

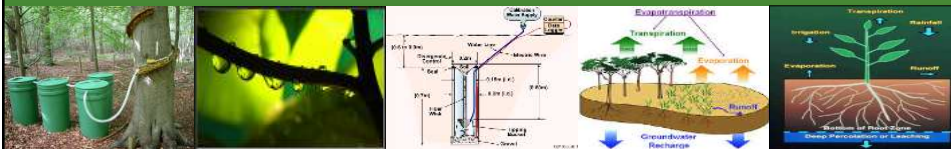
# Rain Partitioning in a Low Elevation Tea Field in Sri Lanka

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Tea Research Institute of Sri Lanka

## Introduction



Tea Research Institute of Sri Lanka

## Introduction...

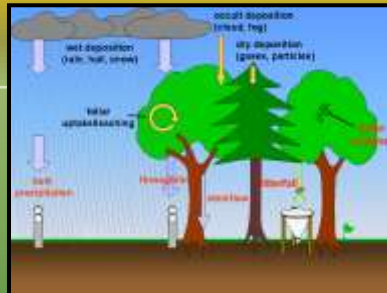


- For any agriculture crop, soil water management is important for survival & productivity.
- Rain - the main contributor for maintaining soil water in tea
- Understanding the way rain enters to the plant root zone is important
- Climate change has created new threat in maintaining the soil water balance
- Rain fall partitioning in tea plantations has an effect to Sri Lanka power generation and soil erosion.
- It is hence even economically important concept to study rain water partitioning in tea fields



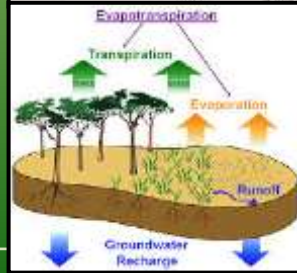
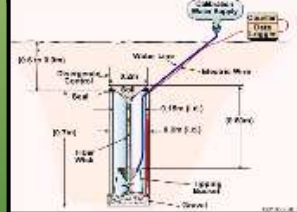
## What is Rain Partitioning?

- Rain partitioning redistribution of rainfall within any vegetative community
- Main components are stem fall and throughfall
- Stemflow
  - Flow of intercepted water down trunk or stem of a plant
  - Important concept in soil erosion
  - Higher in tropical plantations



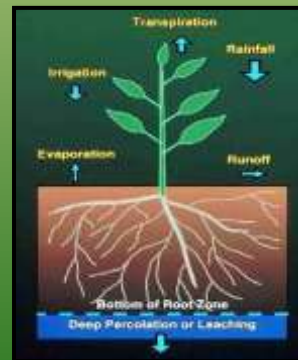
## Rain Partitioning...

- Throughfall
  - Process through which wet leaves drop water to the ground surface
  - Larger than rain drops and have erosive power
- Deep drainage
  - Important concept for watershed management in tea growing environment
- Soil evaporation
  - Moisture leaving soil surface
  - Important factor in maintaining soil water balance in dry periods



## Objectives

- Understand the rain partitioning in tea growing environment
- Understand the role of two shade plants in harvesting rain water
- Estimate basic parameters for soil water balance model



## Materials & Methods



## Site & Measurements

- Field No 01, St. Joachim Estate, Ratnapura
- 6<sup>o</sup>40' N, 80<sup>o</sup>25' E, 29 m amsl
- Study was conducted in 2007 & 2008, SW monsoonal periods
- Stemflow
  - circular attachment to tree stem and drained water collected to container
  - tea – 24 plants,
  - Gliricidia – 10 trees
  - Albizia – 6 trees



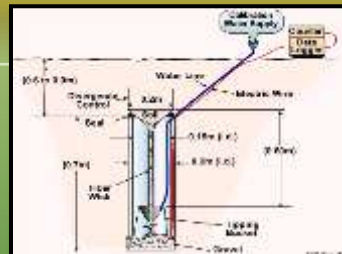
## Site & Measurements....,

- Throughfall –
  - PVC cylinders, 12cm dia., 40cm height
  - 12 collectors, changed position daily
- Soil evaporation
  - Micro lysimeters, steel cylinders – 10cm dia, 15cm height, bottom covered with muslin cloth
  - 16 nos, carefully placed in soil



## Site & Measurements....,

- Deep drainage –
  - 60cm depth, 25cm dia, flux meter
- Runoff –
  - steel structures, 1m<sup>2</sup> area and 20cm wall



## Methodology

- Funneling ratio

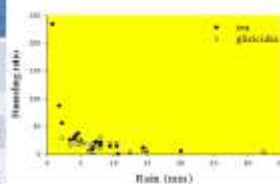
$$F = \frac{SF_{vol}}{BA \times P_g}$$

- SF – stemfall volume
- BA – basal area of plant
- P<sub>g</sub> – incident rainfall
- Relative dominance
- Relationship between rainfall and funneling ratio
- Relationship between rainfall and components of soil water balance



## Results & Discussion

Plant	Density (no/ha)	Stem area (m <sup>2</sup> /plant)	Basal area (m <sup>2</sup> /ha)	Shade	Gibricola only		Abtola only		Gibricola + Abtola	
					RF %	F %	RF %	F %	RF %	F %
Tea	12500	2.05 X 10 <sup>6</sup>	25.8	Tea	98.0	94.0	99.5	8	97.5	7.9
Gibricola	260	6.27 X 10 <sup>6</sup>	1.6	Gibricola	2.0	6.0	-	-	2.0	6.6
Abtola	60	4.97	798.0	Abtola	-	-	0.5	92	0.5	91.5



## Plant Density and Basal Area

Plant	Density (no/ha)	Stem area (m <sup>2</sup> /plant)	Basal area (m <sup>2</sup> /ha)
Tea	12500	2.06 X 10 <sup>-3</sup>	25.8
Gliricidia	260	6.27 X 10 <sup>-3</sup>	1.6
Albizia	60	4.97	298.0

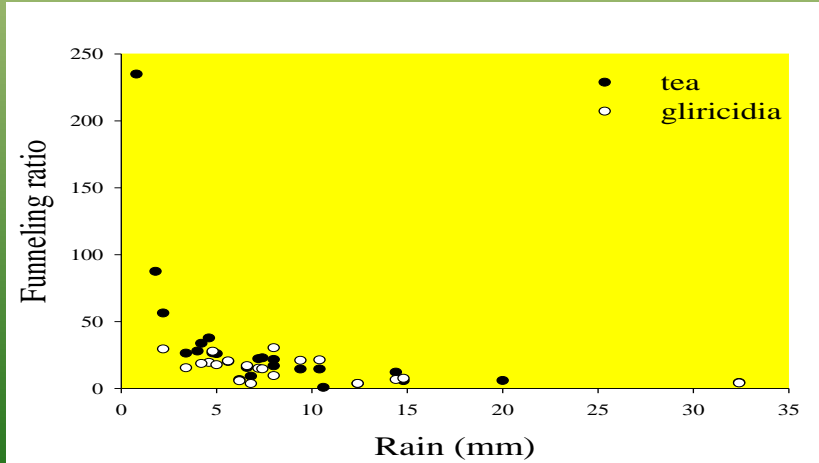


## Frequency of Plants and Relative Dominance

Shade type	Gliricidia only		Albizia only		Gliricidia + Albizia	
	Frequency %	Relative dominance %	Frequency %	Relative dominance %	Frequency %	Relative dominance %
Tea	98.0	94.0	99.5	8	97.5	7.9
Gliricidia	2.0	6.0	-	-	2.0	0.6
Albizia	-	-	0.5	92	0.5	91.5



## Relationship between Funnelling Ratio and Rainfall



## Soil Water Balance Components

Parameter	Slope	r <sup>2</sup>	Probability
Throughfall (n=36)	0.106	0.70	0.0001
Stemfall (n=35)	0.322	0.82	0.0001
Drainage (n=22)	0.084	0.43	<0.0001
Runoff (n=21)	0.038	0.51	<0.0001
Soil evaporation (n=11 days)*	0.017	0.74	0.0007

\*Soil evaporation is in relation to solar radiation





## Discussion



- Study gives an idea of rain partitioning in tea fields
- Stemflow is the main contributor for soil moisture, differ with plant characters
- Contribution of Gliricidia stemfall is lower, Albizia has a higher contribution
- Funneling ratio of tea and gliricida shows a negative relationship with rain due to dripping of water
- Tea plants harvest more water to root zone than gliricidia
- Effective rainfall around 40%
- Parameters give an idea about soil water balance
- Practical limitation to measure higher rainfall events
- Soil evaporation is a key component in loosing soil moisture



## Conclusions

- Albizia tree has a prominent role in harvesting rain water to root zone
- Minimizing soil evaporation is important
- Study details will be useful for climate change mitigations.



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*Thank you*

