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Effects of Halo- and Hydropriming on Early Rice Seedling Vigour under Salinity

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Introduction

A rising sea level leads to increased tidal flooding and saline groundwater, impairing field emergence and salt stress in rice cultivation. Priming is a seed pre-treatment, which involves soaking of the seed in a solution and subsequent redrying. This treatment initialises molecular processes involved in germination. It has been shown to improve plant stress tolerance in diverse species under a variety of abiotic stresses during germination. Different treatments are possible, such as priming seeds in water (hydropriming) and priming seeds in salt solution (halopriming).

Conclusion

- Priming can improve germination speed, even under saline conditions.
- Hydro- and halopriming vary in their effect on germination speed and endosperm use efficiency.
- Interactions between priming treatment and variety should be further investigated.
- Additional research into how priming can effectively mitigate salt stress in rice cultivation is needed.

Results and Discussion

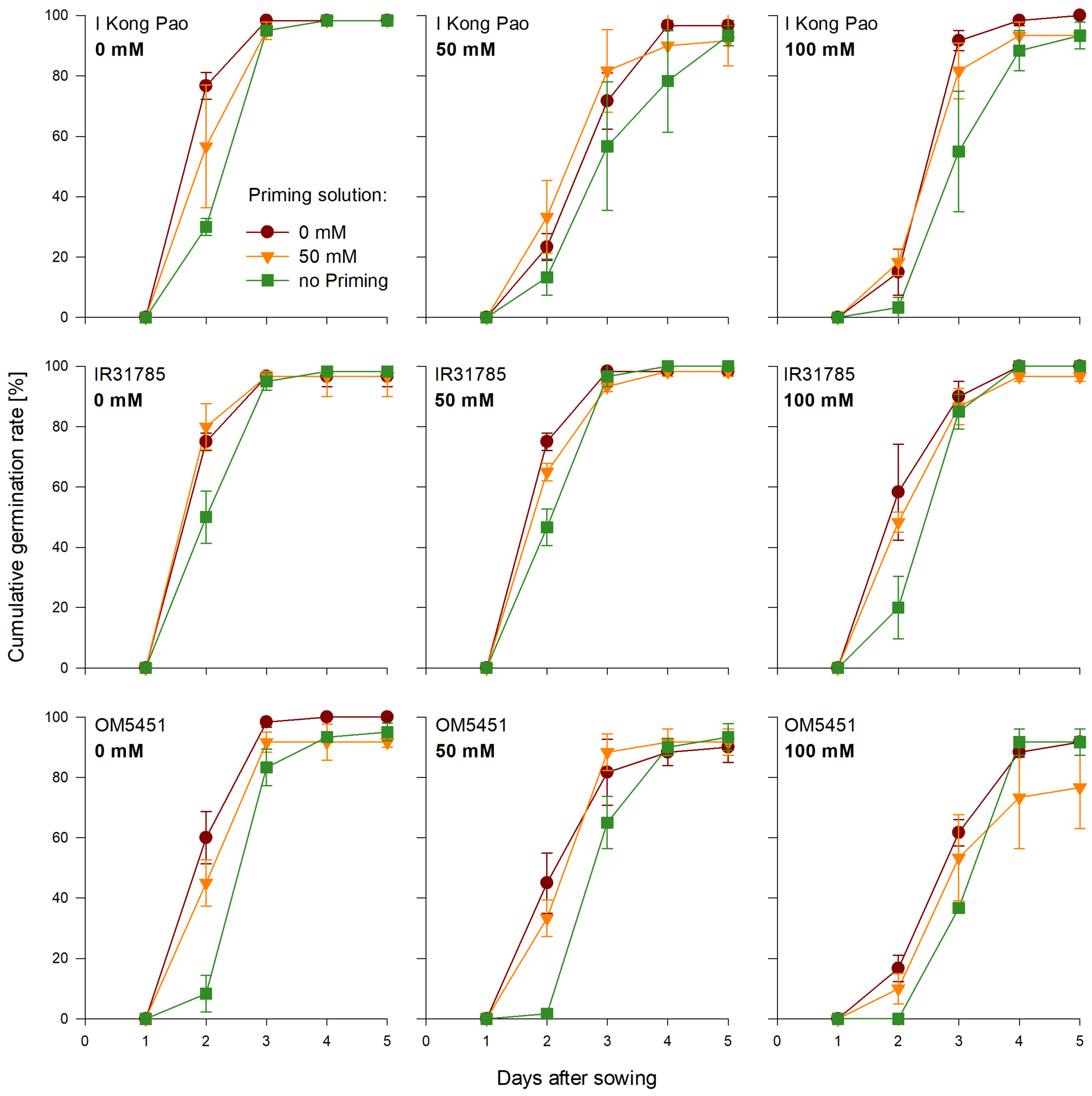

Figure 1 Cumulative germination rates in the germination test of different varieties under diverse salinity conditions and priming treatments

Table 1 Mean germination time (days)

Variety	Salinity	NaCl-concentration of the Priming treatment 0 mM	50 mM	100 mM	no Priming
I Kong Pao	0 mM	2,22±0,04^{a}	2,46±0,22^{ab}	2,45±0,12^{ab}	2,73±0,04^{b}
	50 mM	3,02±0,05^{a}	2,80±0,20^{ab}	2,63±0,11^{ab}	3,42±0,40^{b}
	100 mM	2,95±0,03^{a}	3,01±0,12^{a}	3,45±0,28^{a}	3,49±0,29^{a}
IR31785	0 mM	2,22±0,04^{ab}	2,10±0,09^{a}	2,27±0,04^{b}	2,53±0,10^{c}
	50 mM	2,24±0,04^{a}	2,39±0,06^{abc}	2,49±0,13^{b}	2,57±0,09^{c}
	100 mM	2,52±0,21^{a}	2,54±0,1^{a}	2,60±0,08^{a}	2,95±0,08^{a}
OM5451	0 mM	2,42±0,10^{a}	2,56±0,06^{ab}	2,77±0,03^{bc}	3,05±0,11^{c}
	50 mM	2,69±0,22^{a}	2,67±0,07^{a}	3,15±0,10^{ab}	3,31±0,12^{b}
	100 mM	3,23±0,06^{a}	3,28±0,17^{a}	3,56±0,32^{a}	3,60±0,04^{a}

a-c different letters indicate significant differences between priming treatments, All HSD-tests were done with a significance level of α=0,05.

Table 2 Endosperm use efficiency (Seedling weight increase [g] / kernel weight loss [g])

Variety	Salinity	NaCl-concentration of the Priming treatment 0 mM	50 mM	100 mM	no Priming
I Kong Pao	0 mM	0,41±0,02^{a}	0,46±0,07^{a}	0,37±0,05^{a}	0,38±0,01^{a}
	50 mM	0,36±0,06^{a}	0,45±0,22^{a}	0,32±0,08^{a}	0,28±0,13^{a}
	100 mM	0,20±0,03^{a}	0,53±0,14^{a}	0,10±0,05^{a}	0,35±0,21^{a}
IR31785	0 mM	0,33±0,17^{a}	0,54±0,04^{a}	0,52±0,05^{a}	0,36±0,02^{a}
	50 mM	0,67±0,13^{b}	0,48±0,04^{ab}	0,60±0,06^{b}	0,34±0,01^{a}
	100 mM	0,57±0,01^{b}	0,51±0,03^{b}	0,79±0,08^{c}	0,27±0,01^{a}
OM5451	0 mM	0,47±0,05^{a}	0,40±0,01^{a}	0,42±0,01^{a}	0,51±0,08^{a}
	50 mM	0,42±0,06^{a}	0,43±0,02^{a}	0,39±0,04^{a}	0,42±0,06^{a}
	100 mM	0,73±0,42^{a}	0,18±0,09^{a}	0,28±0,11^{a}	0,42±0,05^{a}

a-c different letters indicate significant differences between priming treatments, All HSD-tests were done with a significance level of α=0,05.

- Priming treatments reduced mean germination time (MGT) under 0 and 50mM NaCl treatment.
- Hydropriming accelerated germination more than Halopriming.
- Endosperm use efficiency (EUE) was positively affected by priming only in IR31785.
- Priming increased EUE at both salt treatments in IR31785.

- ➢ Priming treatments accelerated germination.
- ➢ MGT decreases from 100 to 0mM priming treatment.
- ➢ Effect of priming on EUE seems to depend on variety.
- ➢ Priming treatments vary in their effect across germination parameters.

Material and Methods

The seed moisture uptake pattern of three rice varieties in three different priming solutions (0, 50 and 100mM NaCl) was assessed and no difference related to the NaCl-concentration was found. Seeds were then primed in these solutions and a germination test on wet filter paper under salinity conditions of 0, 50 and 100mM NaCl was carried out. Germinated seeds were counted daily for ten days to calculate mean germination time, or the time needed on average to reach the maximum germination percentage. Endosperm use efficiency was calculated as the ratio of the increase of seedling dry matter to the decrease of seed dry matter between the start of the experiment and day 6.