

Soil water movement, and vegetables yield under subsurface strip irrigation with intermittent flow

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GRAND CHALLENGES
GREAT SOLUTIONS

Introduction

Drip irrigation applies water in low volumes and relatively small rates to eliminate runoff and deep percolation.

- Providing the entire plant water requirement within a small duration may lead to runoff and deep percolation in some soils.
- Applying these irrigation amounts in shorter intervals at intermittent rates may resolve this problem as the intermittent application allows more time for redistribution between pulses.

Review

The intermittent application research was started for surface irrigation, then investigated for surface and subsurface drip systems [1-7].

- Several application regimes were applied according to:

- Specific ON and OFF times [7],
- Fixed number of ON times [8-9] or...
- The depth of applied water [10].
- The ON times were from 1 minute to 15 minutes [10-11].
- The OFF times were = the ON times.
- The intermittent drip irrigation
 - Limits emitters clogging [6],
 - Increases yield [4]; [7-9],
 - Improves water use efficiency [7]
 - Decreases fertilizers loss by deep percolation [11]

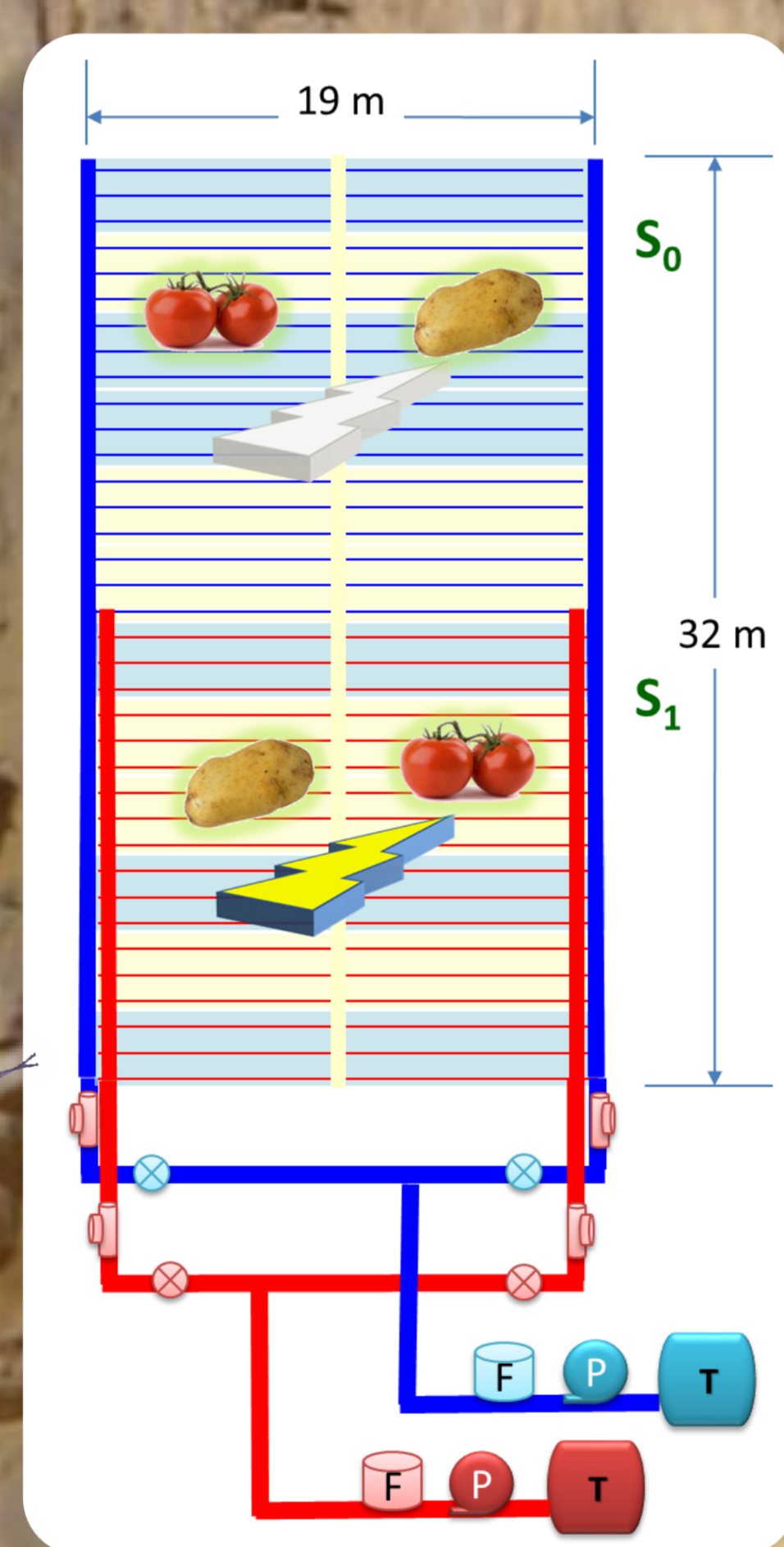


Figure 1

Goals

- To evaluate the effects of the intermittent drip in a sandy loam soil with two vegetable crops.
- To simulate the intermittent application with variable frequencies and ON-OFF ratios.

Figure 2

PB Shape			
PB Exp	10	20	-
Frequency	2	5	10
ON-OFF Ratio	1:1	1:3	1:10 3:1

Methods

- Four-season field experiment were conducted in Riyadh, KSA.
- The soil texture was sandy loam. (Figure 1)
- The field was equipped with automatic irrigation controllers and 32 continuous soil-water loggers.
- The ON-OFF ratio was 1:3, Frequency=1
- HYDRUS simulations were performed for wider range of variables. (Figure 2).

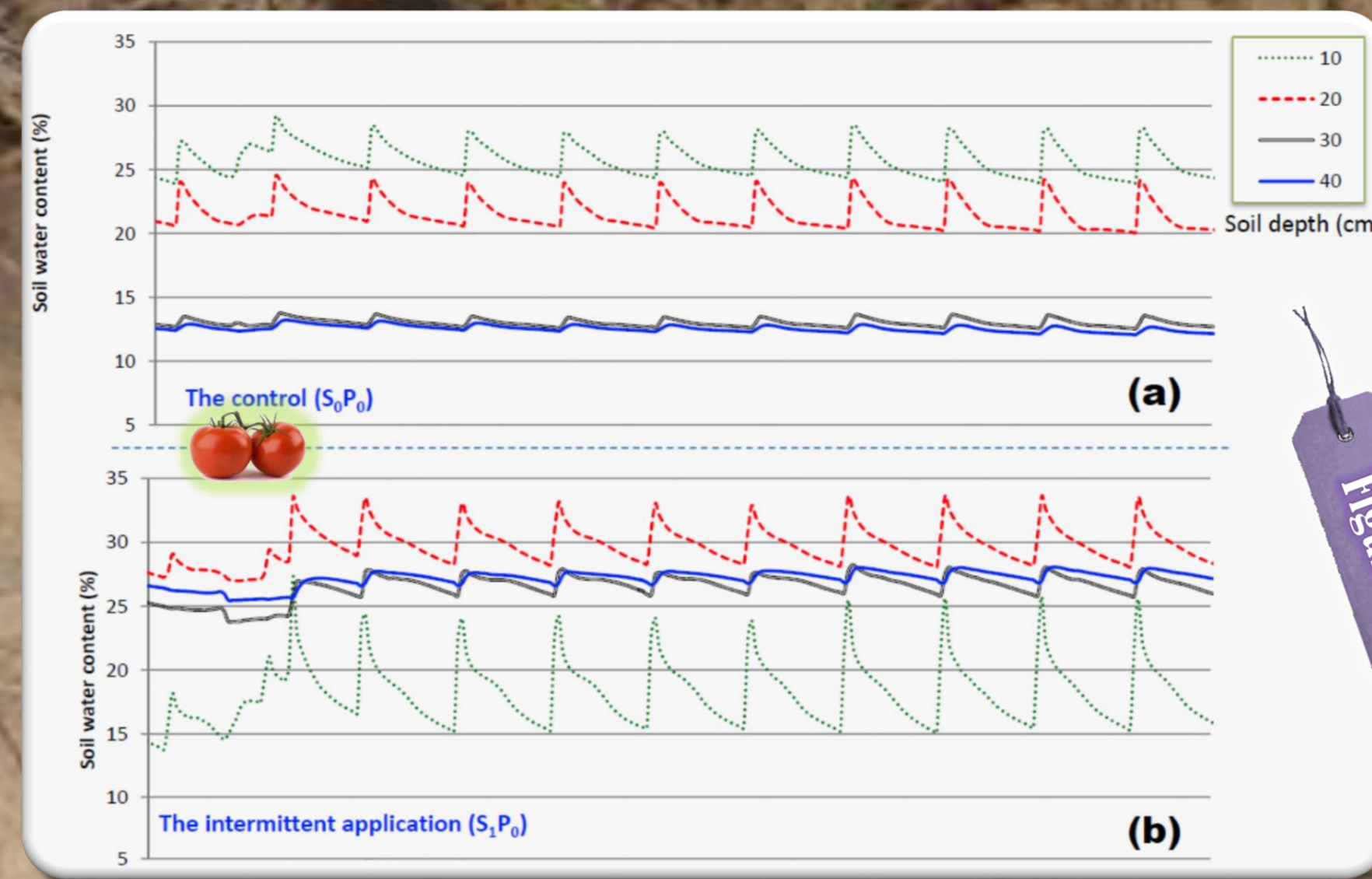


Figure 3

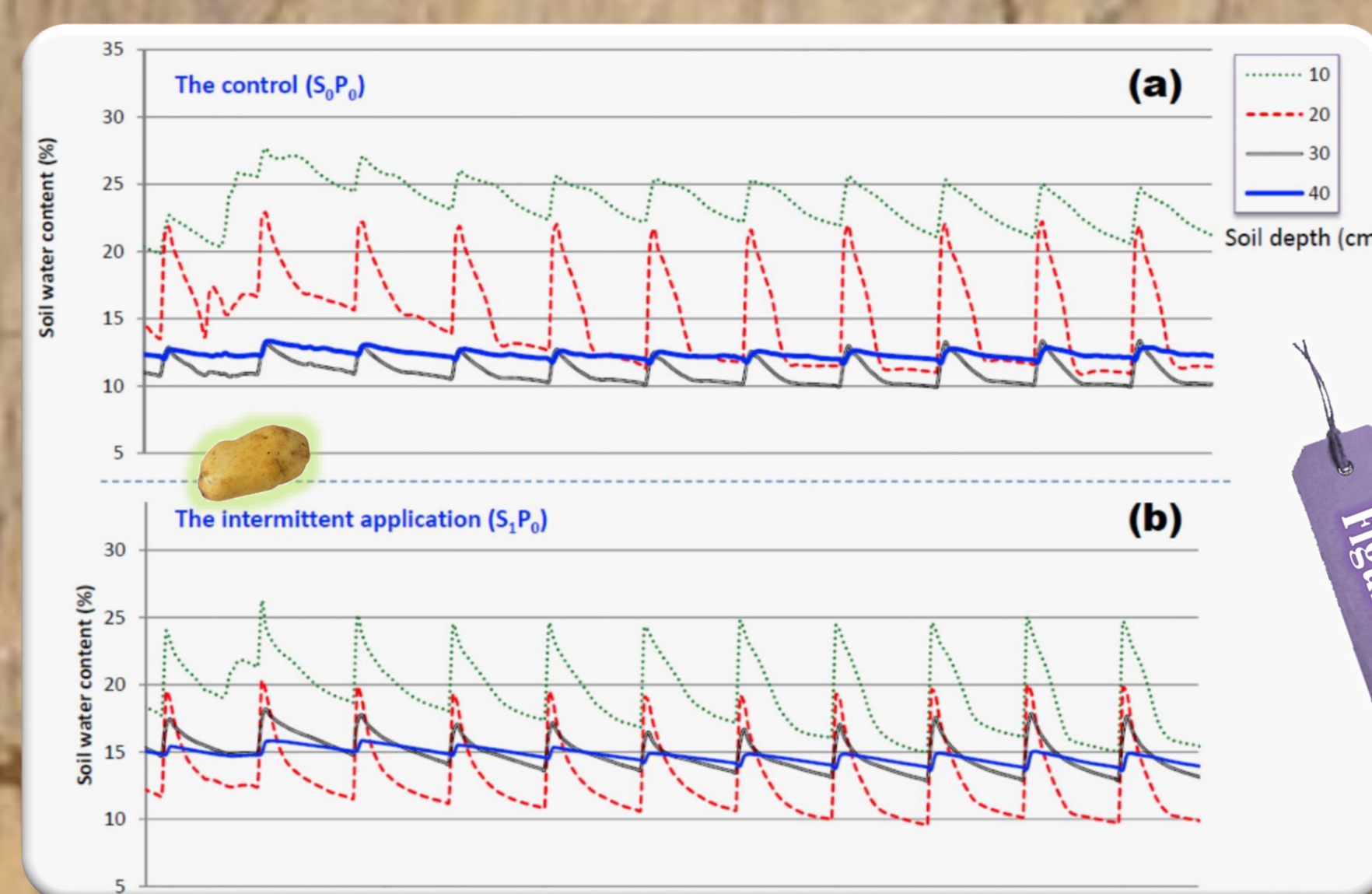


Figure 4

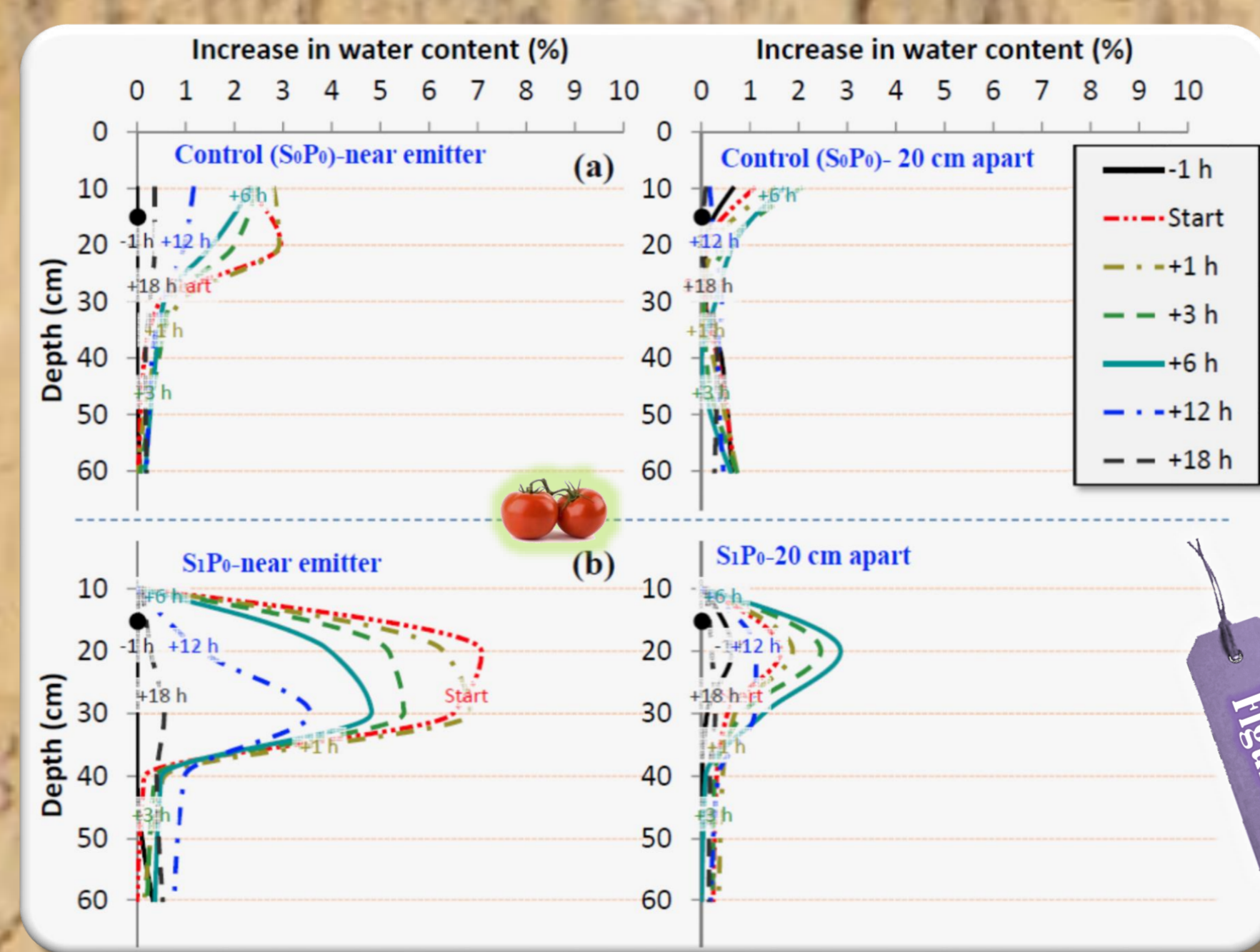


Figure 5

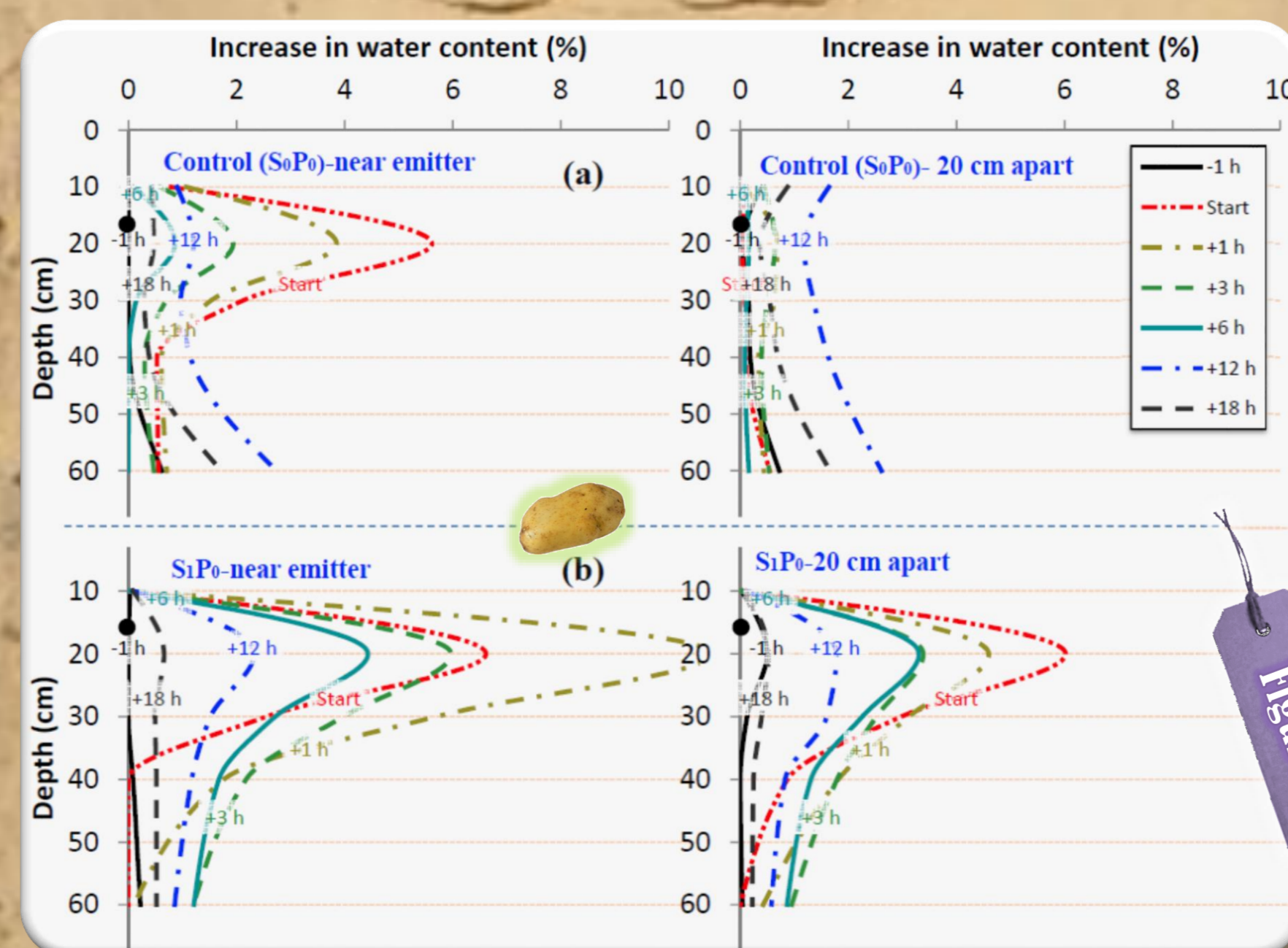


Figure 6

Results

The results showed that intermittent irrigation...

- ...Eliminated runoff, compared to at-once application.
- ...has no effect on deep percolation (Figures 3-6).
- ...has higher water use efficiency than the continuous flow, but the difference was not statistically significant (Figure 7).
- ...Gives higher yields of tomato in in cold seasons and lower for hot seasons but the differences were not statistically significant (Figure 7).
- ...Gives higher yields of potatoes in in all seasons (except season 2) but the differences were not statistically significant (Figure 7).

HYDRUS simulations showed that intermittent irrigation

- ...has a small effect on the wetting pattern during the period that the water flux is active. (Figure 8)
- ...has a negligible effect on the wetting pattern after the flux stopped and redistribution took place(Figure 8)

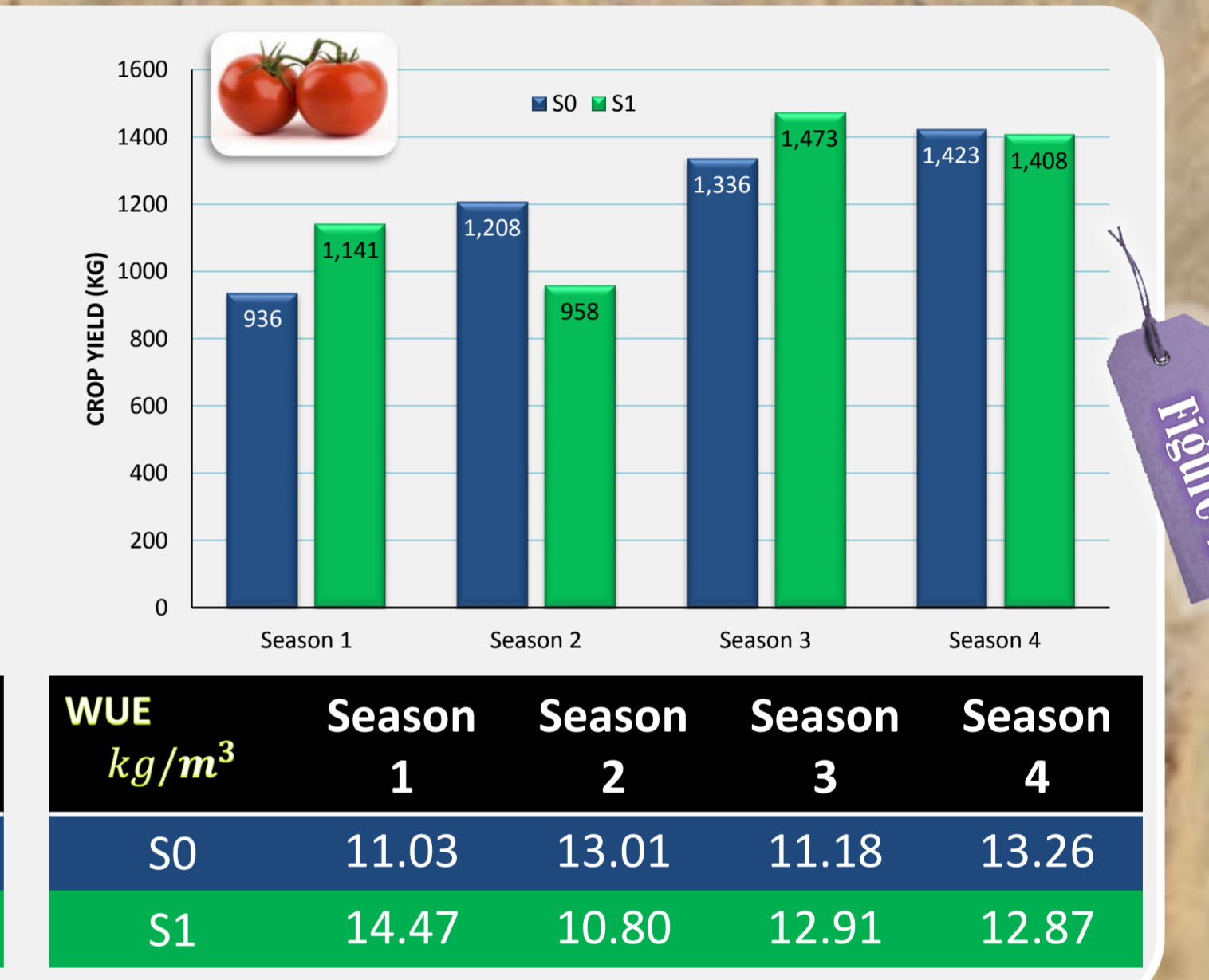
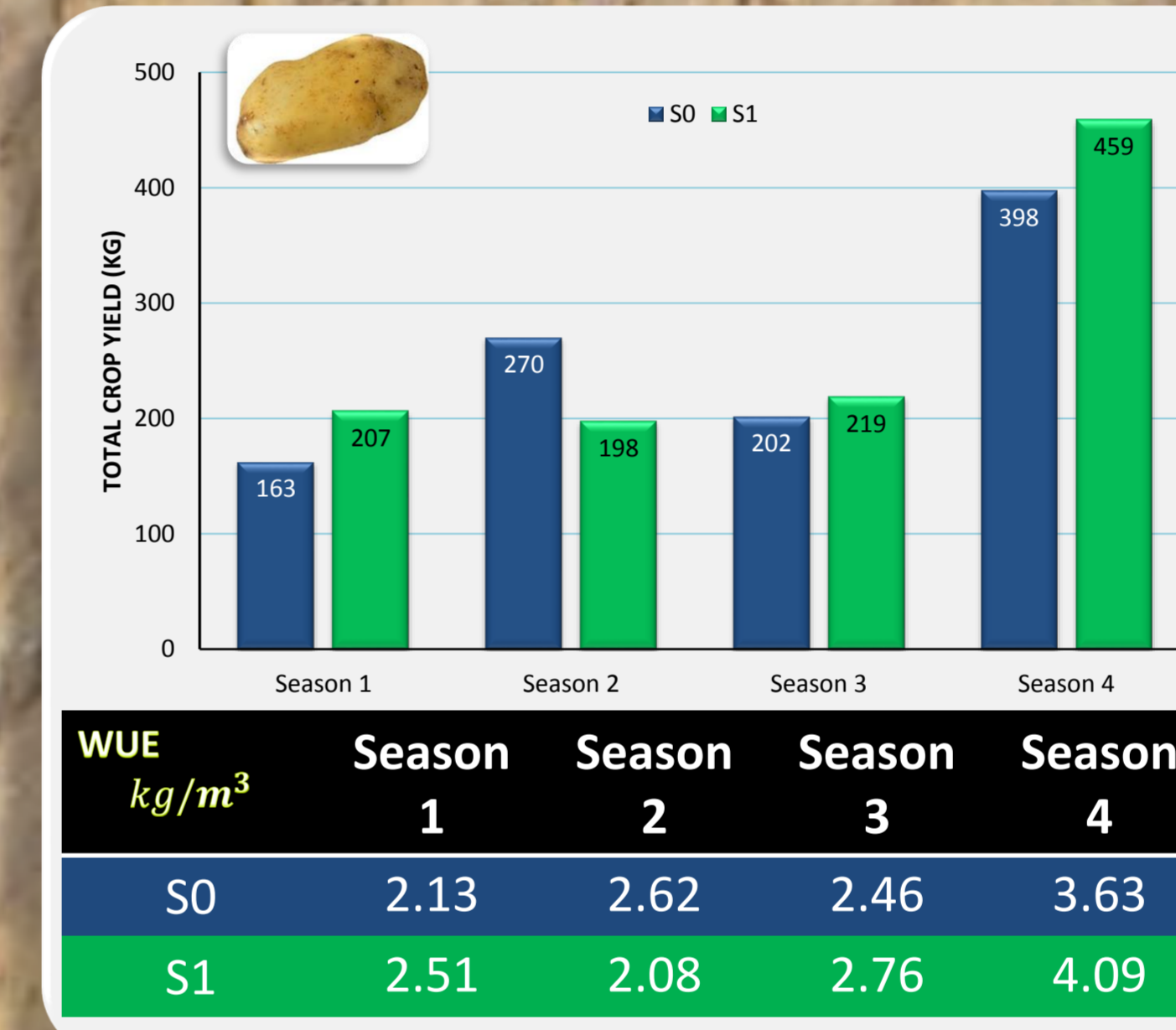


Figure 7

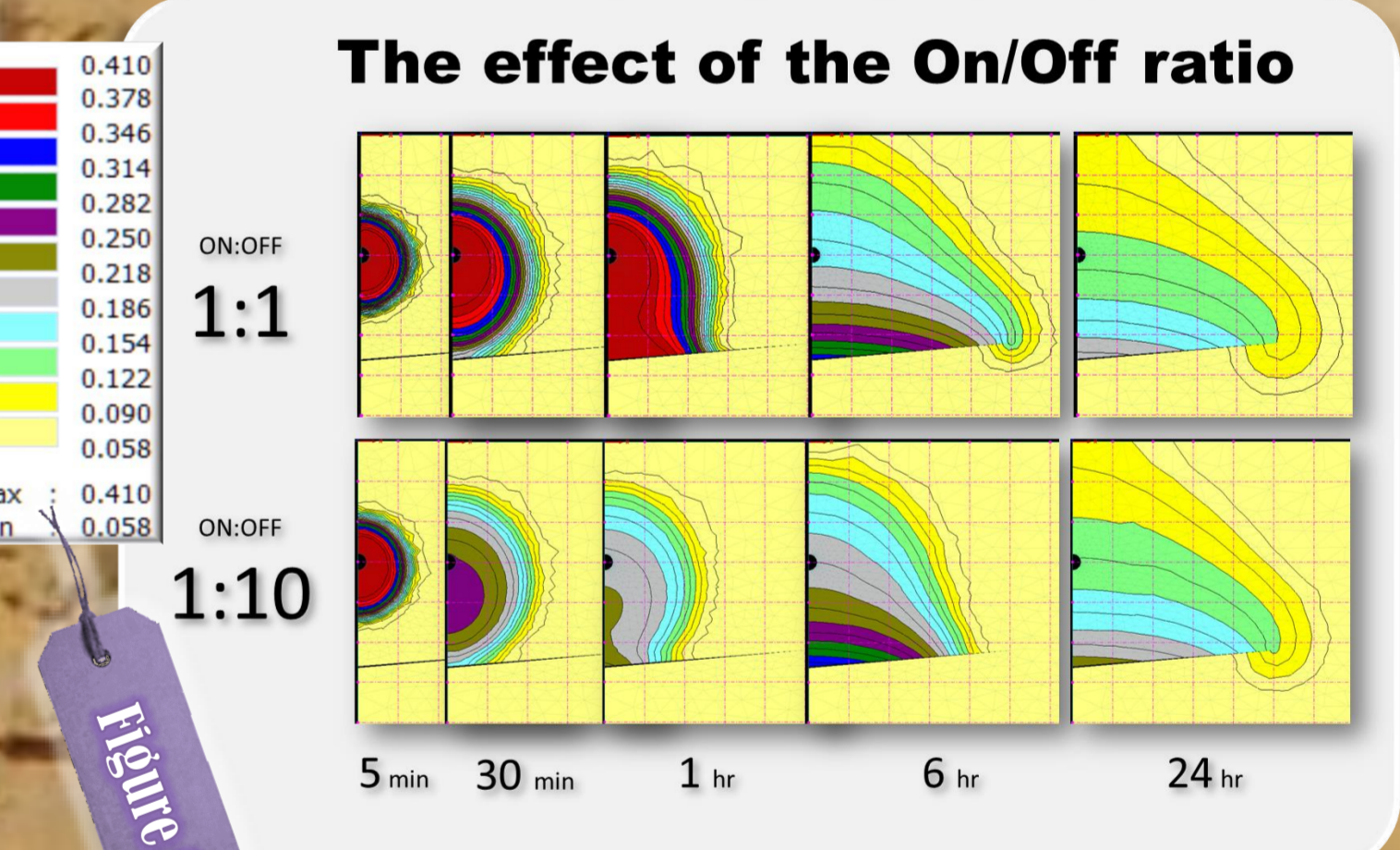
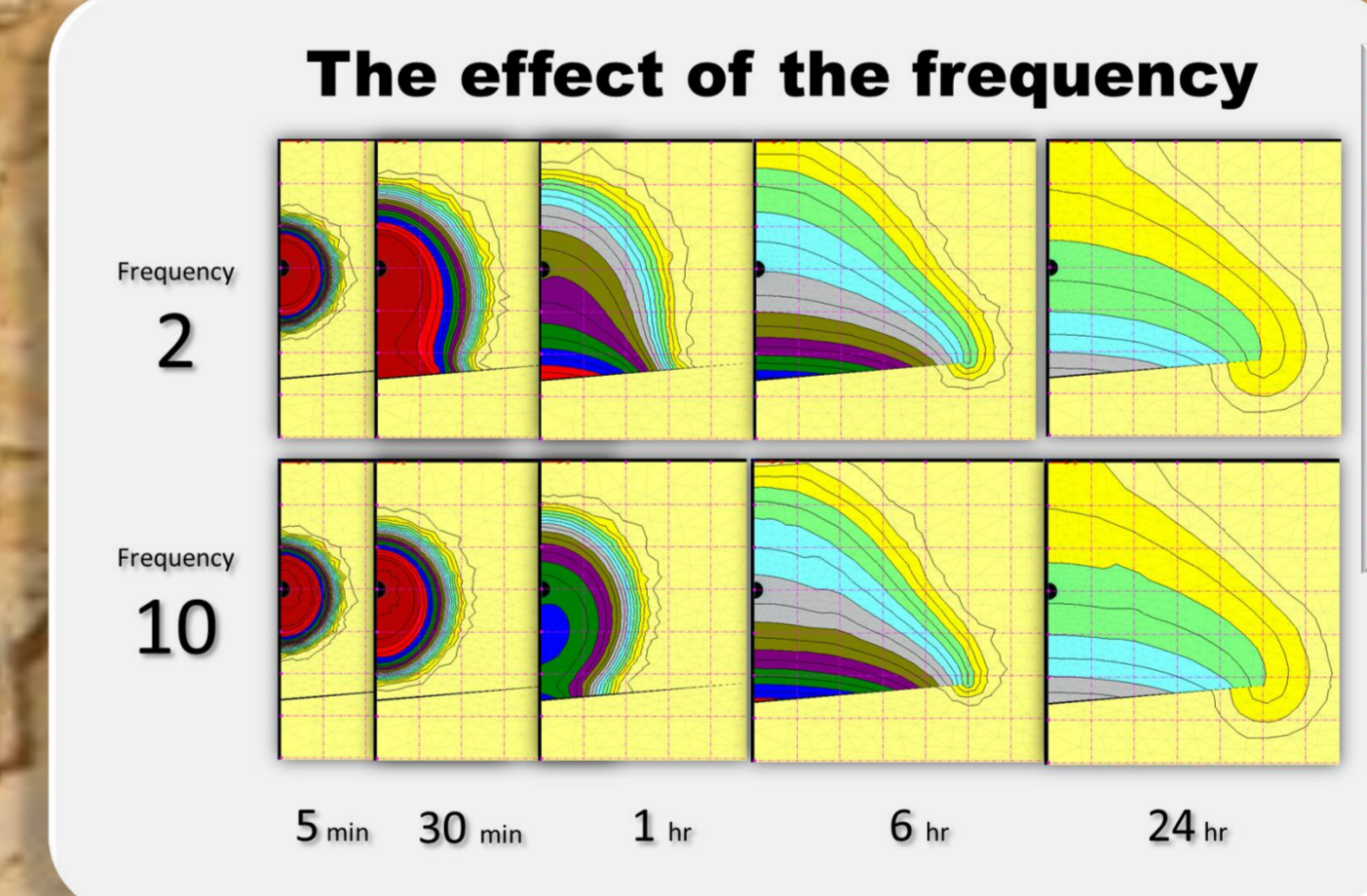


Figure 8

Conclusions

The intermittent irrigation technology should be tested

- In other soil types and with other crops,
- Through higher number of irrigation pulses.

Literature

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Thanks

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