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Design of Small Gravity Drip Irrigation for Smallholder Farming in Water Scarce Region of Indonesia

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Faculty of Agriculture

Introduction

1. Water Resources Vs World Population

9 Billion

2050

- 60% more food needed
- +19% increase of agricultural water consumption (including both rainfed and irrigated) by 2050

2. Climate Change

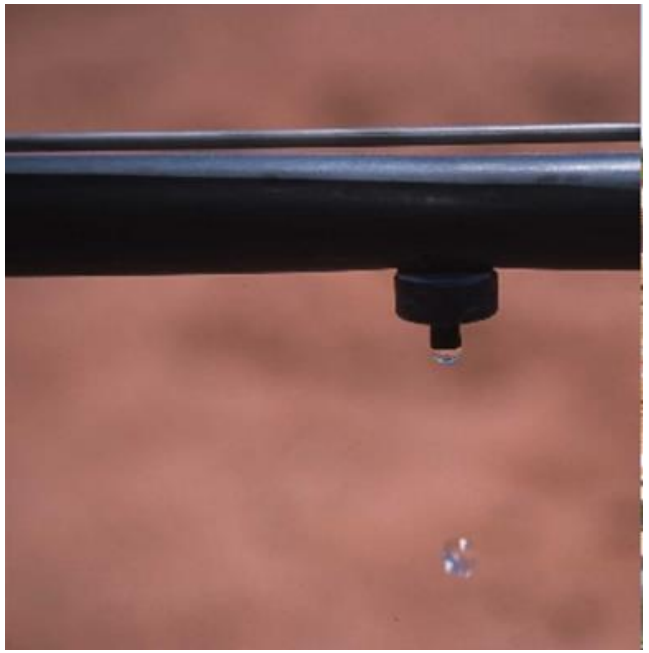
3. Water Scarcity in drought prone area

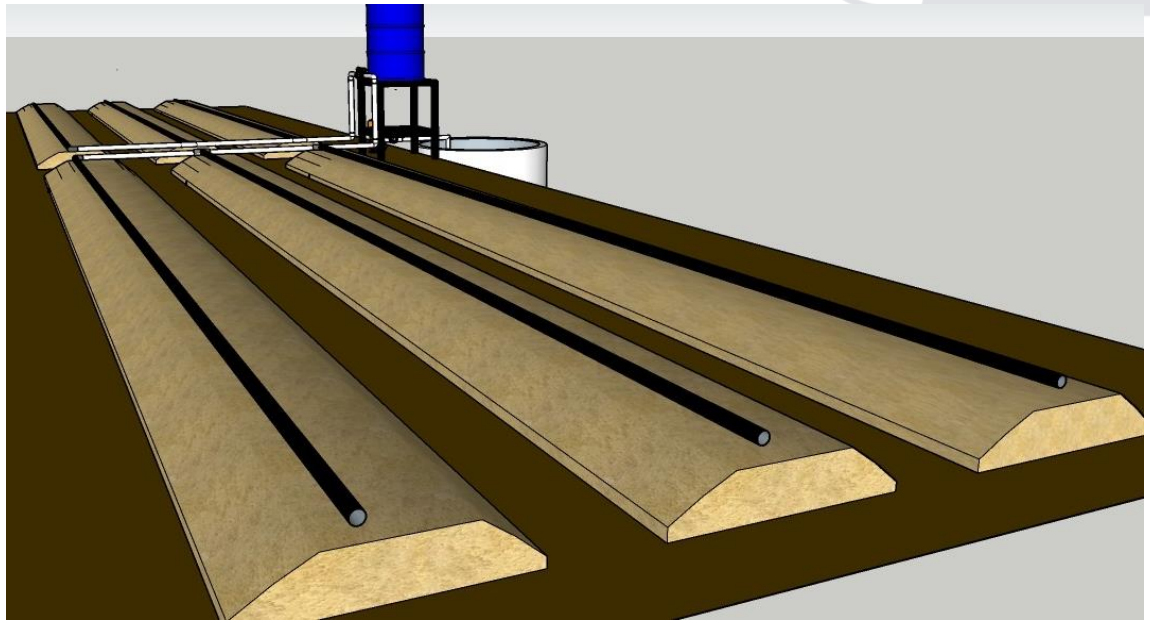
Sustainable Micro Irrigation System

Objectives

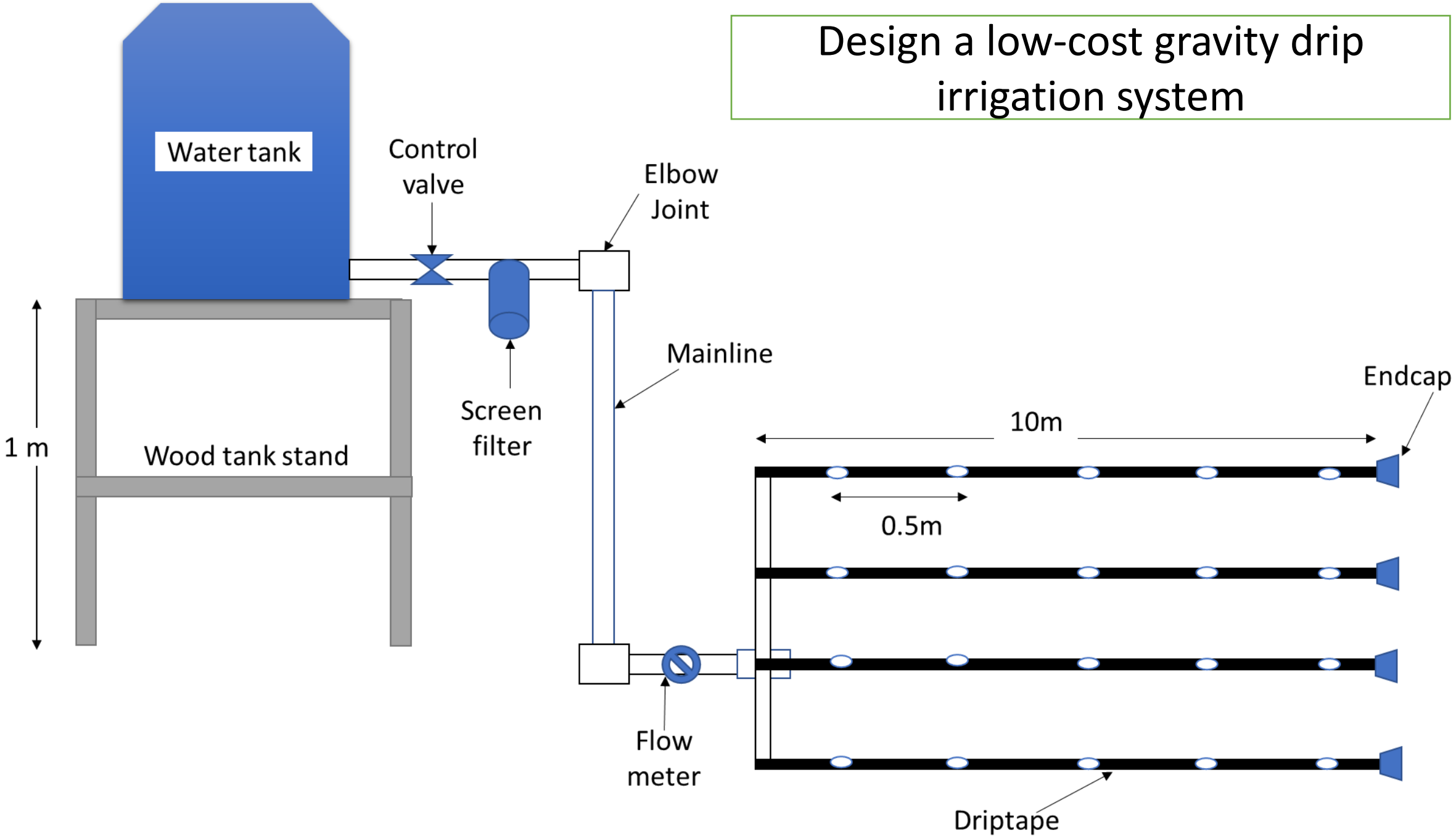
To:

Provide a better design and management of small gravity drip irrigation system for melon cultivation





Design a low-cost gravity drip irrigation system



Observation and Analysis

1. Collecting Soil Samples, Analysis of Physical-Chemical properties

2. Emitter Discharge Rate & EU

$$EU = \left(\frac{q_n}{q_a}\right) \text{ x } 100\% \text{...Eq.1}$$

Karmeli & Keller (1997)

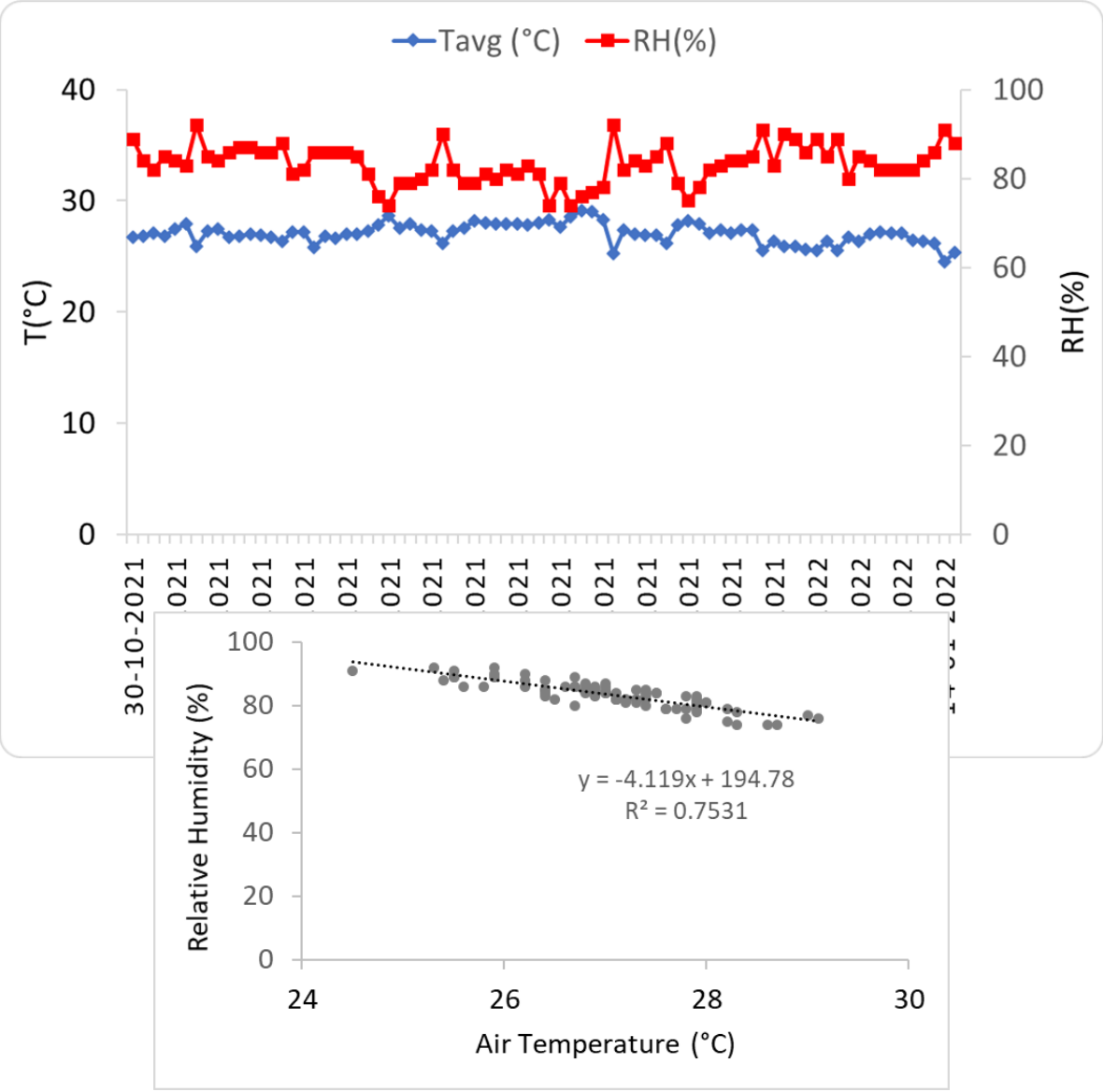
3. Plant Growth Performance, Crop Water Requirement (ETc)

4. Irrigation Water Productivity

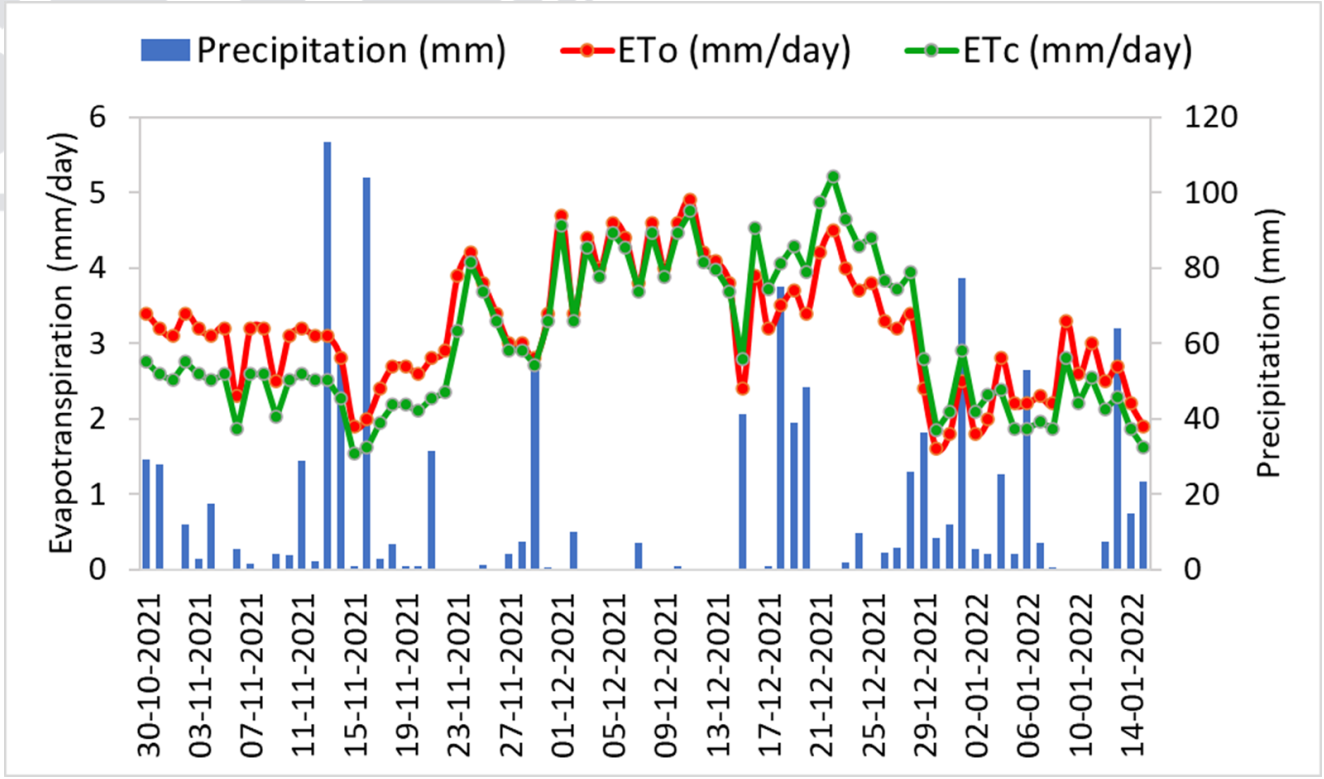
$$\text{IWP} = \frac{\text{Total yield (kg plant}^{-1})}{\text{Irrigation water applied(mm)}}$$

(Heydari 2014; Molden et al. 2010)

Results and Discussion



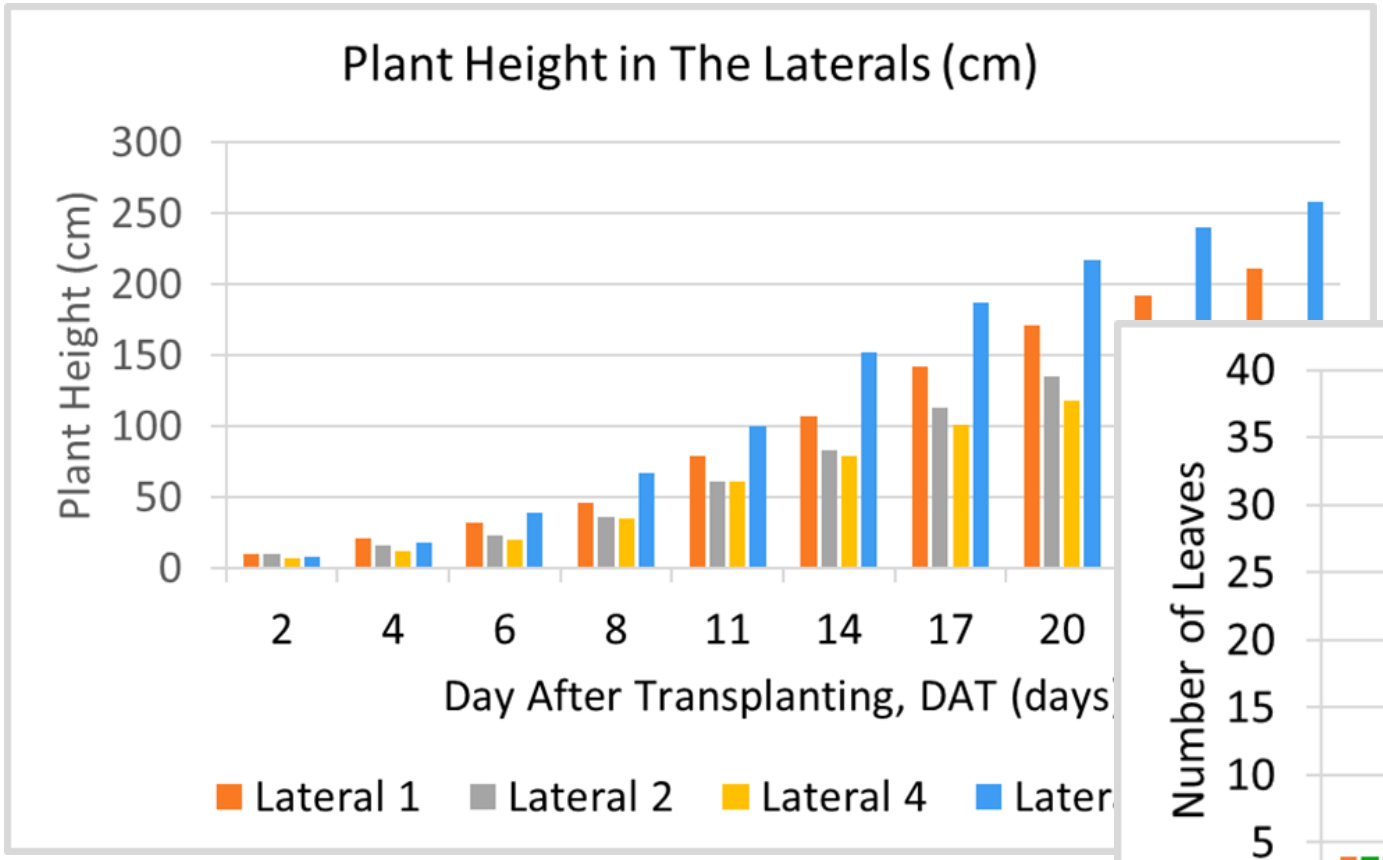
Agro-meteorological characterization and crop water consumption

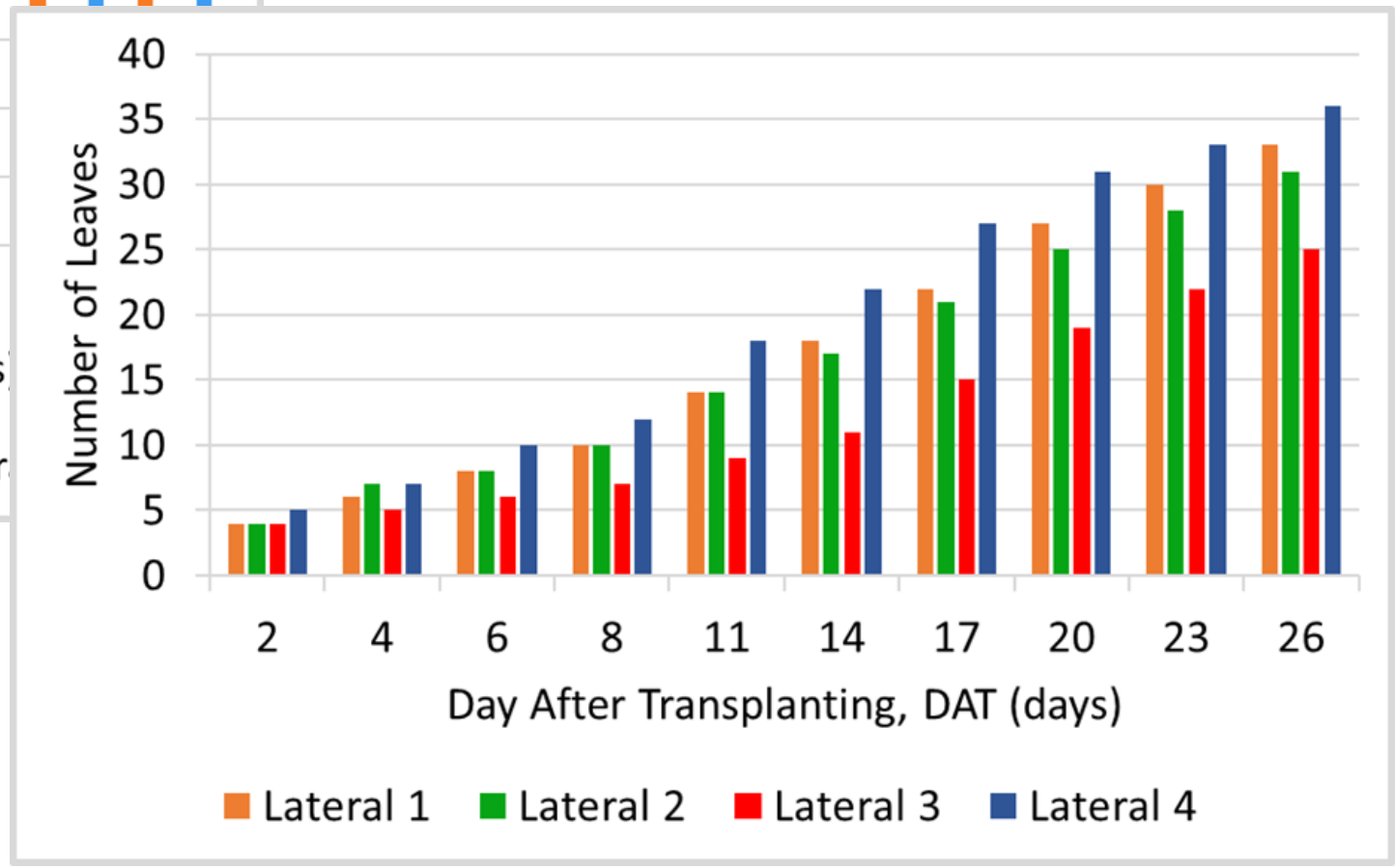


Soil Properties

Depth	Soil Particles (%)				Bulk Density	Particle	Porosity	EC	Organic Matter		
(cm)	Sand	silt	Clay	Soil Texture	(g/cm²)	Density (g/cm²)	(%)	(mS/c	C (%)	N (%)	C/N
5	36	30	34	Clay loam	1	2.7	63	0.65	2.25	0.13	18
10	30	47	23	Silt loam	0.98	2.53	61	0.49	1.96	0.15	13
20	39	27	34	Sandy clay loam	0.91	2.72	66	1.02	1.84	0.14	13
30	26	22	51	Clay	0.78	2.5	69	1.07	1.46	0.09	17
40	34	23	43	Clay	0.72	2.42	70	0.46	0.97	0.09	10
50	34	19	48	Clay	0.65	2.5	74	0.66	0.77	0.13	6

Plant Growth Performance





Performance of Small Gravity DI

Lateral	EU (%)	ASAE 1996 Classification
1	93.1	Excellent (>90%)
2	89.4	Good (80 - 90%)
3	81.9	Good (80 - 90%)
4	96.9	Excellent (>90%)

Parameters	Drip irrigation
Total fresh yield of melon(kg)	27.923
Total irrigation (liter)	18000
Total Irrigation (m^3)	18
irrigation water productivity (IWP) (Kg/m^3)	**1.55**

The economic analysis of farm practices

IRIGASI TETES

Analisis Usahatani

Studi Kasus Penggunaan pada Tanaman Melon dengan menggunakan Irigasi Tetes

Biaya Operasional

Biaya Produksi

• Sarana produksi (benih, mulsa, pupuk, pestisida dan ajir)	Rp. 2.445.000
• Tenaga kerjabudidaya (68 HOK x Rp.30,000) *5-6 jam efektif per HOK	Rp. 2.040.000
• Biaya instalasi jaringan irigasi tetes	Rp. 2.726.300
• Biaya operasi irigasi dan perawatan jaringan irigasi	Rp. 500.000
• **TOTAL BIAYA PRODUKSI**	**Rp. 7.711.300**

Pendapatan

• Hasil Panen 960 kg, dengan harga melon premium Rp 20,000/Kg	**Rp 19.200.000**

Keuntungan

• Biaya-Pendapatan	**Rp 11.488.700**
• B/C Ratio	1,49
• ROI	2,49

Conclusion

- High uniformity of water application
- Increase efficiency the utilization of irrigation water
- Economically-Affordable for small-scale farmers

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