ADDRESSING SEAWATER INTRUSION AT DIFFERENT GROWTH STAGES OF RICE (*Oryza sativa L.*) USING SELECTED SALINE TOLERANT VARIETIES

CRYSTA FARPARAN GAUDIEL

INTRODUCTION

Figure 1. Area of the study located in Barangay Guibongan, Miagao, Iloilo, showing the extent of water intrusion that causes salinity.

Salinity due to rising saline water tables or seawater inundation results to high concentrations of soluble salts in the soil solution causing severe water stress in plants. Soil salinization is a common problem in areas experiencing low rainfall. About half of the existing irrigation systems in the world are under the influence of salinization, alkalization, or waterlogging (Szabolcs, 1994). Soil salinization can also be caused by the submerging of farms to seawater brought about by tsunamis (FAO, 2005). For events like typhoons, salinization is caused by the increased in seawater intrusion volume from both seaward boundary and land surface as a result of flooding (Mahmoodzadeh and Karamouz, 2017).

The Food and Agriculture Organization (2014) estimated that around 6.5% or 831 million hectares of the world's total area is affected by saltwater intrusion. Worldwide, more than 45 million hectares of irrigated land have been damaged by salt, and 1.5 million hectares are taken out of production each year as a result of high salinity levels in the soil (Munns and Tester, 2008).

To prevent the conversion of these arable areas and to improve farmers' yields, the use of salt-tolerant varieties becomes a feasible solution to vulnerable areas. The *Salinas* series of rice varieties are saline tolerant varieties developed by International Rice Research Institute (IRRI) and Philippine Rice Research Institute (PhilRice) at salinity levels of 0-8 dS/m EC. Additional information on the effects of rice field inundation by seawater for several days at various rice growth stages will help identify physiological characteristics that will be useful indicators of high salinity tolerance.

OBJECTIVES

1. Evaluate the effects of extreme saline environment on the germination and seedling growth of salt-tolerant rice varieties

2. Assess growth, biomass partitioning, Na uptake, yield and yield components of selected salt-tolerant rice varieties subjected to simulated sea water inundation of paddy at different growth stages

METHODOLOGY

Test Variety

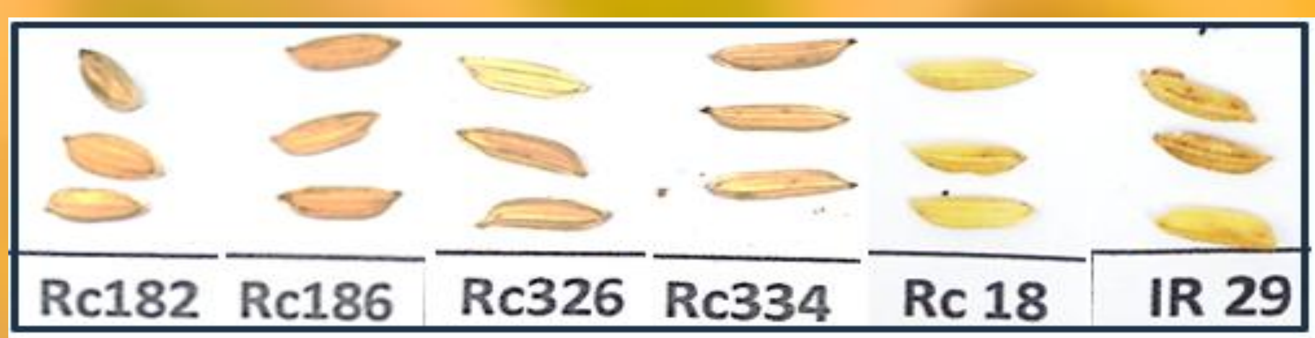
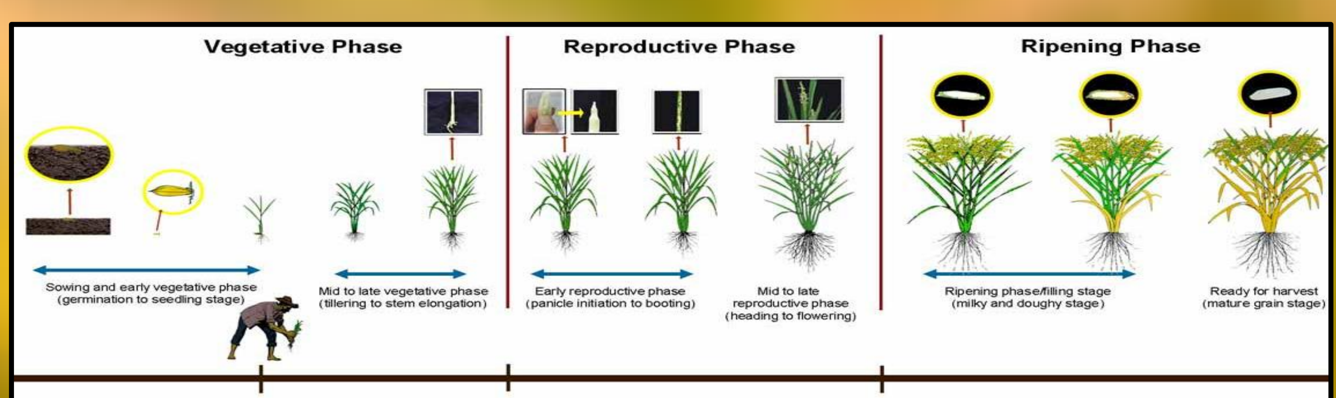


Figure 2. Test varieties. Rc 182-Rc 334 (Salt-tolerant varieties), Rc 18 (Farmer's variety) and IR 29 (Susceptible check)

Salinity stress

- Salinity stress was imposed at different growth stages
- Seawater irrigation (50 liters per $100cm^2$ with 50.97 dS/m EC

Treatment Application



- Vegetative (BBCH 21) - first tiller is visible in 90% of plant population
- Reproductive (BBCH 51) - beginning of panicle emergence where the tip of inflorescence emerged from sheath
- Ripening (BBCH-85) - soft dough stage where the grains are soft, but dry, grains and glumes are still green.

RESULTS

Parameters		Sources of Variations: Replication	Growth Stages (GS)	Variety (V)	GS x V
Growth Parameters	Increase in Plant Height	ns	**	*	ns
	RGR	ns	**	ns	ns
	Leaf Area reduction	ns	**	ns	ns
	Maximum & productive tillers	ns	ns	**	ns
Yield and Yield Components	Panicles per plant	ns	ns	**	ns
	Spikelet per panicle	ns	**	**	ns
	% filled grains	ns	**	*	ns
	No. of days to maturity	ns	**	**	**
	Grain yield per 100m2	ns	**	ns	ns
	1000 grain weight	ns	ns	*	ns
	Biomass partitioning (R/S)	ns	**	**	ns
	Harvest Index	ns	*	**	ns

Table 1. Significant effects of seawater treatment in growth parameters and yield and yield component of different rice varieties stressed at different growth stages.

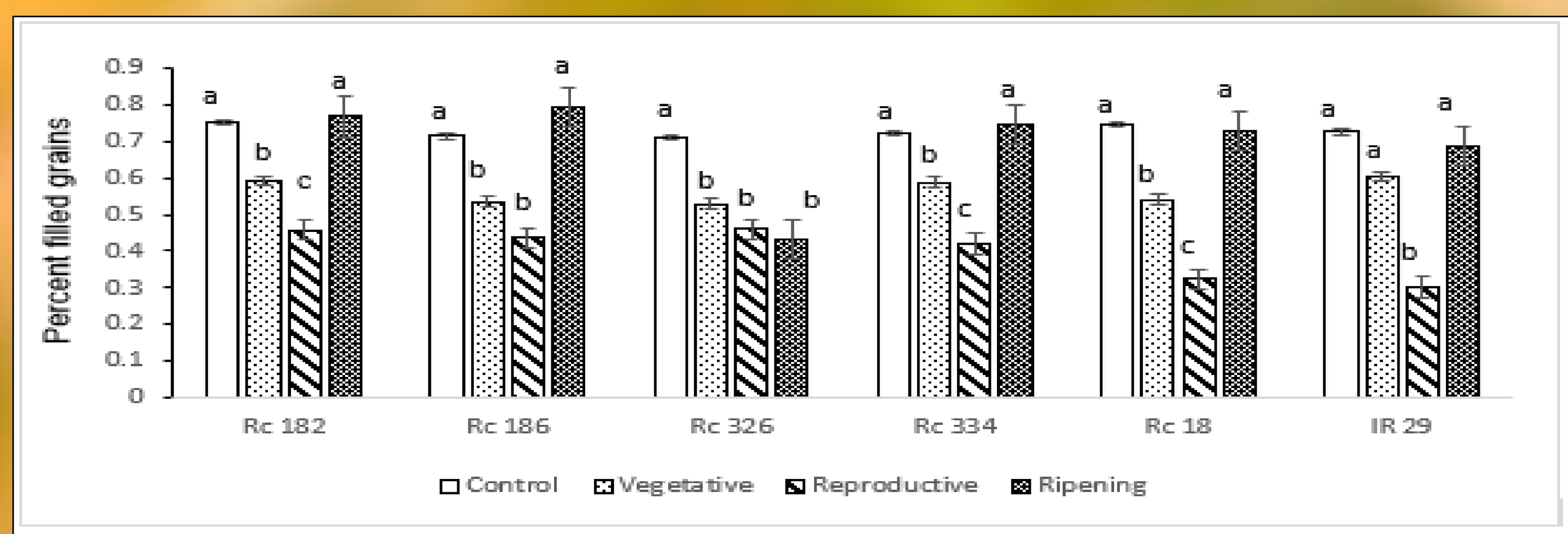


Figure 6. Percent filled grains comparison of treatment at each level of variety. Mean values with the same superscript do not differ significantly (P<o.o5)

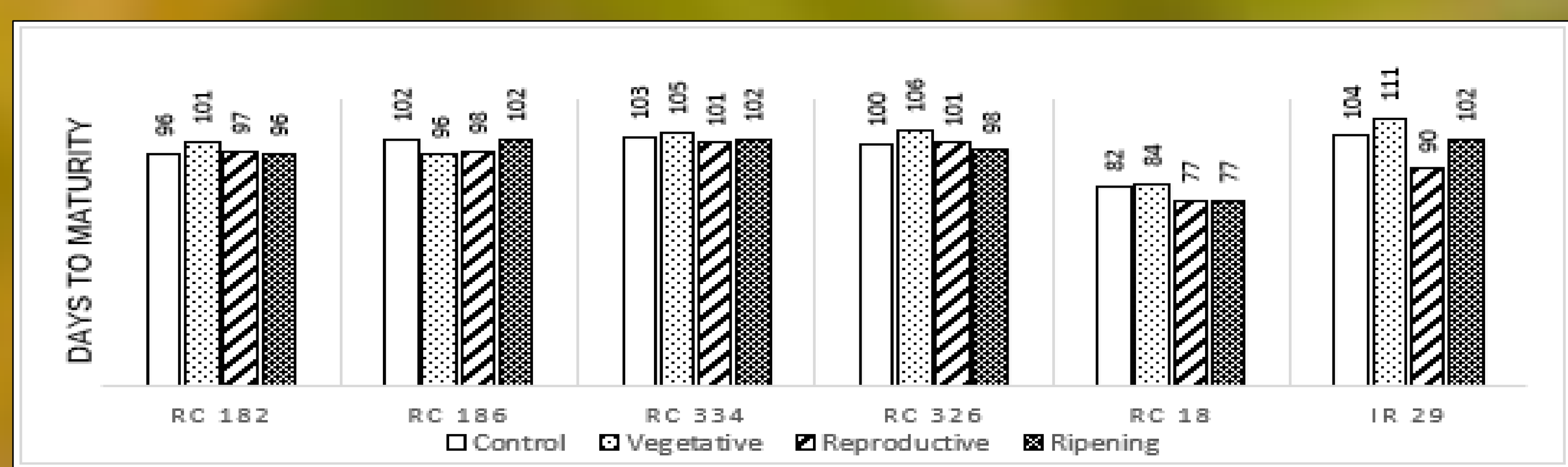


Figure 7. Effects of seawater treatment in number of days to maturity of different rice varieties at different growth stages.

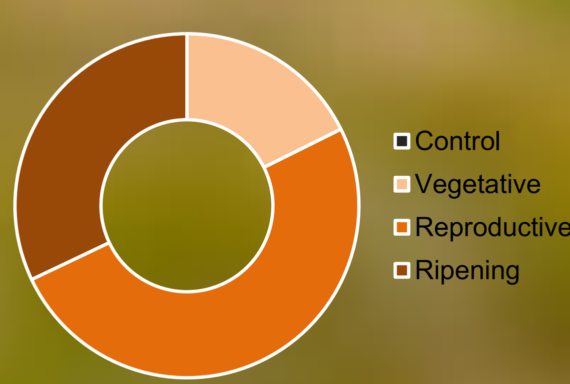


Figure 3. Effects of salinity stress to leaf area reduction at different growth stages.

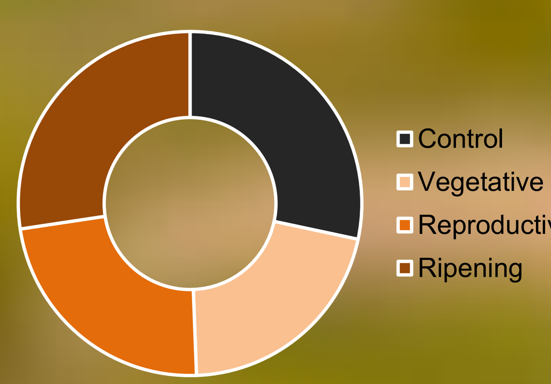


Figure 4. Effects of salinity stress to number of spikelets per panicle at different growth stages.

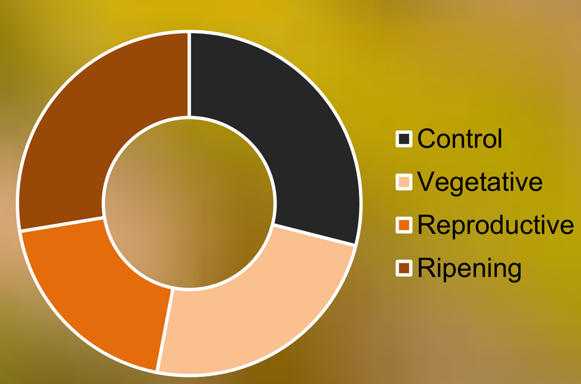


Figure 5. Harvest index of rice varieties stressed with seawater treatment at different growth stages.

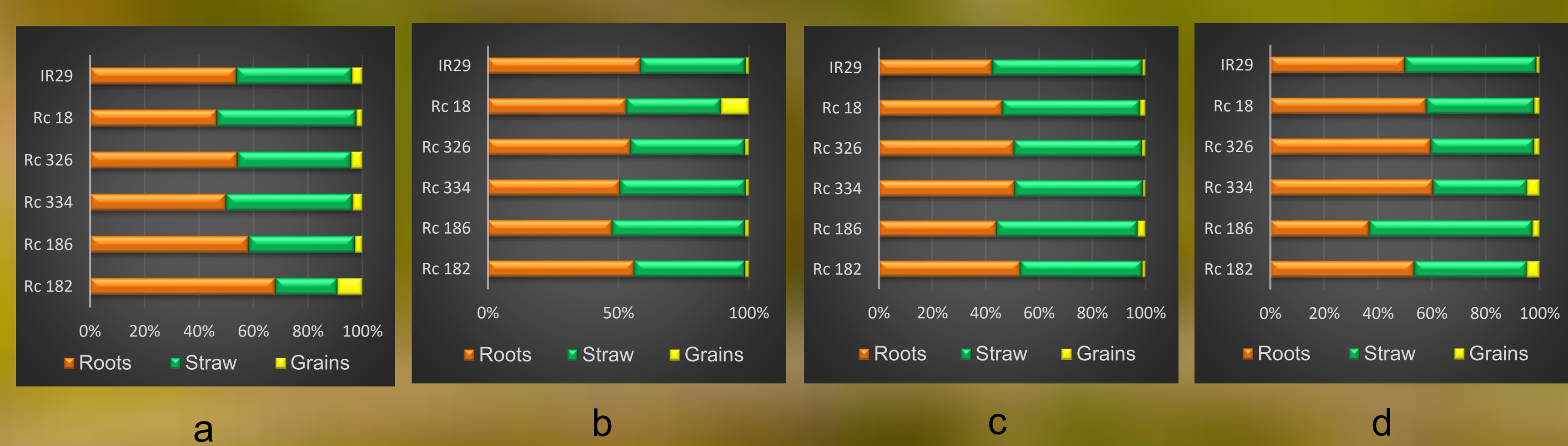


Figure 8. Sodium partitioning in salt-tolerant rice varieties after salinity stress at different growth stages. (a) Control, (b) Vegetative (c) Reproductive and (d) Ripening stage