Soil available water and grain yield for a rainfed maize crop in Brazilian Cerrado

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Water is an essential element for plant survival, as well as for soil ecological functions. In Brazil, it has been reported that variations in maize yield are strongly related to soil water availability (AW), which is traditionally defined as the difference between the upper (field capacity, FC) and lower (permanent wilting point, PWP) limits of available water. The goal of this study was to assess the effects of changes in soil AW on rainfed maize production, through the use of a crop growth model. The model was previously parameterized and evaluated with experimental and environmental data. Weekly sowing date scenarios were simulated using 33 years of weather data, from 1981 to 2013, for conditions in Sete Lagoas, Brazil (19 °30 'S, 44 °12' W). The soil water retention curve adjusted with the van Genuchten's model was used to set up six scenarios of soil AW: FC at -4 kPa, -6 kPa, -10 kPa, -20 kPa, -33 kPa and "in situ". Then, the following production variables were evaluated for the highest yield date (October 31st): grain yield (kg ha^{-1}), number of grains per area (grains m^{-2}), number of grains per ear (grains ear^{-1}) and unit grain weight (g grain^{-1}). There was significant difference ($p<0.05$) among the AW scenarios for all variables analyzed. For FC at -4 kPa, -6 kPa and -10 kPa, grain yield was higher than that of other AW scenarios (8,301, 8,009 and 7,496 kg ha^{-1}, respectively), while the lowest yield was verified for FC at -33 kPa (4,289 kg ha^{-1}). This same contrast was obtained for number of grains per area and number of grains per ear. From the highest to the lowest AW scenario (FC at -4 kPa to -33 kPa), there were reductions of 48.3%, 42.5% and 42.3% in the grain yield, number of grains per area and number of grains per ear, respectively. These results confirm the high sensitivity of maize to changes in the soil AW. For grain unit weight, differences were simulated for AW scenarios of FC at -4 kPa and -6 kPa and of FC at -20 kPa and -33 kPa, with only 8.8% of maximum reduction. Thus, this variable was less affected by water availability

in the soil. In general, changes in soil AW strongly affect the maize grain production, which demands suitable soil water management in its production areas under Cerrado biome.

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