Identification of Drought Resistance Legume Crop Species for Growing Them after Rice to Improve Food Security in Timor-Leste

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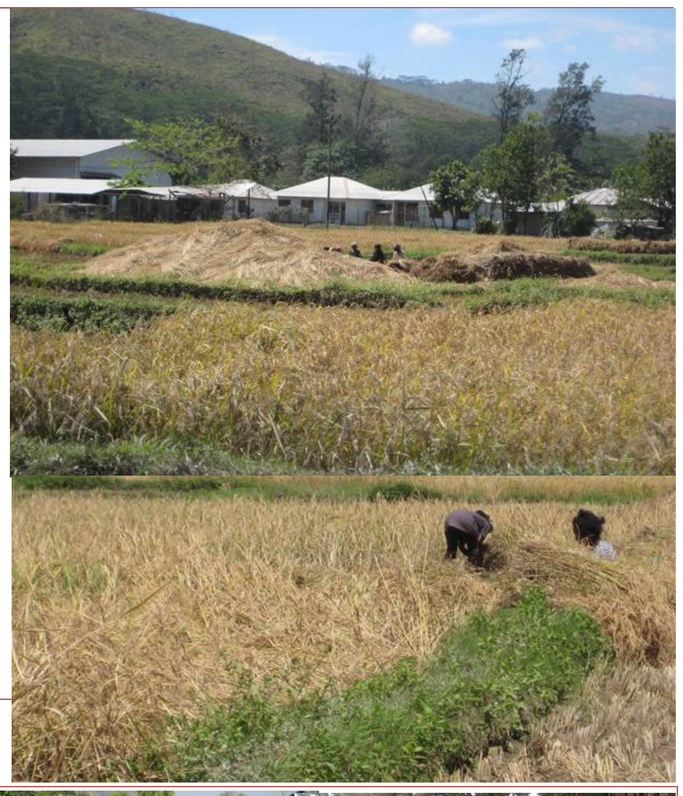
Background

- Although agriculture plays an important role in East Timor (Timor-Leste), land availability for crop production is increasingly limited due to a dramatic increase in population in recent decades.
- As a consequence, there is a high human pressure on land use with unsustainable practices "Slash and Burn" for crop production. This practice is common on steep slopes and thus it leads to the loss of top soil and fertility.
- As a result, yields of crops decrease from time to time leading to continuous food insecurity in rural areas.
- On the other hand, in the low land areas, the land is mostly used for mono-crop rice production which starts from around mid-February to July and is then abandoned until February next growing season.
- However, there is sufficient soil moisture at the harvest of rice that can be utilized for growing drought resistance legume crops.



Objective

- To identify drought resistance grain legume species for growing them after rice

Methods

Experimental sites in Hera (left) and in Aileu (right)

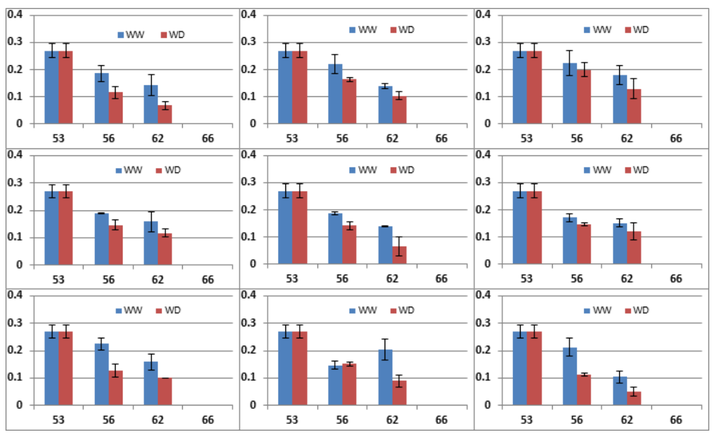
Methods

- A total of 11 local and introduced grain legumes were screened for their adaptation to water deficit during reproduction at Hera and Aileu
- Seeds were sown in a 30 cm x 30 cm distance (except grass pea) on July 20, 2012 in both locations with a CRD and 3 replications
- Treatment started at 50% flowering from 55 to 66 DAS (Hera) and 60 DAS in Aileu

Standing bean with droughted (left) & control (right) plants

Results

Soil water content



Soil water content for Pigeon pea (A), Pea nut (B), Soy bean (C), Red pea (D), Standing bean (E), Winding white bean (F), Winding speckled bean (G), Cow pea red (H) and Green pea (I) of the Hera site.

Yield & yield components

Species	Research site	Treatnt	Biomass (ton/ha)	S. Yield (ton/ha)	Wt of 100 seeds, g
Pigeon pie	Hera	WW	16.7 ± 4.5		
		WD	8.0 ± 1.2		
	Aileu	WW	3.1 ± 0.2		
		WD	3.5 ± 0.2		
Pea nut	Hera	WW	16.6 ± 2.6	1.7 ± 0.5	
		WD	9.0 ± 2.0	1.1 ± 0.3	
	Aileu	WW	3.6 ± 0.9		
		WD	3.3 ± 0.6		
Soy Bean	Hera	WW	4.8 ± 0.4	2.5 ± 0.6	14.9 ± 0.1
		WD	3.2 ± 0.2	1.4 ± 0.1	12.5 ± 0.3
	Aileu	WW	3.1 ± 0.2	1.3 ± 0.1	14.6 ± 0.2
		WD	2.7 ± 0.0	1.0 ± 0.1	14.9 ± 0.1
Red pea	Hera	WW	7.1 ± 0.5		
		WD	6.8 ± 1.3		
	Aileu	WW	1.5 ± 0.1		
		WD	1.9 ± 0.4		
Standing Bean	Hera	WW	6.1 ± 0.5	2.8 ± 0.4	19.5 ± 1.0
		WD	4.1 ± 0.7	1.8 ± 0.3	17.0 ± 1.5
Winding white bean	Hera	WW	5.8 ± 1.7	1.2 ± 0.4	24.8 ± 3.1
		WD	5.1 ± 0.8	1.0 ± 0.3	22.2 ± 2.7
	Aileu	WW	2.8 ± 0.5	0.9 ± 0.2	19.5 ± 0.1
		WD	2.8 ± 0.9	0.7 ± 0.2	22.0 ± 1.6
Winding speckled bean	Hera	WW	6.3 ± 1.2	1.5 ± 0.5	26.4 ± 1.1
		WD	3.2 ± 0.9	0.8 ± 0.3	15.8 ± 4.0
	Aileu	WW	5.3 ± 0.1	1.3 ± 0.1	22.5 ± 1.2
		WD	4.3 ± 0.2	0.9 ± 0.1	24.8 ± 2.3
Cowpea black	Aileu	WW	2.9 ± 0.3	1.8 ± 0.4	17.4 ± 0.3
		WD	2.9 ± 0.1	1.4 ± 0.1	16.3 ± 0.8
Cowpea red	Hera	WW	7.7 ± 0.5	3.0 ± 0.3	20.7 ± 1.7
		WD	5.7 ± 0.6	2.3 ± 0.2	22.7 ± 3.5
	Aileu	WW	2.9 ± 0.3	1.2 ± 0.3	14.4 ± 0.3
		WD	3.3 ± 0.6	0.8 ± 0.2	14.8 ± 1.3
Green pea	Hera	WW	8.1 ± 0.8	3.1 ± 0.5	4.9 ± 0.4
		WD	5.4 ± 0.6	2.1 ± 0.1	6.6 ± 1.3
	Aileu	WW	2.5 ± 0.1	1.2 ± 0.1	7.0 ± 0.2
		WD	2.5 ± 0.3	1.3 ± 0.2	6.4 ± 0.4
Cicera	Hera	WW			
		WD			
	Aileu	WW		0.024 ± 0.016	5.74
		WD		0.010 ± 0.004	6.60

Grass pea-Aileu Standing bean and green pea - Hera

- Generally Hera produced higher plant biomass and yield than Aileu
- The highest dry matter production in Hera were pigeon pea and pea nut which was 17 t/ha in well-watered plants & in Aileu was winding specled bean which was 5 t/ha.
- Drought reduced dry matter production by 52 and 46% for pigeon pea and pea nut, respectively.
- Highest seed yield in control plants in Hera site was green pea and cowpea red which were 3.1 and 3.0 t/ha, respectively followed by standing bean and soy bean of 2.8 and 2.5 t/ha, respectively.
- The most seed yield reduced by drought was 43% in both soy bean and winding speckled bean compared to their well-watered controls
- Earliest matured species was green pea 74 DAS folowed by standing bean (80), winding white bean (82) and soybean (85) (data not shown). Maturation were late in Aileu.

Conclusion

- This study concluded that all grain legumes species and cultivars tested had potential to grow them after rice, except grass pea cultivar Cicera which only adapt to high land areas
- Most of the species produce high biomass and seed yield
- Water deficit affected the yield of speckled bean and soybean
- For the purpose of grain production, species such as green pea, standing bean and soybean are potential to grow after rice particularly in lowland areas, however further study is required under terminal drought

References

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