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Comparison of Crop Water Consumption Estimations under Drought Conditions Using Different Methods: A Case Study from Central Anatolia, Türkiye

Dr. Eray HARMAN[1], Prof. Dr. Belgin ÇAKMAK[2]

State Hydraulic Works (DSI) 31. Department Directorate, Eskişehir, Türkiye. [1]

Ankara University, Faculty of Agriculture, Department of Farm Structures and Irrigation, Ankara, Türkiye. [2]

INTRODUCTION & AIM

Accurate estimation of crop water requirements is essential for sustainable water management, particularly in semi-arid regions facing drought risks. This study compares crop evapotranspiration (ETc) and net irrigation water requirement (NIWR) using three different methods:

(i) Blaney–Criddle (used by DSİ),
(ii) CROPWAT 8.0 (Penman–Monteith),
(iii) SuET (a Turkish-developed Penman–Monteith-based tool).

A drought scenario based on the average climate data from the driest years (1994, 1995, 2007, 2008) was also constructed.

METHOD

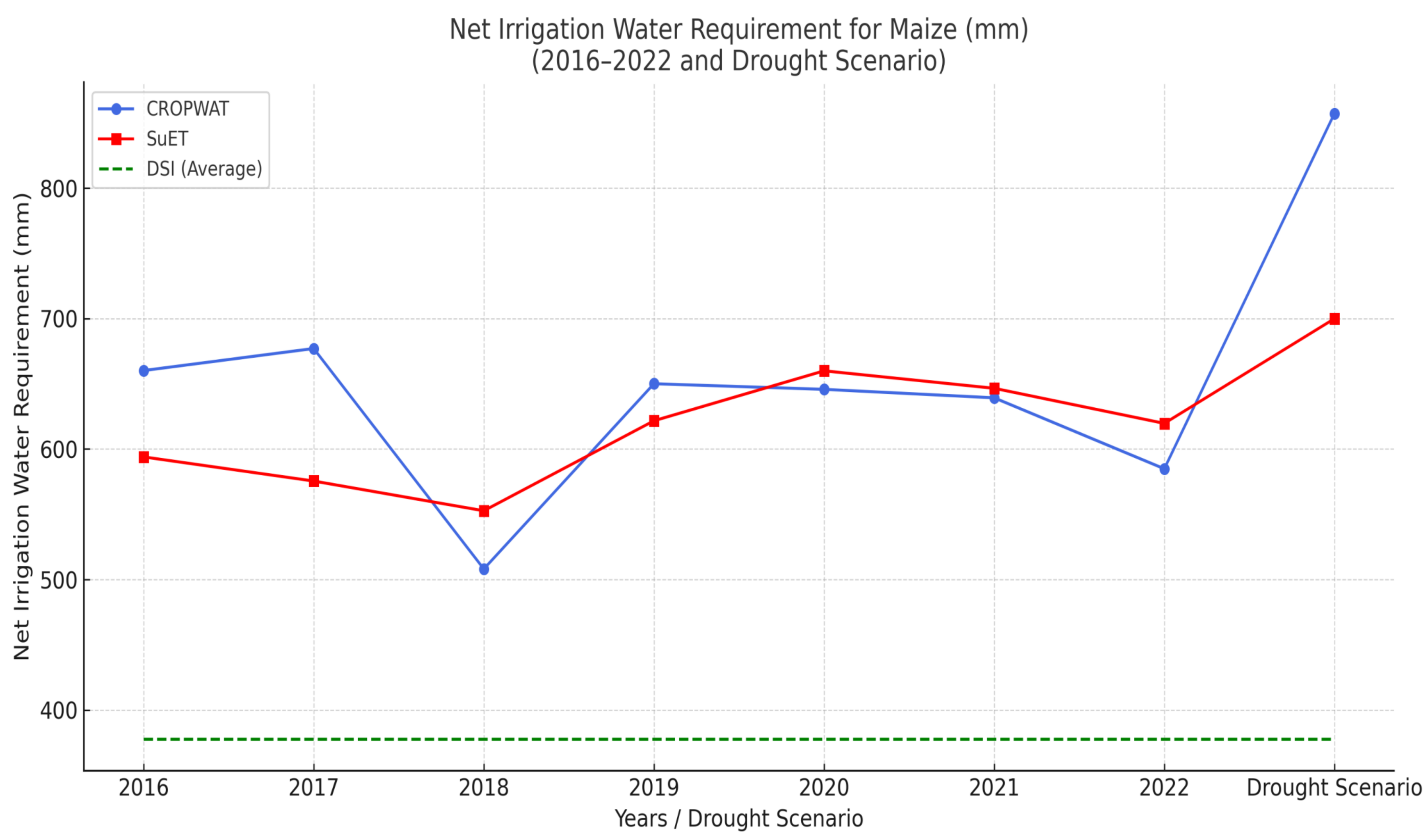
This study was conducted in the semi-arid Central Anatolia region of Türkiye for the 2016–2022 period. Net irrigation water requirements (NIWR) and crop evapotranspiration (ETc) were estimated using three methods:

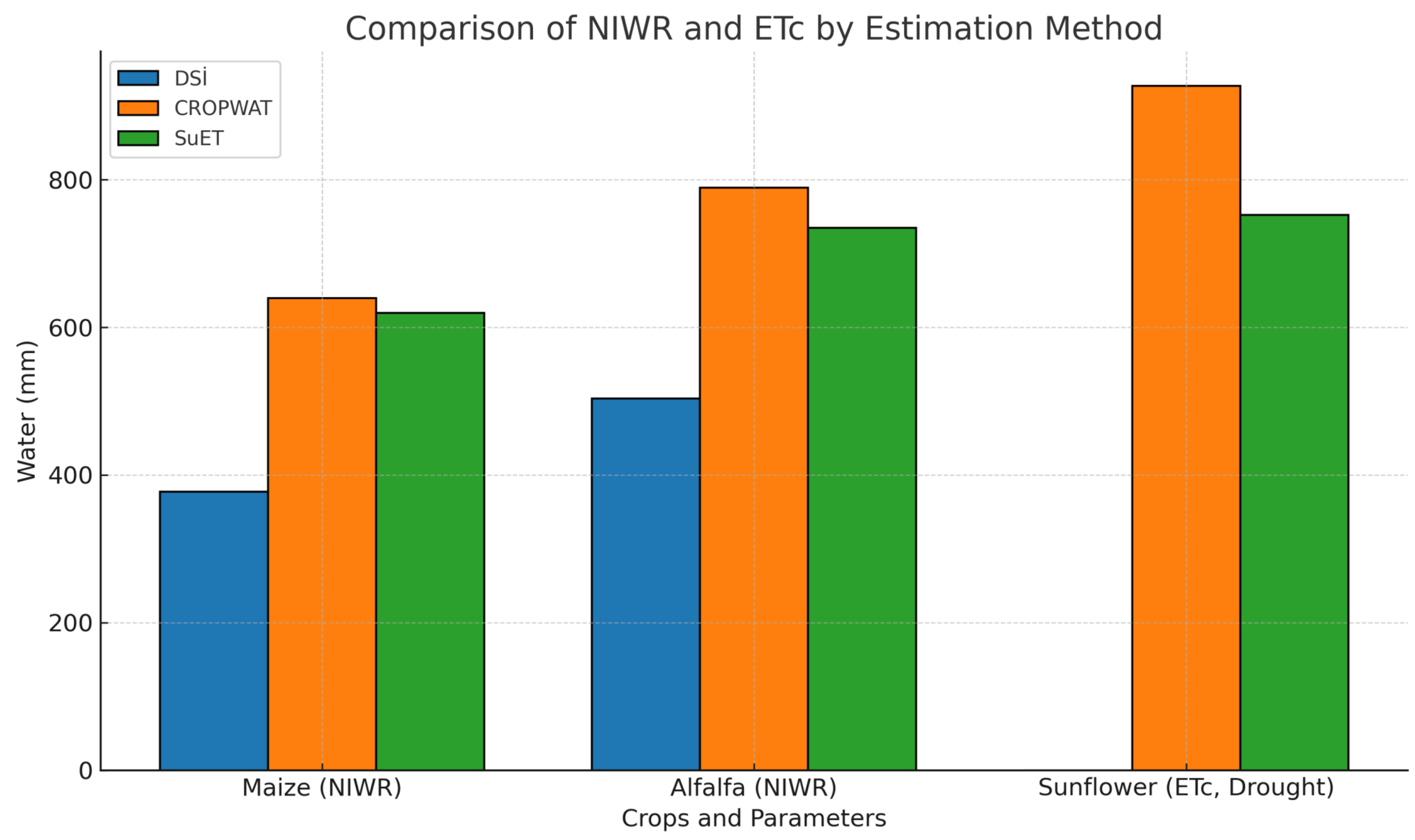
DSİ Method – Based on the Blaney–Criddle equation, used officially by the State Hydraulic Works (DSİ).
CROPWAT 8.0 – A FAO-based model applying the Penman–Monteith method.
SuET – A locally developed software also using the Penman–Monteith approach with regional calibration.

In addition, a **drought scenario** was constructed by averaging climatic data from the driest years (1994, 1995, 2007, 2008) to simulate water-scarce conditions.

RESULTS & DISCUSSION

Net irrigation water requirements varied significantly depending on the estimation method and climatic conditions. CROPWAT and SuET software produced higher values compared to the DSİ method. For example, for maize, CROPWAT estimated 857.3 mm while SuET estimated 700 mm under the drought scenario. These results highlight the need to reassess current estimation methods and implement climate-resilient irrigation planning.





CONCLUSION

Planning crop patterns according to water availability is no longer optional—it is a necessity for sustaining agricultural productivity in the face of climate-induced droughts. This study reveals that irrigation water requirements vary significantly depending on the estimation method and climatic scenario, emphasizing the need for more precise, location-specific assessments. Integrating such adaptive planning approaches is key to protecting water resources, enhancing resilience, and securing the future of agricultural systems in semi-arid regions.

FUTURE WORK / REFERENCES

Future Work:

To enhance irrigation sustainability in the face of increasing drought risk, future studies will focus on developing dynamic crop pattern models that integrate real-time climate data, reservoir storage, and crop profitability. In addition, field-level validation and farmer decision models will be integrated to improve practical applicability.

Selected References:

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