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WATER RESOURCES MANAGEMENT USING AGROPHYSIOLOGICAL PARAMETERS : A CASE STUDY OF MAIZE (*Zea mays* L. cv. synthetic C).

Introduction

Like most countries in the soudano-sahelian zone, Senegal is affected by drought which limits production. In this country, maize is cultivated wnder rainfed conditions south of the 600-700 mm isohyet and under irrigation conditions. mainly in the valley of the Senegal river. This study was conducted with the aim of identifying agrophysiological parameters which could be used as tools to determine the stage(s) in the growth cycle of maize in which water deficit is most critical and to manage water resources for optimal production

Material and Methods

The experiment was carried out with *Zea mays* cv. synthetic C, planted in the experimental fields of CERAAS on a sandy-clay soil, at Bambey (14° 42 N, 16° 28 W) in Senegal. This cultivar was selected by the Senegalese Institute of Agricultural Research because of its high yield potential and short growth cycle of 90 days which fits into the rainfall pattern of this zone. The plants were subjected to four water regimes simulating the types of drought usually experienced in Senegal (Sivakumar, 1988) : well irrigated throughout the growth cycle water deficit during the vegetative phase, the flowering phase and the vegetative and flowering phases. Three agrophysiological parameters were examined : available soil water (ASW), determined from soil water content measurements, hydrodynamic characteristics of the soil and root dynamics (Lecoeur *et al.*, 1996) ; satisfactory water consumption (SWC), determined from the ratio of actual and maximal evapotranspiration ; crop water stress index-CWSI (Idso, 1982), determined from the relationship between vapour pressure deficit measured using the ventilated psychrometer and the canopy air temperature differential measured by infra-red thermometry (Fig.1).

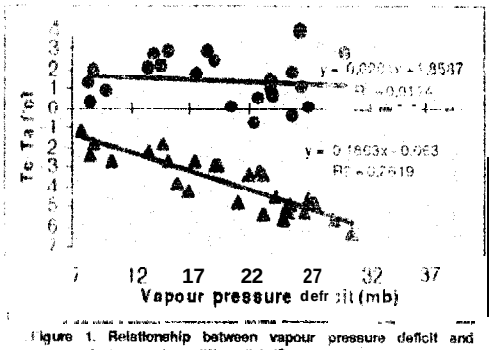

Figure 1. Relationship between vapour pressure deficit and canopy-air temperature differential (● stress, ▲ well irrigated, Tc = canopy temperature, Ta = air temperature).

Results

When ASW droppped below 60 %, CWSI increased above 0.40, corresponding to a severe water deficit (Fig. 2). SWC values of 78 % considered as moderate stress level for maize, corresponded to a CWSI below 0.27 (Fig. 3)

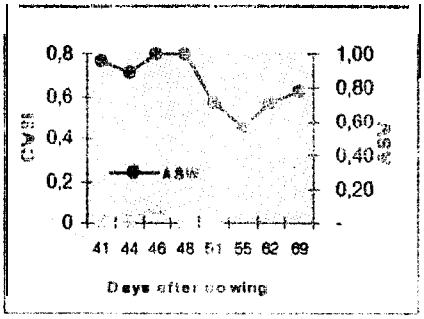

Figure 2. Relationship between available soil water (ASW) and crop water stress index (CWSI).

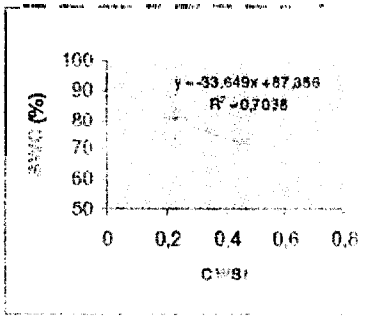

Figure 3. Relationship between satisfactory water consumption (SWC) and crop water stress index (CWSI).

High yields were obtained with CWSI of 0.27 and below during flowering (Fig. 4). Above 0.27, a reduction in grain yield was observed.

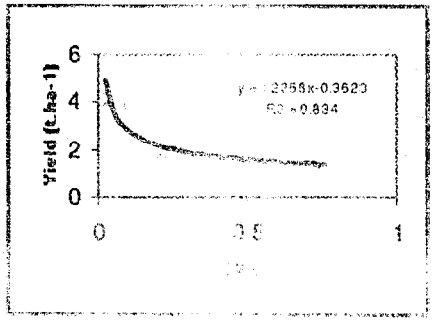

Figure 4. Yield as a function of CWSI at flowering.

Maize cultivated in the experimental field of CERAAS (stage 48 days after sowing).

Conclusions

Results from water balance studies of the soil-plant-atmosphere system have confirmed the sensitivity of maize to water deficit during flowering. The relationship between satisfactory water consumption (SWC), crop water stress index (CWSI) and grain yield has shown that a CWSI of 0.27 corresponds to the threshold value for scheduling irrigation for the synthetic C maize cultivar. These results could serve as a tool in the rational management of water resources in the semi-arid zones.

References

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