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# Rising nutrient availability may have much more impact than climate change on pearl millet in Senegal

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## Context and objectives

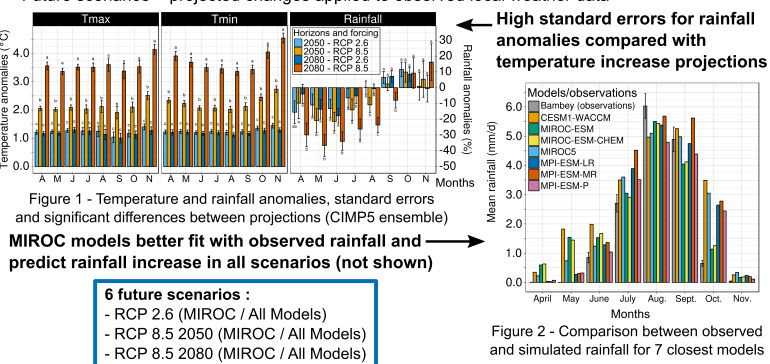
- Semi-arid Africa (Senegal)
- Traditional food crops productions low and far from attainable yields
- Assessing the impact of climate change on millet yield
- Comparing climate change impact with crop intensification (*i.e.* increased fertilization)



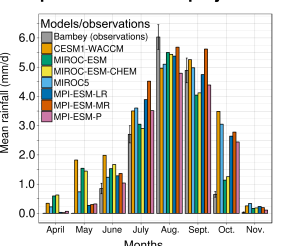
## Methods

- CIMP5 ensemble
- 3 time horizons (1985, 2050, 2080), 30-years time spans, 2 radiative forcing (RCP 2.6, RCP 8.5)
- Future scenarios = projected changes applied to observed local weather data

### Climate modelling



High standard errors for rainfall anomalies compared with temperature increase projections



### Crop modelling

- CELSIUS crop model
- Calibrated against observed data under varying weather, soil and nutrient management
- Millet crop simulations:
  - ➔ Present and future climate, 30-years time spans
  - ➔ Severe and moderate nutrient limitations.

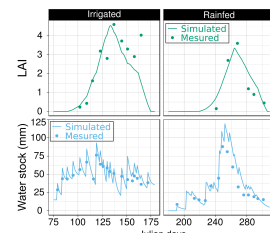
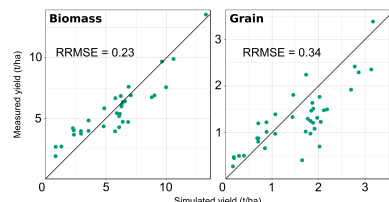
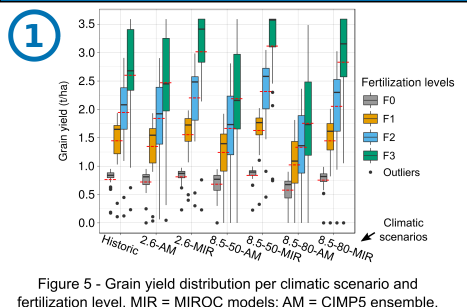


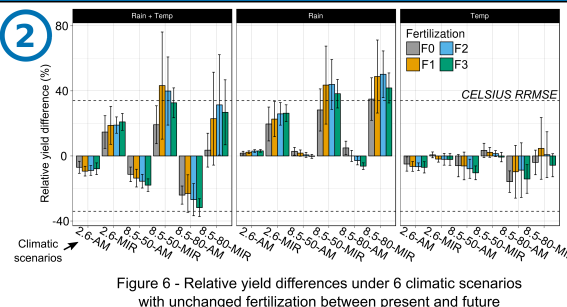
Figure 4 - Comparison between observed and simulated values for millet LAI and soil water content in two contrasted situations

- 4 nutrient limitation levels :**
- F0 : 25% of potential yield (Yp) = current representative yield level
  - F1 : 50% of Yp
  - F2 : 75% of Yp
  - F3 : 100% of Yp

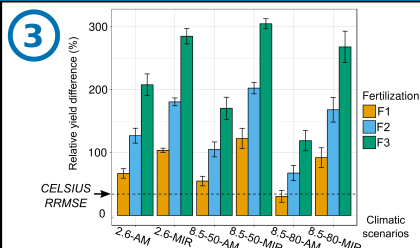
## Results



- Yield interannual variability increases in the future, under CIMP5 ensemble projections
- Contrasting trends depending on climate models



- Relative yield differences lower than model RRMSE, especially for temperature impact
- Strong differences depending on rainfall projections



- The lowest tested level of nutrient supply (F1=35 kg.ha<sup>-1</sup>) is sufficient to provoke a substantial increase in yield
- Relative yield differences significantly higher than CELSIUS RRMSE

## Discussion

- In our simulations, climate change impact on yield differences depends above all on rainfall. However, rainfall scenarios still remain uncertain.
- Millet currently grown under severe nutrient limitations (continuous cropping, insufficient recycling and external supply)
- Our simulations suggest that fertilization have more impact on millet yield compared to climate change scenarios.
- Strong yield increase could be expected from increasing organic or inorganic fertilization.