AUTOMATIC SUBSURFACE IRRIGATION AND DRAINAGE USING SHEET-PIPE TYPED MOLE DRAIN

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INTRODUCTION

- Indonesia swampland ±43.7 million hectares, ±9,8 million ha potential for farmlands, and ±1 million ha cultivated and more being developed.
- Problems:
  - Low productivity and intensity
  - Inundated due to high rainfall, flat lowland & sea tides.
  - Saline/acidic soils with low percolation due to heavy clays.
  - Hard soil and Soil cracking during dry periods.
- Need appropriate surface/Sub-surface drainage techniques
- Introduce subsurface drainage with sheet-pipe type-mole drain.

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OBJECTIVES

- Optimize irrigation and drainage rates to maintain expected water level.
- Characterize effectiveness of sheet-pipe for draining and leaching.
- Come up with a control system of irrigation and drainage using the sheet-pipe.
- Characterize performances of the control system.

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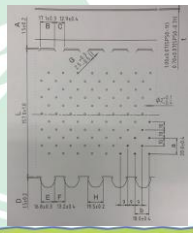
SHEET-PIPE



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SHEET-PIPE INSTALLATION

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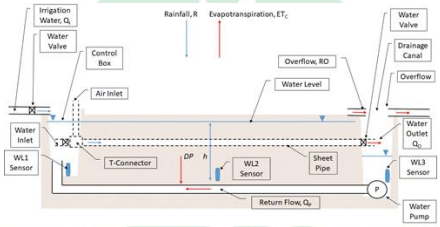
CONCEPTUAL DESIGN



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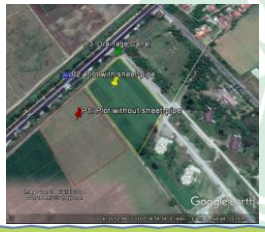
RESEARCH PLAN

- First Stage in 2018/2019:
  - Box experiment in laboratory to characterize WL profiles and drainage flow;
  - Field experiment to characterize WL, hydrograph, drainage and leaching.
- Second Stage in 2019/2020
  - Field monitoring on irrigation efficiency and water productivity.
  - Box experiment in lab to test the performance of the control system.
  - Engineering design of the automatic control system in field scale.
- Third Stage in 2010/2021
  - Installation and monitoring of the control system in the field.
  - Field monitoring on irrigation efficiency and water productivity

EXPERIMENTAL SITE

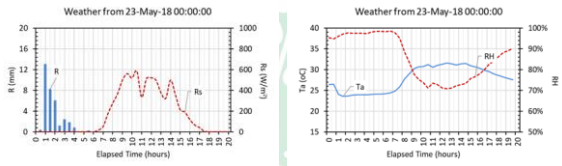


- Rice Research Centre, Ministry of Agriculture, Sukamandi District, Subang Regency, West Java, Indonesia.
- P1: Plot without SP 1.12 ha.
- P2: Plot with SP 1.1 ha.
- P3: Drainage canal

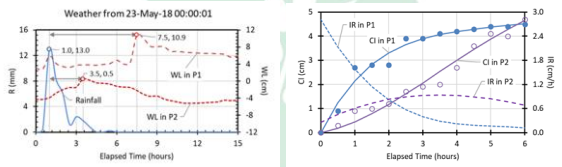
RAINFALL EVENTS

No	Started	Length (h)	Amount (mm)	Rate (mm/h)
1	20-May-18 04:30	2.0	0.8	0.40
2	21-May-18 02:30	1.5	1.2	0.80
3	22-May-18 00:00	5.5	3.4	0.62
4	23-May-18 00:00	6.0	34.0	5.67
5	23-May-18 20:00	6.0	25.6	4.27
6	25-May-18 06:00	3.5	3.6	1.03

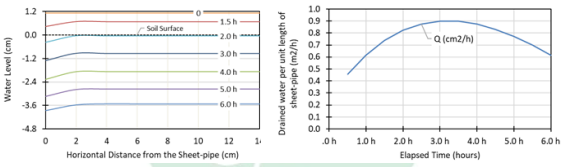
RAINFALL, TEMPERATURE & HUMIDITY



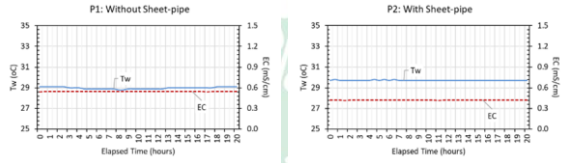
WATER LEVEL & PERCOLATION



WATER LEVEL & DRAINAGE RATE



WATER TEMPERATURE & CONDUCIVITY



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CONCLUSIONS

- Sheet-pipe can drain faster, manage water level, and regulate soil aeration.
- After rainfall, rainwater percolates faster resulting in parabolic curve.
- WL level was flat but lower closer to the sheet-pipe.
- Soil EC was lower due to leaching effect which is good to neutralize the soil.

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THANK YOU FOR YOUR ATTENTION

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