Selection of drought resistance grain legumes for rice agroecosystems and food security

By

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Background

- Timor-Leste dominates with mountainous and hills
- limited productive flat lowland areas.
- The productive lowland areas are mainly used for rice production once a year.
- This is because there is lack of irrigation water resources to supply for another crop.
- Due to a rapid increase in the population, land availability for crop production increasingly limited.
- Lowland areas, however, has not been optimized in crop production,
- A research approach to increase their productivity through growing grain legumes after rice was initiated and identified some potential grain legumes which were used in this study.

Objective

- The objective of current study was to :

  - ✓ Investigate adaptive and compare species under terminal drought and its impact on the growth and yield of the potential grain legumes

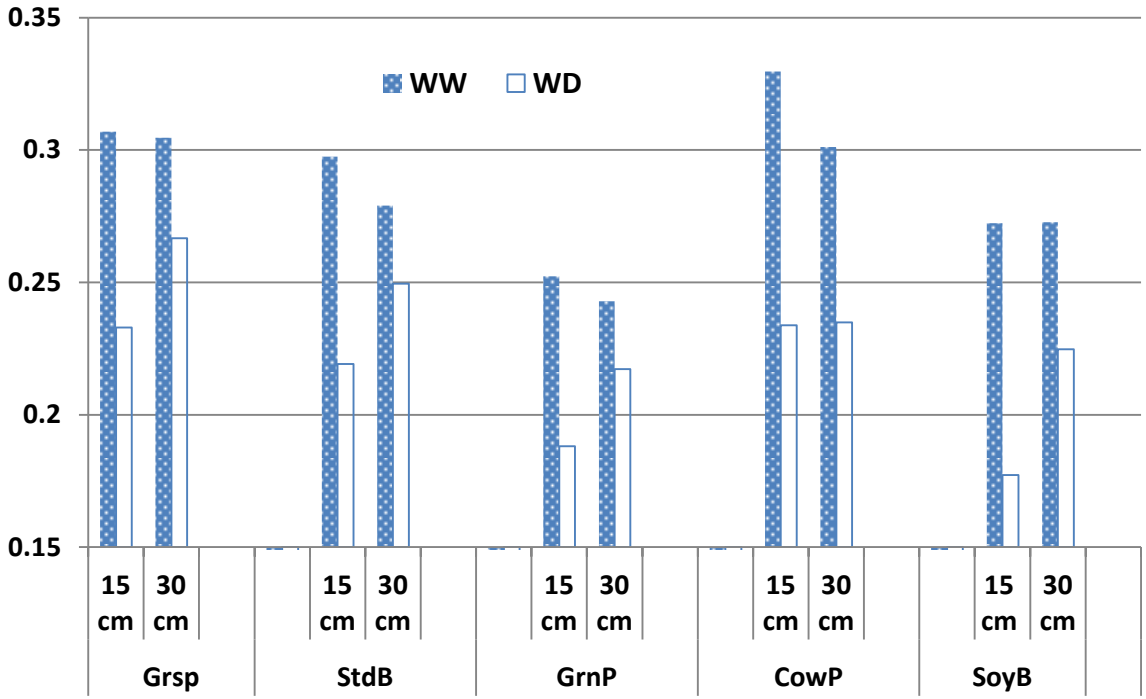
  - ✓ Multiply seed production for grass pea cultivar Ceora

Methodology

- Research location and starting date: Manleuana, Dili from May to September 2016
- Research design: randomized block design with three replications
- There 30 plots and each of the species had 6 plots (three for control and three for drought treatment)
- Planting distance: 25 cm length by 20 cm width with 2-3 seeds/hole
- Species used: soy bean, green pea, pigeon pea, beans and grass pea (*Lathyrus sativus cultivar Ceora*).
- Treatment started 33 days after sowing (DAS)

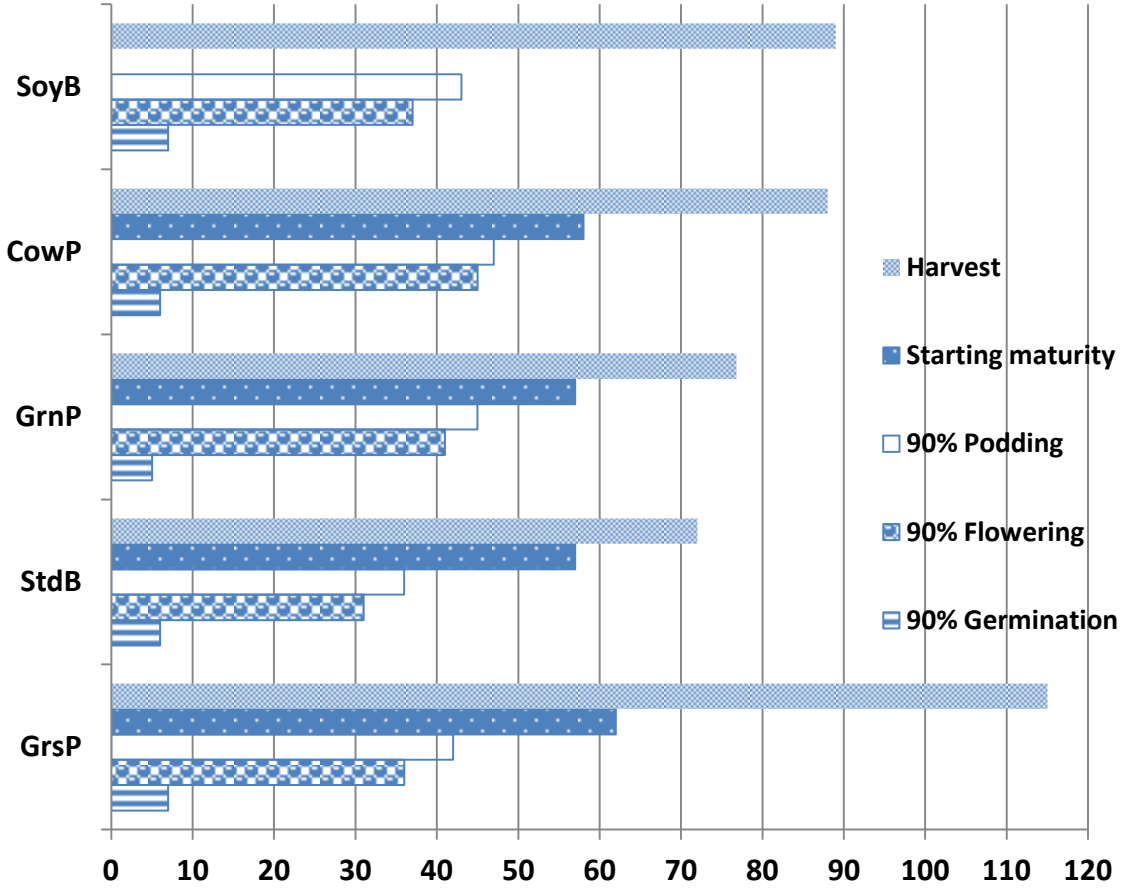
Soil sampling for soil water content determination & plant measurement

Results & Discussion: Gravimetric soil water content (WC)



- ✓ Soil WC observed 60 DAS or 27 days after drought treatment
- ✓ Soil WC of the droughted plants lower than the control plants
- ✓ However the level of WC is still high enough for plants to absorb

Crop phenology



- The fastest germination species was green pea followed by beans and cowpea
- Beans was the earliest flower species in about a month from sowing
- Similarly, beans set pod and reached maturity (70 DAS) faster than any other species
- Grass pea starting maturity in about 60 DAS but due to its indeterminate growth habit it took longer days to complete maturity

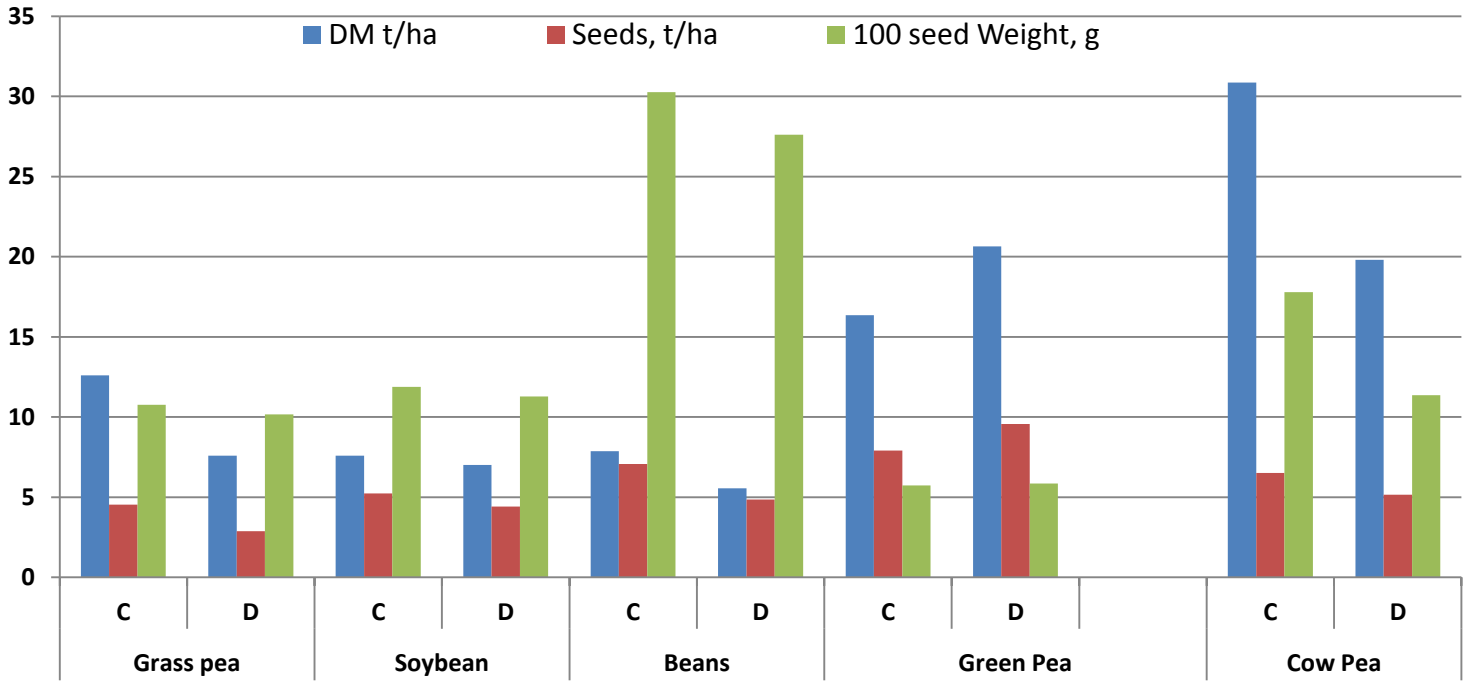

Cow pea

Crop appearance at maturity

Seeds of grass pea

Species	Treat-	Node	Plant	No of	Empty	Filled	Seed/pod	Plant	Seed	100 seed
	ment	No	height, cm	Branches	Pod	Pod		DM, t/ha	DM, t/ha	Weight, g
Grass pea	C	271.6±20.6	72.4±2.4	12.7±2.5	13.8±4.2	32.4±5.6	1.4±0.0	12.6±2.8	4.5±1.1	10.8±0.
	D	225.3±21.5	54.6±3.8	12.1±0.2	11.6±1.3	20.6±4.7	1.4±0.0	7.6±0.7	2.9±0.9	10.2±0.
Soybean	C	13.1±0.7	73.9±3.1	8.9±0.6	2.1±0.5	25.4±5.8	2.0±0.1	7.6±0.9	5.2±1.7	11.9±1.
	D	15.5±1.8	70.9±8.4	9.2±1.2	2.9±0.6	23.5±2.7	2.0±0.01	7.0±0.6	4.4±0.9	11.3±0.
Beans	C	8.8±0.3	36.9±2.5	1.9±0.2	3.6±0.8	9.5±1.1	2.8±0.1	7.9±1.0	7.1±1.2	30.3±0.
	D	8.3±0.2	36.3±0.4	1.8±0.1	3.4±0.2	7.3±0.9	2.7±0.1	5.5±0.3	4.9±0.9	27.6±2.
Green Pea	C	7.9±0.3	71.4±7.4	3.7±0.6	4.1±1.5	14.8±1.8	10.2±0.4	16.4±1.6	7.9±0.9	5.7±0.1
	D	11.3±1.7	72.3±1.2	3.5±0.1	5.8±1.0	13.7±0.2	9.4±0.6	20.6±1.9	9.6±1.5	5.9±0.3
Cow Pea	C	17.4±2.5	194.1±24.8	5.3±0.7	3.1±0.6	5.8±1.4	8.2±0.6	30.9±7.6	6.5±0.9	17.8±0.
	D	13.4±2.5	88.9±30.9	3.5±0.6	1.8±0.4	3.6±2.9	5.4±2.4	19.8±6.9	5.2±4.7	11.4±4.

Yield and yield components



- Cow pea produced highest biomass of >30 t/ha © and the lowest beans of about 5 t/ha (D)
- Green pea was second highest biomass produced
- The highest seed production was green pea (approx. 9.5 t/ha) and the least yield was grass pea which was 2.9 t/ha
- High seed yield in green pea was due to high number in pods and seed per pod

- Grass pea had the highest filled pod no, however it had limited number in seed per pod which was 1.4 seeds per pod on average.
- Beans was the highest seed size (followed by cow pea)
- Beans had a similar yield to cowpea and was the second highest yield observed
- Beans was the fastest maturity species observed in this study and also in the previous study confirming its adaptation to lowland areas during dry season
- Thus beans be potential species for grain production after rice.
- This study also confirmed the adaptation of grass pea cultivar Ceora to a new environment of Timor Leste

Residues management for improving agroecosystems for next cropping

Conclusion and recommendations

- This study observed that all legume plant species tested produced high biomass and thus yield that are potential to grow them after rice.
- In particular, the study confirms adaptation of beans, a high elevation legume crop to lowland areas during the dry season.
- Moreover, the study also confirms the adaptation of grass pea, a new introduced grain legume to new environment in Timor Leste.

- The author is seeking to continue this study at the farm level and release them when necessary.

- The author is therefore seeking a continuous support from Alumni Small Grant in the future to fulfill the plan.

Publication

- UNTL Deskobre Koñesimentu Foun
- September 6, 2016, **DILI, ANTIL News Letter**
- News taken during a field day participated by more than 100 people (students, staffs, lestures, MAF staffs, etc)
- **Presented at a regional IPSI workshop in Malaysia, 18-20 April 2017**

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Thank you