

Long-term effect of
SEASON OF BURNING
on species composition,
light interception, biomass
production and soil
chemical properties in the
Dohne sourveld of the
Eastern Cape, South Africa

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INTRODUCTION

- Prescribed fire manipulates rangeland vegetation to favour optimum forage and animal productivity.
- Fire and herbivory improve photosynthetic rates, increase availability of nutrients (Mbatha and Ward 2010).
- All fires alter the cycling of nutrients, biotic, physical, moisture and temperature characteristics of soil.



PROBLEM STATEMENT

- The role of fire in maintaining rangeland quality is poorly understood and
- Hence, farmers resist 'prescribed burning period' recommendations
- Results in negative ecological and socio-economic effect on rangeland and livestock industry, hence depletion of natural resource



JUSTIFICATION

- Fire maintains sourveld, hence optimum livestock performance
- Quantified and gathered scientific evidence on the role of fire in the Dohne Sourveld
- Formulates guidelines for correct seasons of burning Dohne sourveld, improvement of rangeland management, fodder flow
- Hence, optimum livestock production



OBJECTIVES

- To determine effect of burning and sampling seasons on herbaceous species composition and diversity
- To determine effect of fire seasons on fIPAR, LAI and biomass production
- To determine long-term effect of fire seasons on soil pH, macro nutrients (SOM and C), N, P, K, Mg and micro-nutrients: Zn, Mn and Fe



KEY QUESTIONS & HYPOTHESIS

- What effects does long-term seasons of burning have on fPAR that are absorbed by the grass canopy, LAI, biomass production, species composition, soil pH, soil micro and macro nutrients and soil nutrient release?
- The following hypotheses were tested: Season of burning has no effect on PAR, LAI, biomass production, species composition, soil pH, soil micro and macro nutrients.

METHODS

- The study at Döhne Agricultural Development Institute (A.D.I.)
- Treatments: July, August, September, October and November.
- Two step method and Shannon-Wiener Index used species composition and diversity
- Ceptometer for PAR/LAI
- Disc Pasture Meter for above ground biomass, material was harvested.



Seasons of burn site



Application of burning



Soil sampling





METHODS (Cont.)

- Soil auger for topsoil at 2cm, 4cm and 8cm
- Two-way ANOVA for dominant species, One way ANOVA for treatment effects on light interception, biomass production and soil chemical properties.
- R statistical package was used for t-tests and pairwise comparison on PAR, LAI and biomass production, soil nutrient at 10% interval

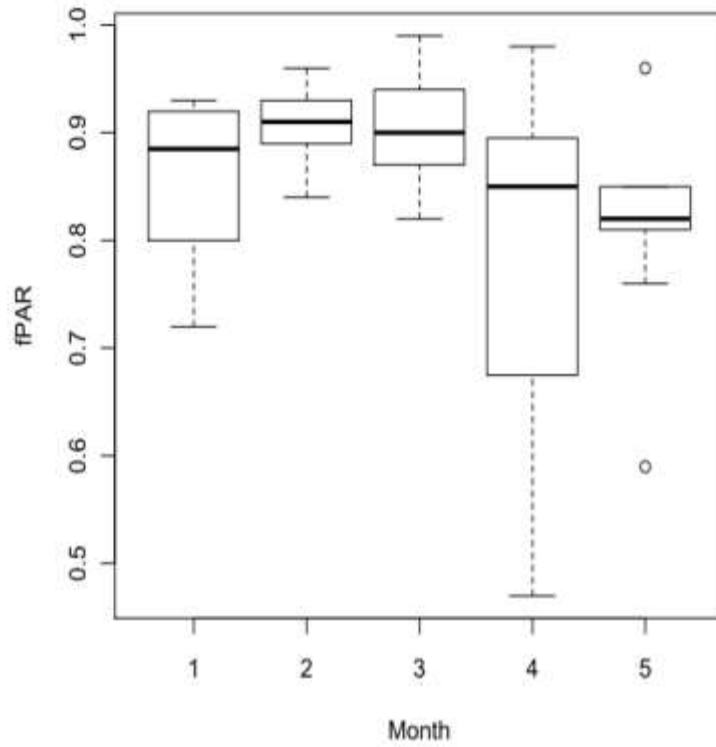
RESULTS

- Burning promoted *Tristachya leucothrix* across all treatments.
- *Themeda triandra* was significantly lower in the July treatment than in the October and November burns ($P < 0.05$) on most abundant species.
- The species diversity between July, September and November treatments was significantly higher than August and October treatments ($P < 0.05$)
- In the summer survey PAR/LAI in August and September burning treatments were significantly higher than in other burns ($P < 0.1$)

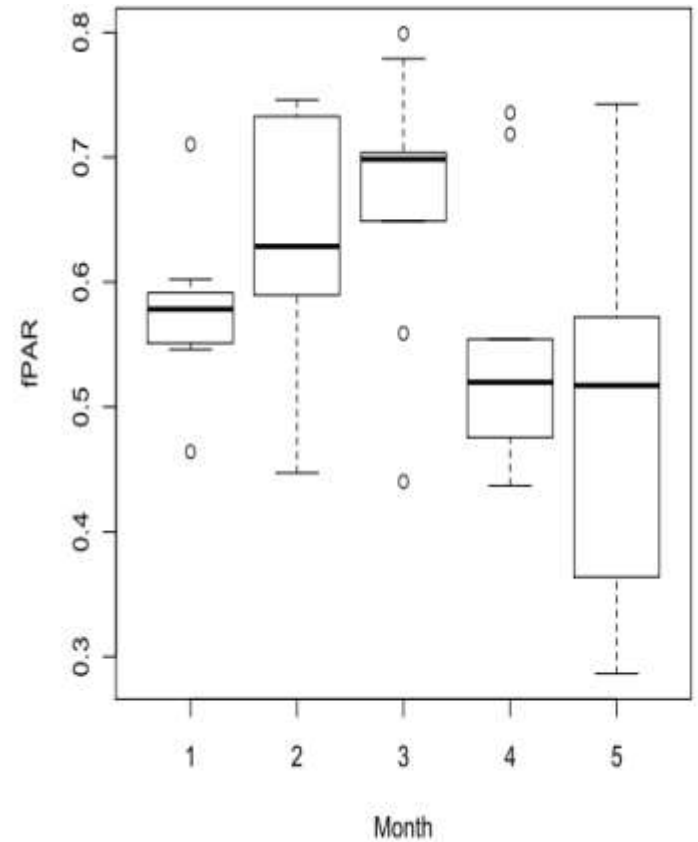


RESULTS (Cont.)

PAR boxplot winter



PAR boxplot summer





RESULTS (Cont.)

- Burning treatments had no significant effect on the biomass production ($P > 0.1$), soil N, P, K, Mg and C contents in both surveys ($P > 0.1$).
- Both surveys showed no significant effects of burning treatments on the soil pH and Fe ($P > 0.1$).
- P was significantly higher at 2cm depth than at both 4cm and 8cm soil depths ($P < 0.05$).



RESULTS (Cont.)

- N was significantly higher at 4cm soil depth in July burn than November treatment.
- P was significant low in July, August and September burns than October treatment at 2cm soil depth.
- At 4cm soil depth K content was significantly lower in July treatment than August burn.

DISCUSSION

- Post fire climate, overshadowing and suppressive effect could have led to differently lower *T. triandra* in July burn than in both October and Nov. treatments
- Fire tolerance, reproductive methods and also annual burns led to significant high species diversity across burning treatments.
- Significant high PAR/LAI in summer survey on August and September burns might be due to longer growing period.



DISCUSSION (Cont.)

- Ash and Unvolatilized P on surface could have led to the significant high P content at 2cm
- The differently low N content in November treatment might be due to N volatilization
- P was significantly low in July, August and September burns than October treatment at 2cm soil depth. Loss of N, P loss through runoff and leaching than in other fire treatments.





DISCUSSION (Cont.)

- At 4cm soil depth August burn had differently higher K due to leaching and volatilization in July burn.
- Zn was significantly higher in October at 2cm soil depth due to ash transport, leaching and erosion in all other treatments.
- Significantly lower Mn in summer survey could be attributed to high fire temperatures, hence Mn decreases at temperatures exceeding 2000°C.

CONCLUSION

- There was significant effect of seasons of burn on species composition, hence null hypothesis is rejected.
- Null hypothesis is rejected, Seasons of burn had a significant effect on PAR/LAI.
- There was no significant burning effect on biomass production, hence, null hypothesis is not rejected.
- Generally seasonal burning had no significant effect on N, P, K, Mg and C. Hence, null hypothesis is not rejected.
- There was a significant effect of season of burn on micro-nutrients, hence, null hypothesis is rejected.





RECOMMENDATIONS

- Dohne Sourveld should be best burnt in October and November as it favoured *Themeda triandra*.
- Grazing animals or cutting of vegetation are recommended to be part of the research design in future.
- More research work on the PAR, LAI and biomass is vital scientific data required and not readily available for the Dohne Sourveld.



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THANK YOU!



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