Irrigating farms the smarter way–a study on the utilization of precision irrigation by vegetable farmers from South 24-Parganas district, West Bengal, India

Panchali Sengupta

Department of Zoology, West Bengal State University, Berunanpukaria, Malikapur, Barasat, West Bengal, India

email:panchali17sg@gmail.com

INTRODUCTION & AIM

Precision irrigation is a novel concept that optimizes water use precisely when and where needed, thereby enhancing crop productivity and water use efficiency. It involves accurate monitoring of crop and soil parameters to determine appropriate amount of water for healthy plant growth and crop production.

Present study highlights the usage of Precision irrigation across vegetable fields practicing monoculture farming in Baruipur, Sonarpur and Jaynagar blocks of South 24-Parganas district, West Bengal, India from April 2024-March 2025.

METHODOLOGY

Cultivation of *Trichosanthes dioica, Abelmoschus esculentus, Cucurbita maxima, Cucumis sativus, Luffa acutangula* and *Trichosanthes cucumerina* was practiced. This study involves an array of sensors (soil, moisture, temperature, humidity, crop growth monitoring and soil nutrient analyzer), algorithm and drip tip and sprinkler irrigation for formulating an optimum irrigating schedule.

K-nearest neighbor, logistic regression, support vector machine, decision tree, random forest and gradient boosting algorithm were used for analysis using Raspberry Pi microprocessor.

Watering schedule was designed based on signal generated by microcontroller. Sprinkler irrigation at 50% Depletion of Available Soil moisture (DASM) was employed for the studied cropping system.
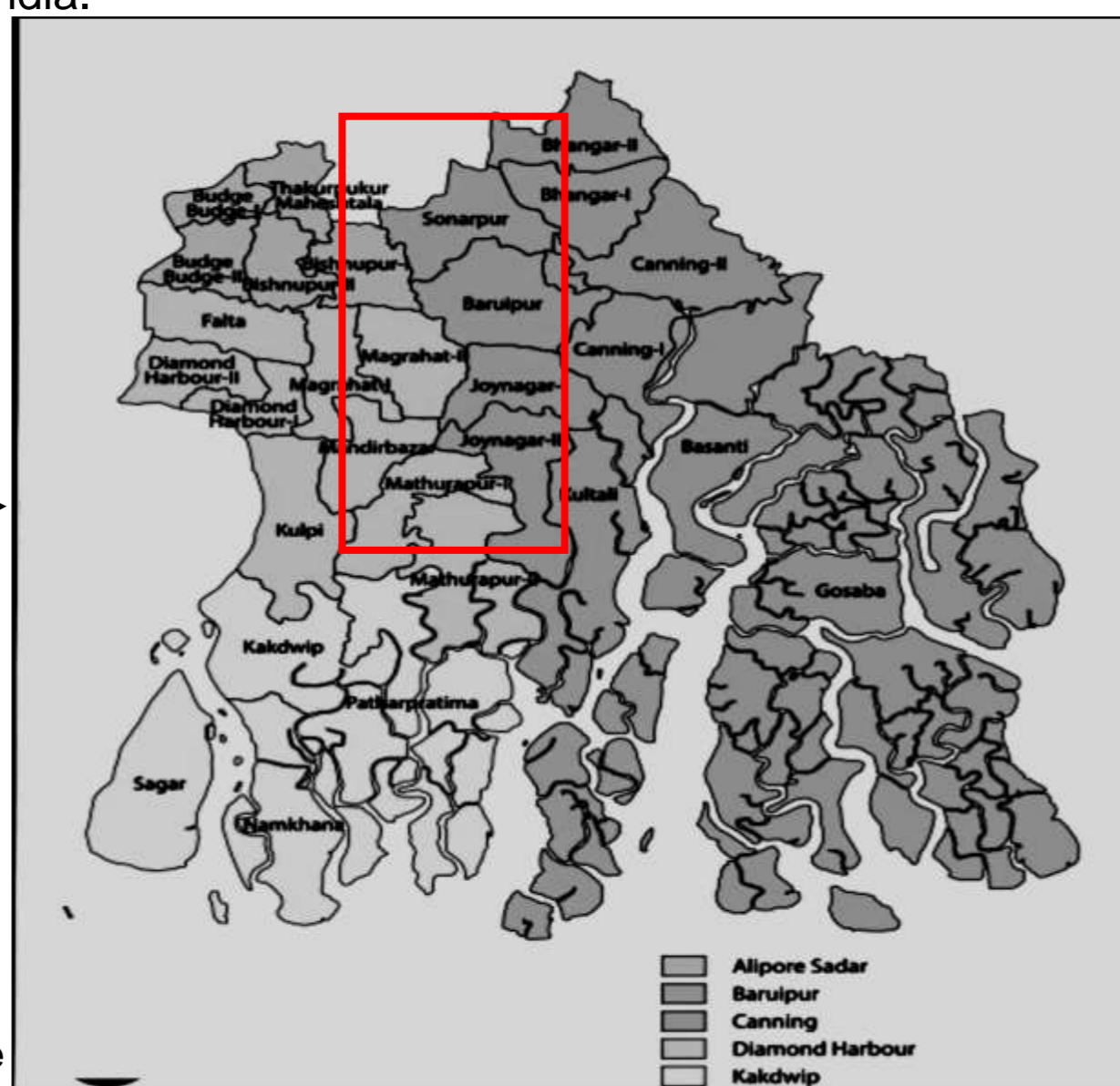
Water productivity (WP) was defined as the relationship between crop produced and the amount of water provided for the said purpose.
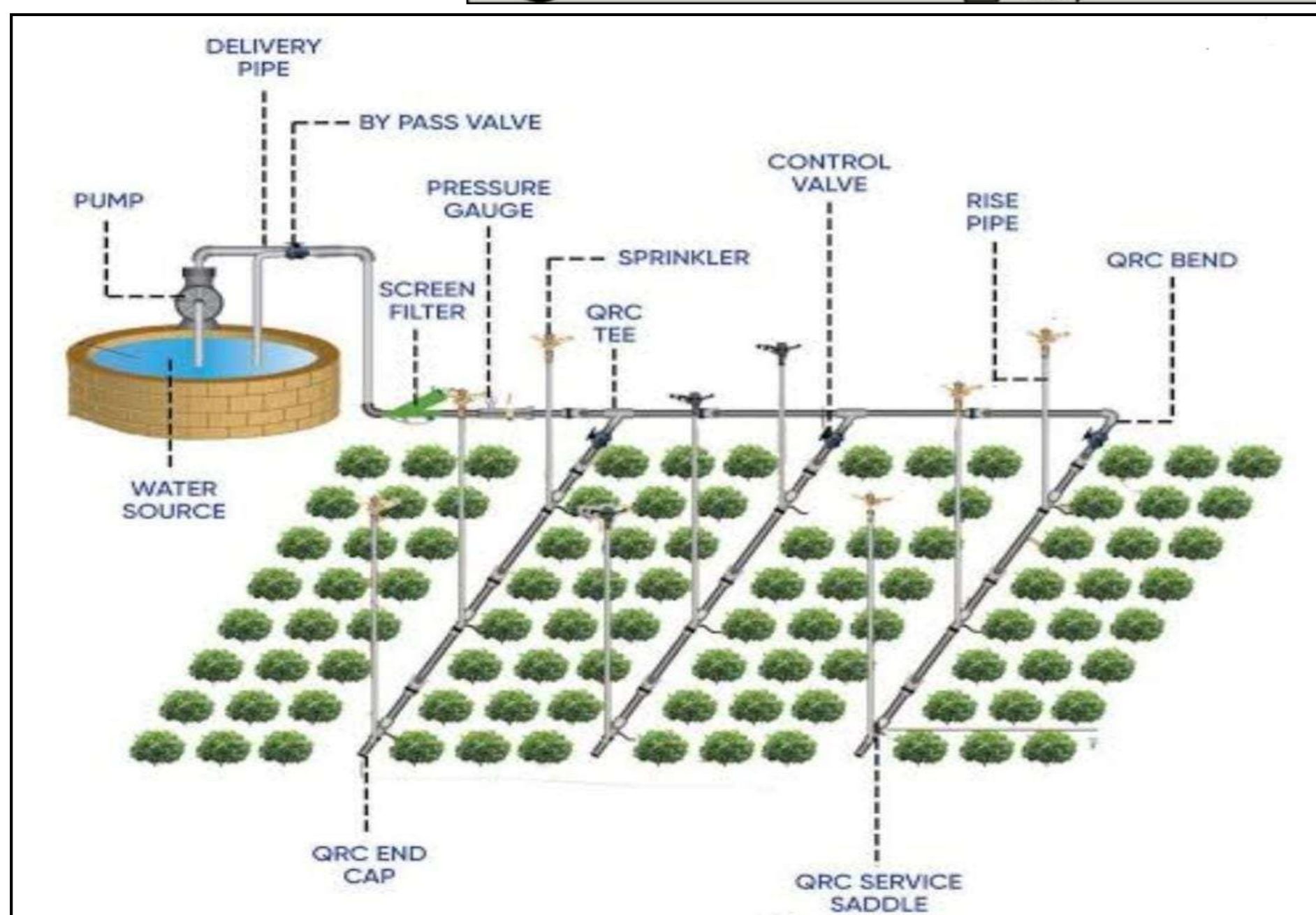
STUDY DESIGN

The study was undertaken across fields in Baruipur, Sonarpur and Jaynagar of South-24 Parganas district of West Bengal, India.
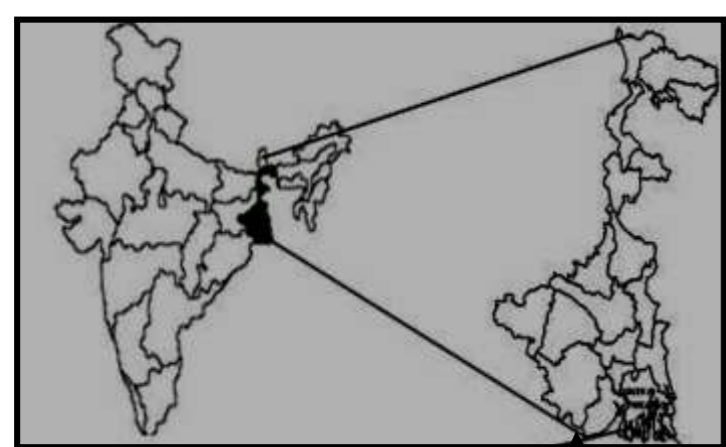
Map of the study area


Set up of Sprinkler irrigation in study site

Schematic representation of the set up of Sprinkler irrigation in the study area

RESULTS & DISCUSSION

WP in crop field under traditional watering schedule recorded values between 18.22 kg/ha/cm. (*Cucurbita maxima*) to 48.65 kg/ha/cm (*Trichosanthes dioica*). However utilizing precision irrigation techniques yielded result varying between 22.15kg/ha/cm (*Trichosanthes cucumerina)* to 52.68 kg/ha/cm (*Cucumis sativus*).

Random Boost algorithm (accuracy=98.20% for *Cucurbita maxima*), random forest (accuracy=97.5 % for *Trichosanthes cucumerina*) and decision tree (accuracy=97.20% for *Trichosanthes cucumerina*) were found to provide the most accurate results.
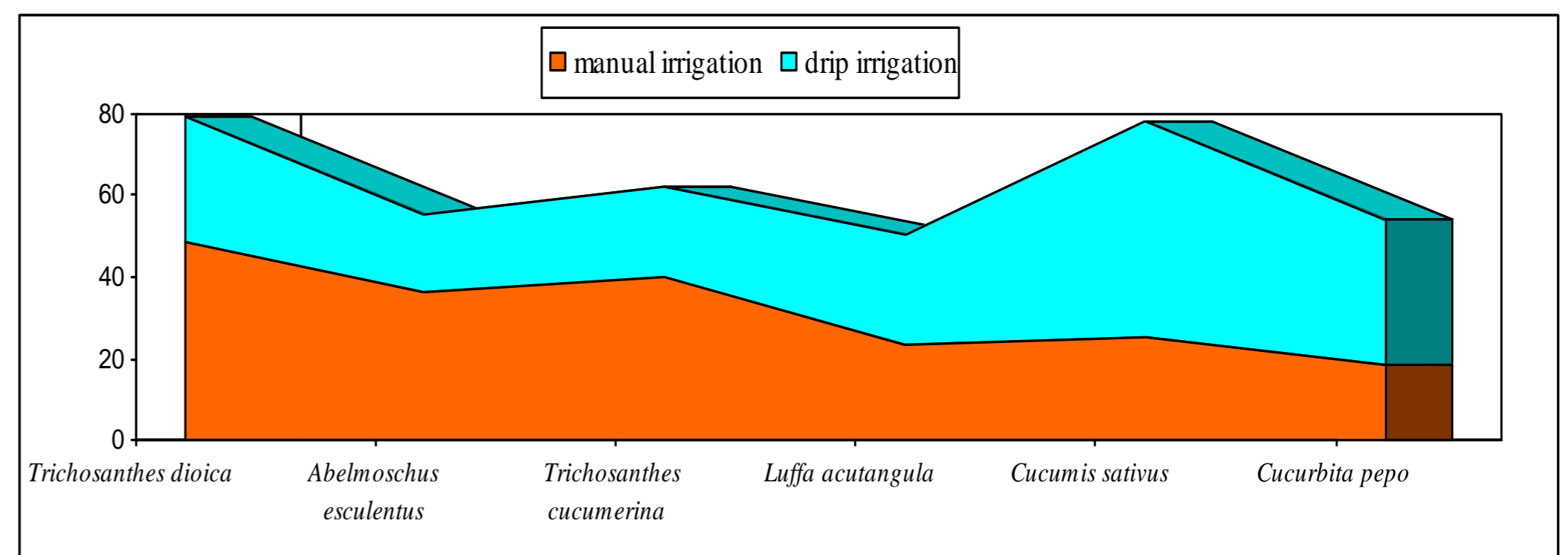
Mean water productivity (expressed as kg ha-1 cm-1) of crop species using manual method and under drip irrigation

CONCLUSION

FAO estimation about increasing agricultural productivity between 1998-2030 by 49% in rain-fed against 81% in irrigated regions across developing countries is worth mentioning. Higher water productivity (WP) in crop production system was observed in the studied farm lands under the influence of drip irrigation. This was in contrast to lower values of WP as observed when the farmers followed traditional watering system for crops in the study area. Thus precision irrigation as used in this study could probably help in minimizing labor costs while optimizing sustainability. AI algorithm could also add flexibility making it accessible for small landholders in the study.

Set up of Drip irrigation for studied crop species

REFERENCES

Ali, M.H.; Talukder, M.S.U. Increasing water productivity in crop production-a synthesis. *Agricultural Water Management* **2008,** 95, 1201-1213.

FAO, **2003**. *World agriculture: towards 2015/2030,*Earthscan Publications Ltd., London, pp. 432.

https://sciforum.net/event/IOCAG2025