







## Article

# Water saving using thermal imagery-based thresholds for timing irrigation in potatoes under drip and furrow irrigation systems

Javier Rinza <sup>1</sup> , David A. Ramírez <sup>1,2\*</sup> , Johan Ninanya <sup>1,3</sup> , Felipe de Mendiburu <sup>4</sup> , Jerónimo García <sup>3</sup>  and Roberto Quiroz <sup>5</sup> 

<sup>1</sup> International Potato Center (CIP), Headquarters P.O. Box 1558, Lima 15024, Peru; j.rinza@cgiar.org (J.R.)

<sup>2</sup> Water Resources Doctoral Program, Universidad Nacional Agraria La Molina (UNALM), Lima 15024, Peru; d.ramirez@cgiar.org (D.A.R.)

<sup>3</sup> Applied Meteorology Master Program, Universidad Nacional Agraria La Molina (UNALM), Lima 15024, Peru; j.ninanya@cgiar.org (J.N.); jgarciavi@lamolina.edu.pe (J.G.)

<sup>4</sup> Academic Department of Statistics and Informatics, Faculty of Economics and Planning, Universidad Nacional Agraria La Molina (UNALM), Lima 15024, Peru; fmendiburu@lamolina.edu.pe (F.d.M.)

<sup>5</sup> CATIE - Centro Agronómico Tropical de Investigación y Enseñanza, Cartago Turrialba 30501, Costa Rica.; roberto.quiroz@catie.ac.cr (R.Q.).

**Table S1.** Climate conditions in the study zone 2013–2020. Dataset Rinza et al. [1].

Month	T <sub>a</sub> (°C)	T <sub>max</sub> (°C)	T <sub>min</sub> (°C)	HR (%)	V (ms <sup>-1</sup> )	VPD (kPa)	SR (MJd <sup>-1</sup> )	Rain (mm)	E <sub>0</sub> (mm)
Jan	23.1	30.9	18.2	76.5	1.4	0.7	17.6	2.0	3.7
Feb	24.5	32.5	18.8	73.8	1.4	0.9	18.2	0.3	4.1
Mar	24.2	31.1	18.2	72.2	1.4	0.9	19.1	0.7	4.2
Apr	21.8	29.6	16.0	76.6	1.2	0.7	17.6	0.3	3.3
May	19.3	28.7	13.5	82.4	1.1	0.4	11.2	0.3	2.2
Jun	17.2	25.4	12.9	86.5	1.0	0.3	7.3	0.6	1.4
Jul	15.9	24.3	11.6	88.8	0.9	0.2	6.8	1.1	1.3
Aug	15.5	23.7	12.1	88.9	0.9	0.2	8.6	0.6	1.4
Set	16.1	24.1	12.4	88.3	1.1	0.2	10.8	0.5	1.9
Oct	17.2	24.4	12.0	84.9	1.2	0.3	14.7	0.1	2.5
Nov	18.5	25.8	13.3	81.7	1.2	0.4	15.4	0.6	2.9
Dec	20.5	27.7	15.4	80.7	1.3	0.5	16.3	0.1	3.0

T<sub>a</sub> – average temperature; T<sub>max</sub> – maximum temperature; T<sub>min</sub> – minimum temperature; RH – relative humidity; V – wind speed; VPD – vapor pressure deficit; SR – Solar radiation; E<sub>0</sub> – potential evapotranspiration.

**Table S2.** Summary of crop management information of drip irrigation (DI) and furrow irrigation (FI) for different treatments: T1 – control, T2 – 0.4 of CWSI, and T3 – 0.7 of CWSI. CWSI – Crop water stress index. Rinza et al. [2] dataset.

Input data	Trial A						Trial B						Trial C		
	DI-T1	DI-T2	DI-T3	FI-T1	FI-T2	FI-T3	DI-T1	DI-T2	DI-T3	FI-T1	FI-T2	FI-T3	DI-T1	DI-T2	DI-T3
crop area (m <sup>2</sup> )	45	45	45	45	45	45	45	45	45	45	45	45	71.1	71.1	71.1
Harvested amount (kg)	209.7	127.8	81.8	188.4	127.8	75.1	156.7	140.4	73.5	183.5	187.1	75.3	352.1	315.0	214.0
Seed amount	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	108	108	108
Soil texture	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Soil organic matter (%)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5
Soil pH	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.60	7.60	7.60
Fertilizer amount (dose kg ha <sup>-1</sup> of N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O)	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	180:100:160	160:80:180 and 60:30*	160:80:180 and 60:30*	160:80:180 and 60:30*
Irrigated water (m <sup>3</sup> )	11.1	9.1	7.5	17.5	12.6	11.1	14.8	13.1	9.8	21.4	18.3	12.1	12.4	8.7	5.6
Chemical pest applications	1-2-2	1-2-2	1-2-2	1-2-2	1-2-2	1-2-2	1-2-4	1-2-4	1-2-4	1-2-4	1-2-4	1-2-4	1-2-1	1-2-1	1-2-1
Energy use (field hydro-electric, kWh)	7.0	6.5	6.3	15.5	10.9	9.3	8.7	8.4	7.9	20.2	17.2	10.9	2.7	1.7	1.2
Energy use (field petrol, liters)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	4.8	4.8	4.8
Off-farm transport (distance, km)	0.3	0.3	0.3	0.3	0.3	0.3	2.1	2.1	2.1	2.1	2.1	2.1	4.8	4.8	4.8
Harvest date	10-Oct-2017	10-Oct-2017	10-Oct-2017	10-Oct-2017	10-Oct-2017	10-Oct-2017	15-Jan-2018	15-Jan-2018	15-Jan-2018	15-Jan-2018	15-Jan-2018	15-Jan-2018	13-Sep-2018	13-Sep-2018	13-Sep-2018

\* Doses kg ha<sup>-1</sup> of CaO:MgO; \*\* Application rate of 0.5 kg ha<sup>-1</sup>.

**Table S3.** Pearson correlation matrix for agronomic (FTY – Fresh tuber yield and IW – total irrigated water), environmental (TE – Total emissions carbon), and economic (BCR – Benefit cost ratio) indicators.

FTY			
IW	0.22	IW	
TE	-0.92	-0.23	TE
BCR	0.68	0.58	0.60

## References

1. Rinza, J.; Ramírez, D.A.; Ninanya, J.; Yactayo, W. "Dataset for: Meteorological data at La Molina CIP experimental station from 2013 to 2020". *International Potato Center*, **2021**, V1. [[CrossRef](#)]
2. Rinza, J.; Ninanya, J.; Ramírez, D.A. "Dataset for: Estimating carbon footprint in potato trials under drip and furrow irrigation". *International Potato Center*, **2021**, V1. [[CrossRef](#)]