Climate impact analysis and adaptation strategies to climate change on peanut in Senegal

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Introduction

• In Senegal, agriculture supports 70% of the rural population.
• Peanut constitutes the principal source of agricultural incomes for farmers.
• Climate change is projected to bring drought, together with higher temperature and increased CO2 (Roudier et al., 2011).
• This study assessed the impacts of climate change on peanut yield and proposed adaptation strategies for Senegal.

Data and methods

The study was conducted in Senegal in two different locations: Bambey, located at 14°42N and 16°29W and Nioro, located at 13°45N and 15°46W.

Figure 1. Study area


Four regional climate models (RCM) used: DMI-HIRHAM5, KNMI-RACMO22T, CLMcom-CCLM4-8-17, SMHI-RCA4.

Corrected input:

- RCM data
- Observed data

Figure 2. Bias corrected RCMs output used for climate change impact analysis

SIMPLACE< Lintu5,DRUNIR,CanopyT, HourlyHeat> was used to simulate daily growth and development for peanut in Senegal.

Peanut cultivar: Fleur 11.

Evaluation of canopy temperature (Tc) versus air temperature (Ta) to account for interaction of heat stress and crop water status adopted the Monin-Obukhov Similarity Theory method (Webber et al., 2016).

Conclusion

• Climate change may have positive impact on peanut yield in Senegal due to elevated CO2 levels.
• Interactions between heat stress, drought and elevated CO2 are still uncertain and need consideration in modelling assessments.
• Current sowing date led to improved yield levels under climate change. Furthermore, short season varieties can be recommended as adaptation strategy to cope with the impact of early rain cessation.

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References


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Climate change signal for RCP4.5 and RCP8.5

- Decreased precipitation with a high inter-annual variability (Figure 3a).
- Increased temperature with a clear difference between RCP4.5 and RCP8.5 from 2050 for the RCMs ensemble (Figure 3b).

Effect of CO2 elevation on simulated yield under dry season

- Maximum yield change went up to -42.1% for RCP4.5 and -55% for RCP8.5 when Ta is used under dry season (Figure 4).
- Positive yield change resulted from the increase in CO2 concentration. This caused an increasing yield from 9.6% for RCP4.5 to 13.2% for RCP8.5 (Figure 5).

Effect of CO2 elevation on simulated yield under rainy season

- Negative effects of climate change were greater in dry season than during rainy season.
- Ta should be used instead of Tc to account uncertainty in assessing the impacts of heat in dry season where maximum Ta is above 35°C.

Figure 3. Inter-annual variability of precipitation (a) and temperature (b) (1981-2100) averaged over the RCM ensemble.

Figure 4. Relative yield change under dry season (irrigation) condition without and with elevation CO2.

Figure 5. Relative yield change under rainy season condition without and with elevation CO2.