CROP MONITORING THROUGH REMOTE SENSING

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Annotation: World agriculture is facing a great challenge since it is necessary to find a sustainable way to increase food production. Current trends in advancing the agriculture sector are based on leveraging remote sensing technology and the use of biostimulants. However, the efficient implementation of both of these on a commercial scale for the purposes of productivity improvement remains a challenge. Thus, by proposing a crop monitoring strategy based on remote sensing data, this paper aims to verify and anticipate the impact of applying a Glycinebetaine biostimulant (GB) on the final yield.

Keywords: agronomy, remote sensing, glycinebetaine, Sentinel-2, yield, crop monitoring.

INTRODUCTION

A strong agricultural sector is of paramount importance if the global population is to maintain its current economic and social progress. Currently, 8.9% of the world's population suffer from hunger, a worrying number considering the increase in world population predicted by the UN in the coming decades [2]. This is a 21st century problem, with an added environmental component—the increase in world food production must be sustainable. This calls into question the green revolution of the 20th century, to which a large amount of global pollution is attributed [4]. In this context, some authors have pointed out the need for a second green revolution, which is capable of strengthening world food security in a sustainable and environmentally friendly way. Although scientific publications have reflected this need, exhibiting a greater presence of genetic and technological improvements, these advances are a long way from being manifested in the current data on the production of raw food materials. A clear example is the cultivation of rice, which contributes 21% of the calories ingested in the world, and thus is the most important food crop.

MATERIALS AND METHODS

In agriculture, several factors lead to the instability of international markets, some of which transcend human control. In this way, abiotic stresses can generate unexpected fluctuations in food production; the cultivation of rice, given its great demand for water and climatic requirements, does not escape this trouble [1]. Drought, salinity and extreme temperatures greatly condition the crop. Faced with this problem, the use of biostimu-lants is considered a valid alternative in the scenario of the second green revolution [3]. A widely accepted biostimulant is a compatible solute called glycinebetaine (GB). It is a fully *N*-methyl-substituted derivative of glycine, and it can be found naturally in many plants [4].

RESULTS AND DISCUSSION

The experiment consisted of four replications of 5000 m^2, each one conducted following a completely randomized design (Figure 1). One treatment, with two concentrations: 0 and 5.0 L ha^{-1} (1450 mM) of GB biostimulant was studied. Note that hereafter the statistics

representing the control and the GB correspond to the average of the four replication areas in each case. GB was applied on 33 DAS (tillering stage), according to the rice crop model obtained in Franch et al. (2021) [2]. The GB was applied by drone to avoid any additional machinery overpass: AGR model A6; tank volume: 6 L; flow rate: 0.57 L min^{-1} by nozzle; pressure: 6 bar; forward speed: 6 m s^{-1}; spray height: 1.5 m; swath width: 2 m; and 4 nozzles (Agroplast Ppij, model 6MS 01C anti-drift orange with ceramic tip, fan-shaped, 110°).

Phenological stages were classified according to the BBCH scale. Figure 1 shows the phenological cycle of the crop in the experimental plot and the periods when the fields are dried. Climatic data were registered by a datalogger. Figure 2 shows the most important meteorological crop growth parameters that were retrieved: air temperature (T) and relative humidity (RH) (no rainfall occurred during the drying periods).

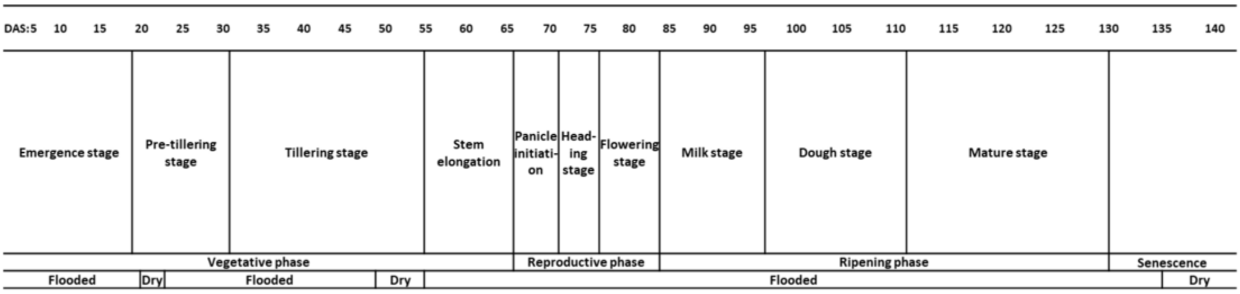

Figure 1. *Timing of the main phenological stages of rice in Valencia until harvest (DAS: Days after Sowing) and the last row the water management.*

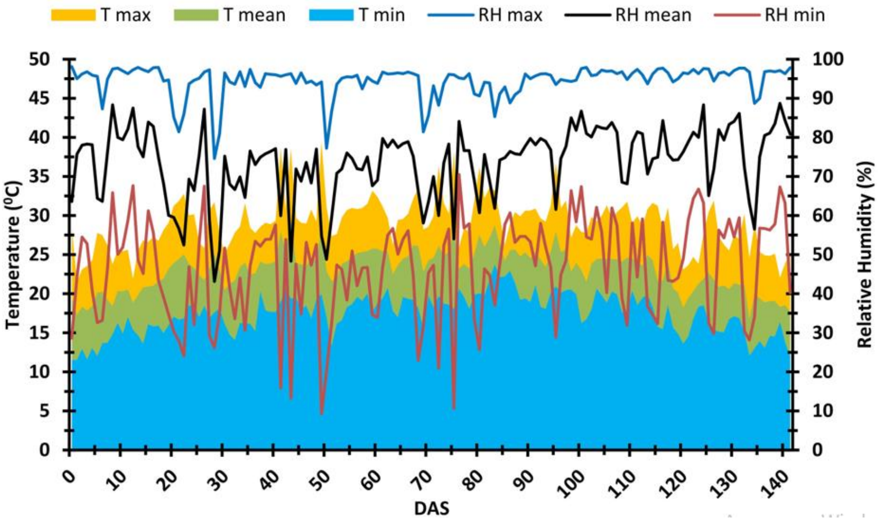

Figure 2. *Maximum (T max), mean (T mean) and minimum (T min) temperatures; maximum (RH max), mean (RH mean) and minimum (RH min) relative humidity from sowing to harvest in the experimental plot area in 2021.*

Plant height, panicle length, panicles per m^2, filled grain per panicle, weight of 1000 grains, grain length and width were obtained by means of field measurements at harvest time. These measurements were acquired in an area of 0.25 m^2, randomly selected avoiding the edge effect (10 m inside) in 4 repetitions for each replication. In addition, we measured the days elapsed from sowing until the emergence of 50% of the panicles and the marketable yield ($kg \cdot ha^{-1}$) for each replication.

CONCLUSION

The results obtained in the present paper demonstrate how useful remote sensing data are for monitoring the productivity of the rice crop. Glycinebetaine is widely recognized as a potent biostimulant for crop yield improvement; however, its agronomic influence on the productive behavior of the rice crop and the monitoring of its effect under natural field conditions remains unknown. The application of GB at the beginning of tillering (the critical phase, which is determinant in the final yield) has led to a better performance of yield components, thus achieving a significant increase in the final yield. The results also verify the need to analyze the dynamics of reflectance in all spectral regions, maximizing the sensitivity to changes in any band with a new index. This index should be tested in more areas and for longer periods in order to offer clear evidence that it contributes to the better monitoring of the rice crop; therefore, a preliminary study is presented in this paper.

REFERENCES

1. Onojeghuo, A.O.; Blackburn, G.A.; Huang, J.; Kindred, D.; Huang, W. Applications of Satellite 'Hyper-Sensing' in Chinese Agriculture: Challenges and Opportunities. *Int. J. Appl. Earth Obs. Geoinf.* **2018**, *64*, 62–86.

2. Marvin, D.R. The Second Green Revolution Will Bring Agri-Tech Breakthroughs to Growers. *Ind. Biotechnol.* **2018**, *14*, 120–122.

3. Wollenweber, B.; Porter, J.R.; Lübberstedt, T. Need for Multidisciplinary Research towards a Second Green Revolution. *Curr. Opin. Plant Biol.* **2005**, *8*, 337–341. Scopus—Document Search. Available online: https://www.scopus.com/search/form.uri?display=basic#basic (accessed on 2 December 2021).

4. FAOSTAT. Available online: https://www.fao.org (accessed on 2 December 2021).