



# 0030– DECISION SUPPORT SYSTEM SOFTWARE TO CALCULATE IRRIGATION AND NUTRIENT REQUIREMENTS IN GREENHOUSE TOMATO

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## INTRODUCTION

Potassium (K) and nitrogen (N) supply and the hydric welfare index were the most important limiting factors responsible of greenhouse tomato yield variability in Uruguay. In addition, improper irrigation management and excessive fertilization are the main causes of salt accumulation and N leaching in greenhouse crops.

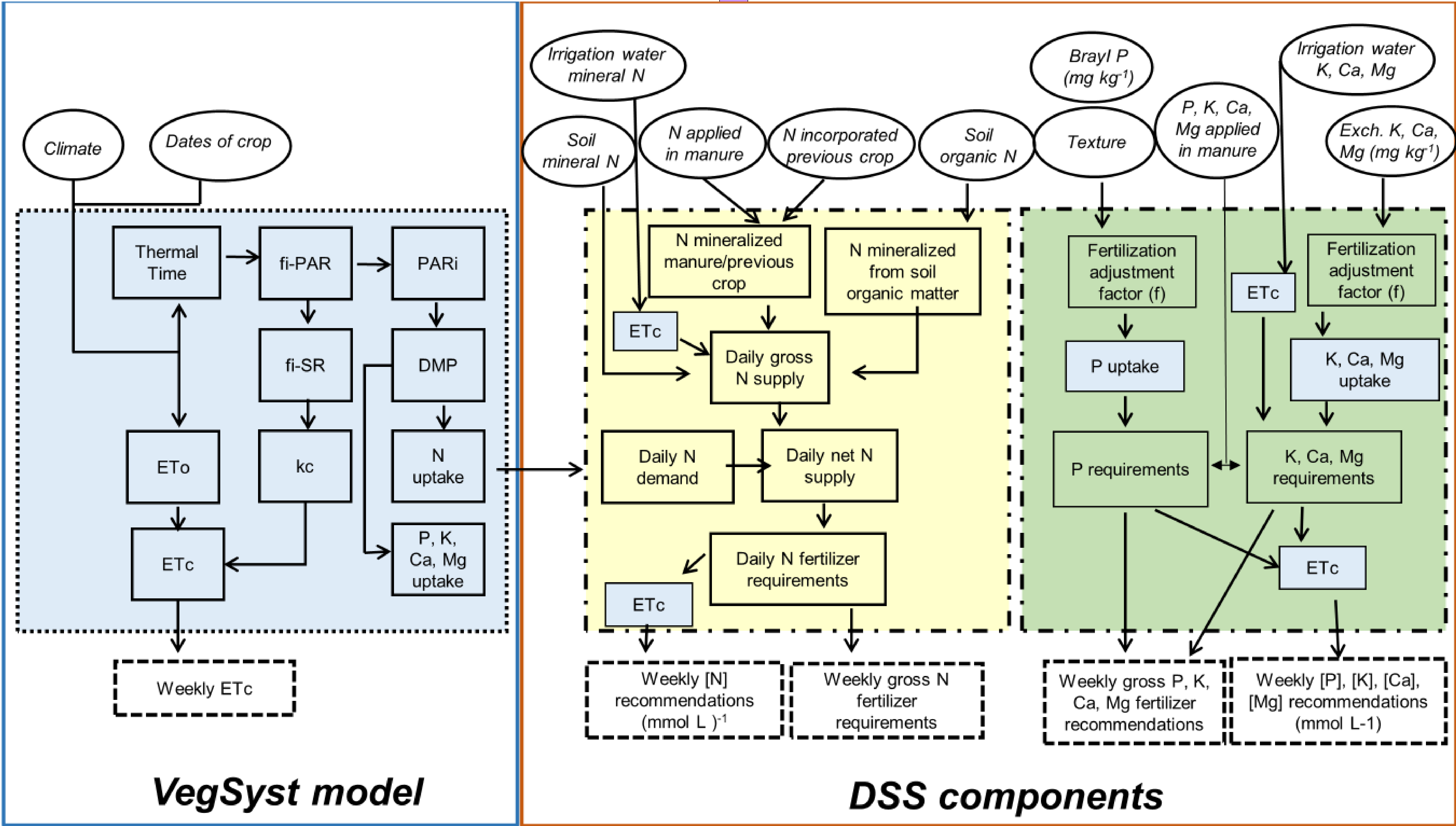
To assist farmers and advisers in daily calculation of irrigation and nutrient concentration tailored to the specific characteristics of each crop and greenhouse, this work presents a tomato fertigation decision support system (DSS) software based on VegSyst-DSS (Figure 1). The DSS calculates daily N, phosphorous (P), K, calcium (Ca), magnesium (Mg) fertilizer and irrigation requirements, and the nutrient concentration in fertigation solutions. The DSS will be available for free use as an app.

## DSS DESCRIPTION AND CALCULATIONS

The recommended application of P, K, Ca and Mg consider (i) modelled nutrient uptake (VegSyst model), and (ii) the available/exchangeable nutrients in the soil (saturated paste analysis) measured before planting. Soil nutrient availability and texture determine availability category (Very Low, Low, Medium (adequate), High, Very High) for each nutrient. Modelled nutrient uptake is multiplied by a factor associated with soil availability category based on the maintenance/build up approach.

DSS recommendations would form a nutrient management plan to be used as the prescriptive part of a prescriptive-corrective management approach. The DSS subsequent corrective part would involve the use of crop/soil monitoring to make adjustments to ensure optimal crop nutrient status.

Figure 1. Schematic representation of the tomato fertigation DSS showing the calculations made by (1) the VegSyst simulation model component and (2) the DSS components.



## DSS DESCRIPTION AND CALCULATIONS

The tomato fertigation DSS is based on the VegSyst simulation model calibrated and validated for greenhouse spring-summer and autumn-winter tomato growing seasons in Uruguay (Berrueta et al., 2023). VegSyst simulation model calculates daily N, P, K, Ca and Mg crop uptake and crop ETc. N fertilizer requirements are calculated using a N balance based on daily crop N uptake from VegSyst model and considers (i) soil mineral N at planting, (ii) N mineralized from: manure, incorporated previous crop or green manure and soil organic matter, and (iii) irrigation water N concentration. Irrigation requirements are based on calculated ETc and irrigation system flow.

## DSS DESIGN

The software has been participative designed to be intuitive for practical use by farmers and agronomical advisors. Three workshops with potential users were done to discuss: inputs availability, format and applicability of outputs and usability of the tool.

**The DSS will contribute to improve crop yield, water and nutrient use efficiency and reduce environmental burden.**

## REFERENCES

Berrueta, C., Grasso, R., García, C., Thompson, R. B., & Gallardo, M. (2023). Use of the VegSyst model to simulate seasonal dry matter production, N and K uptake and evapotranspiration in greenhouse soil-grown tomato in Uruguay. *Agricultural Water Management*, 286, 108395.