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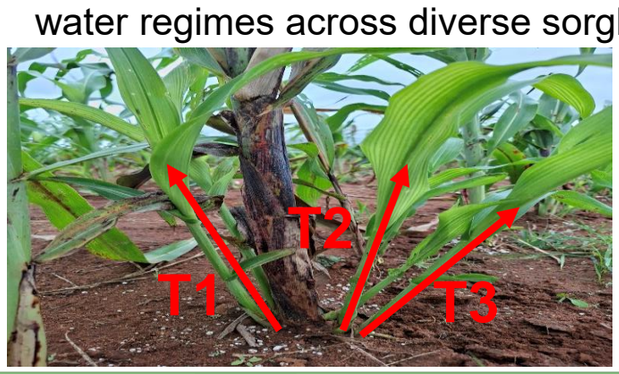
Quantifying tiller contribution to yield as a compensatory and water stress adaptation mechanism in sorghum

J. Ntuli[1], P.E. Dlamini[1], S.T. Hadebe[1]
[1]Department of Plant Production, Soil Science and Agricultural Engineering, University of Limpopo, Private Bag Box X1106, Sovenga 0727, South Africa
201827206@myturf.ul.ac.za

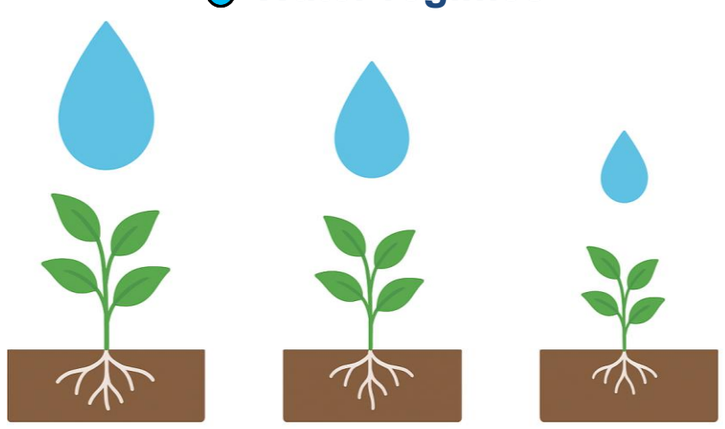
INTRODUCTION & AIM

- Climate change intensifies water scarcity, especially in semi-arid regions.
- Sorghum: drought-tolerant, low-input crop, suitable for water-limited systems.
- Despite adaptability, sorghum yields remain low in SSA (~0.9 t/ha).
- Water scarcity during key developmental stages is a major yield-limiting factor.
- **Tillering**: production of secondary shoots from the main stem.
- Debated role under water stress:
- **Adaptive view**: compensates for reduced main stem yield (moderate/early stress).
- **Maladaptive view**: competes for resources under severe/prolonged stress.
- Aim: quantify the contribution of tillers to yield under contrasting water regimes across diverse sorghum cultivars



METHOD

Water regimes

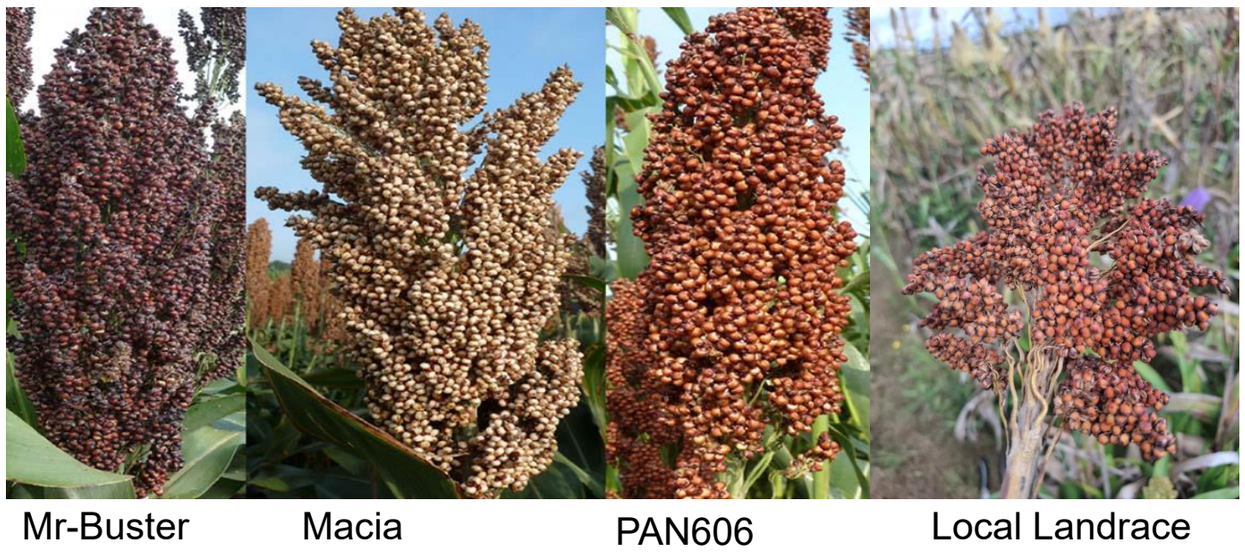


Full irrigation | Deficit irrigation | Rainfed

PR 2/6 soil profile probe & moisture meter

- Full irrigation: applied from planting to physiological maturity.
- Deficit irrigation: supplementary watering only from boot stage to maturity.
- Rainfed: no irrigation; relied only on rainfall.
- Irrigation scheduling: water applied to field capacity based on available soil water content.

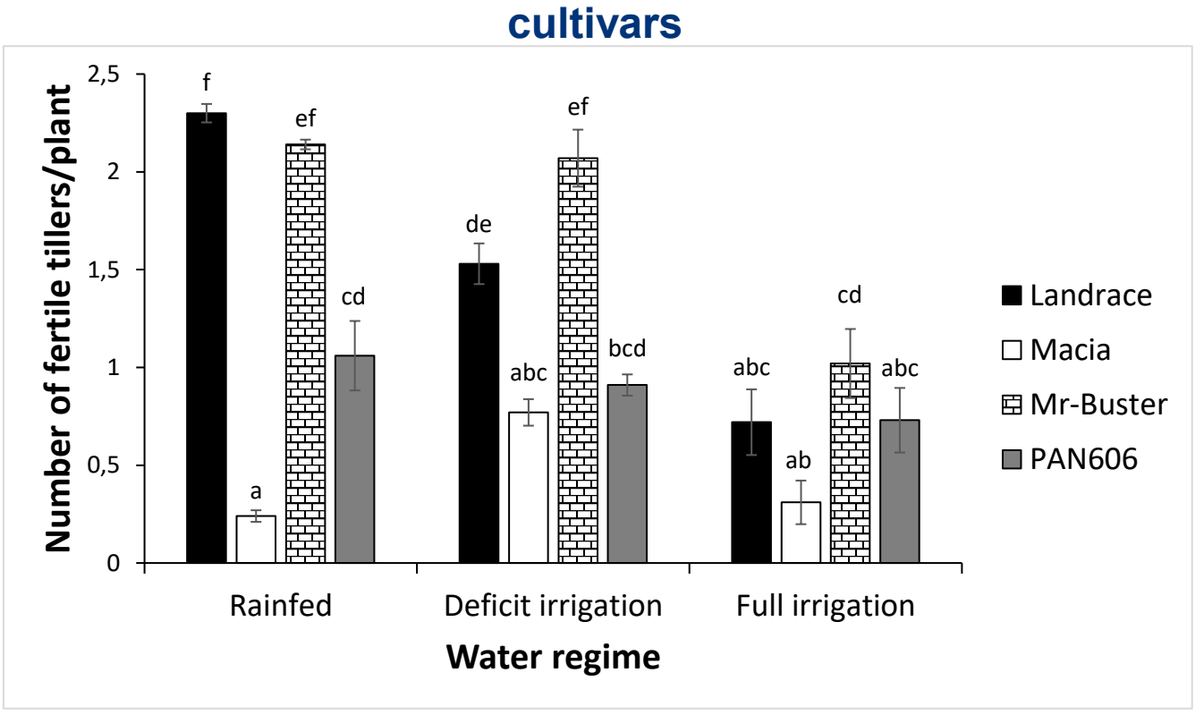
Sorghum cultivars



Mr-Buster (High tillering) | Macia (Low tillering) | PAN606 (Medium tillering) | Local Landrace (High tillering)

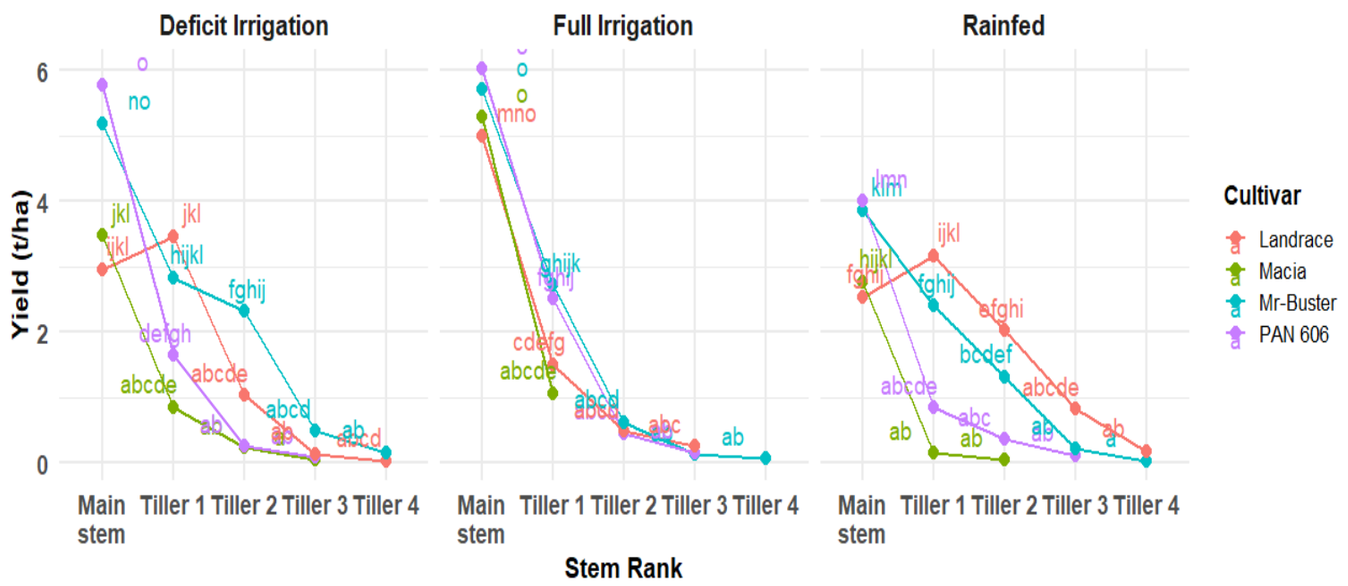
RESULTS & DISCUSSION

Fertile tiller number under varying water regimes and cultivars



- **More tillers under stress**: rainfed and deficit irrigation increased tillering (1.5 - 2.4 tillers/plant in Landrace & Mr-Buster).
- **Adaptive response**: early water stress triggered tiller formation to compensate for reduced main-stem growth.

Grain yield partitioning among stem ranks under contrasting water regimes and cultivar differences



- Hybrids had the highest main stem productivity: PAN606 & Mr-Buster produced 3.9 - 6.0 t/ha, though yields declined under rainfed conditions.
- **Strong tiller contribution under stress**: Landrace & Mr-Buster tiller 1 and 2 added 1.5 - 3.2 t/ha under water stress.
- **Drought compensation**: under stress, sorghum redirects assimilates to tillers, allowing secondary shoots to sustain total yield.
- **Genotype effect**: high-tillering cultivars (Landrace, Mr-Buster) show greater yield stability under water limitation.

CONCLUSION

- Fertile tillers (especially T1 & T2) significantly boosted total grain yield under water-limited conditions.
- Matching genotype × water regime enhances tillering plasticity and strengthens yield resilience in semi-arid systems.

FUTURE WORK

- Quantify tiller effects on water and nutritional water productivity under different management conditions.
- Refine AquaCrop to simulate sorghum performance under complex tiller-regulating factors.