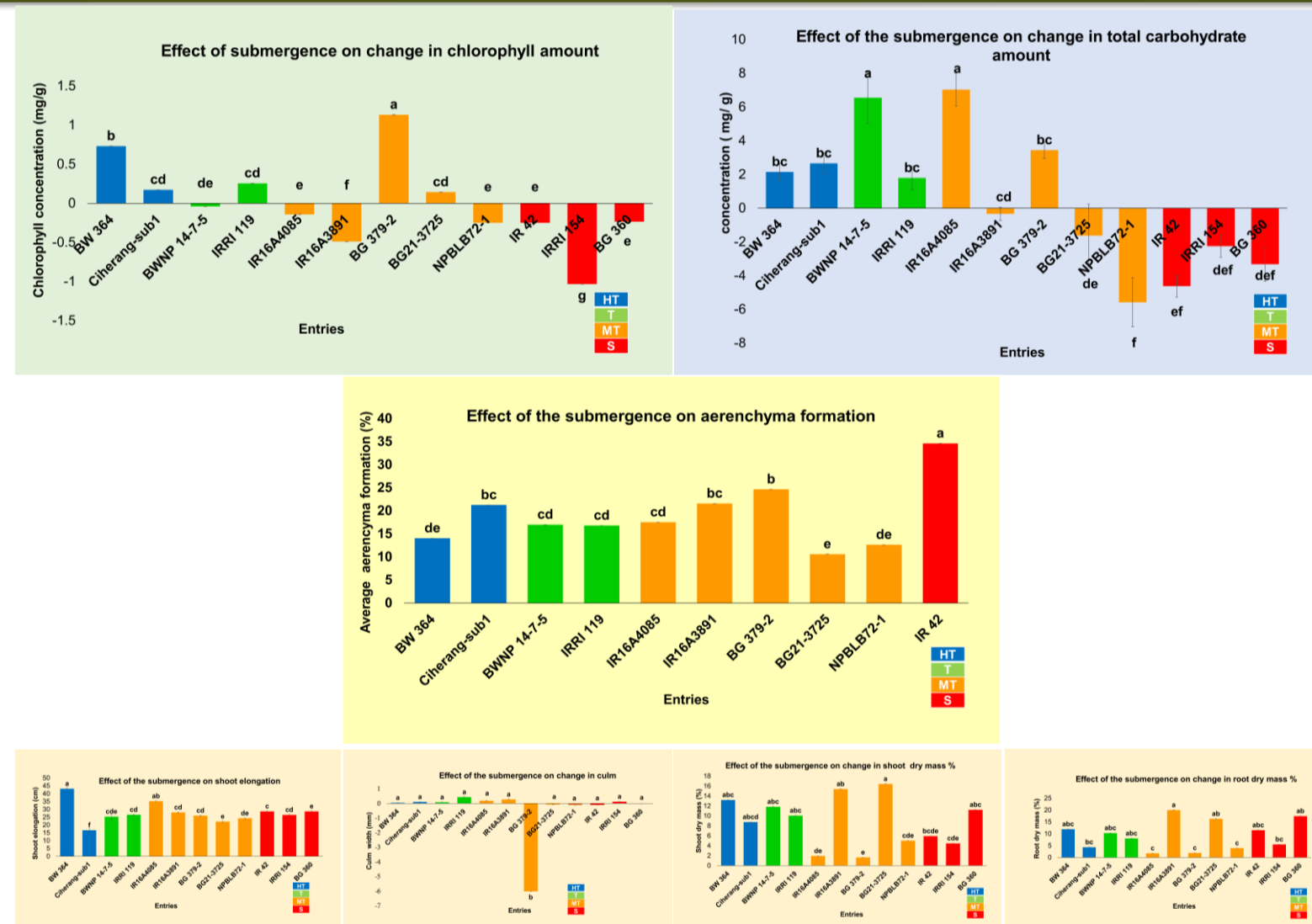
### RESULT- Phase I



#### Highly tolerant

1. IR19LT1717
2. IR19LT1724
3. IR20LT2438
4. IR20LT2580
5. IR20LT2585
6. IR20LT2376
7. IR20LT2449
8. IR18A1223
9. BG21-3738
10. IR64 SUB1
11. BW 364
12. Ciherang-sub1

### RESULT -Phase II



### DISCUSSION & CONCLUSION

- » According to the SES for rice, 138 rice entries were categorized into five groups; HT (12 entries), T (9 entries), MT (55 entries), MS (31 entries), S (31 entries)
- » Changes in physiological, biochemical, and anatomical parameters could be used to distinguish rice entries according to the level of submergence tolerance.
- » The highly tolerant group exhibited chlorophyll accumulation (0.17-0.73 mg g<sup>-1</sup>), while the susceptible group showed degradation (0.23-1.03 mg g<sup>-1</sup>).
- » Nonstructural carbohydrates showed accumulation (1.79-6.55 mg ml<sup>-1</sup>) in highly tolerant and tolerant groups, while degradation (2.25-4.46 mg ml<sup>-1</sup>) was observed in the susceptible group.
- » Susceptible check IR 42 exhibited significantly higher (P < 0.05) aerenchyma formation (34.6%) compared to highly tolerant, tolerant, and moderately tolerant groups.
- » Changes in morphological parameters could not be clearly related to respective stress responses.

### REFERENCES

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