

# Competitive ability of Vetiver grass: Does vetiver allow germination and establishment of native grasses?

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# Background

## Vetiver (*Chrysopogon zizanioides*)

- Central India
- Tufted perennial, 3m depth roots, wall-like form
- Grows fast & different environment
- Resistant to fire and drought
- Produces **non viable seeds**

## Vetiver grass technology

- 1980s in India, water & soil conservation
- Rehabilitation, remediation & wastewater treatment **worldwide**
- Insect trap and wind barrier
- Low cost, effective & natural
- Allow succession





## Vetiver oil

- Cosmetic industries
- Anti-fungal & anti-microbial

## Therefore, research focus

- Application & benefits of vetiver
- Less focus on its ecology

## Problems with alien plants

- Outcompete natives
- Reduce biodiversity
- Reduce agricultural productivity



# Research questions

1. Do vetiver grass tufts inhibit or facilitate seed germination in native grasses?
2. Is the germination of native grass seeds affected by sowing method?
3. Do vetiver grass tufts affect seedling survival of native grasses ?
4. Do vetiver grass tufts inhibit establishment of native grasses?
5. Is the establishment of native grasses inhibited by:
  - a) Vetiver root density?
  - b) Allelopathic properties?

# Germination and establishment trial

- NM Tainton Arboretum
- October 2016 - February 2017
- ***E. curvula* & *P. maximum***
  - Contrasting traits
  - **100 Seeds**
  - **alone, 1 vetiver, 2 vetiver**
  - **Surface, buried & hydro-seeding gel**
- **6 replicates, 18 combinations**
- % germination, % survival, grass height, number of leaves, and number of tillers recorded





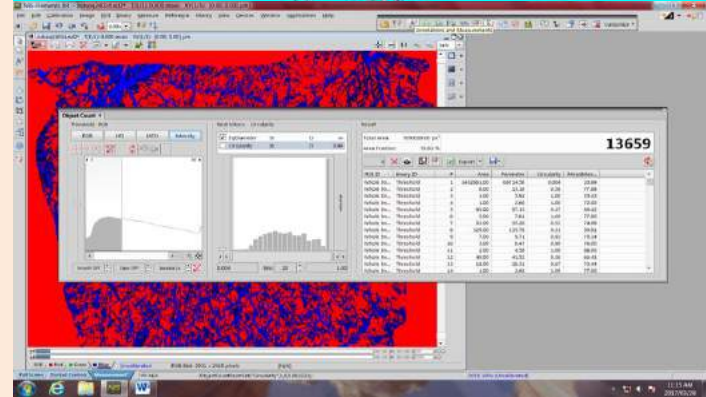
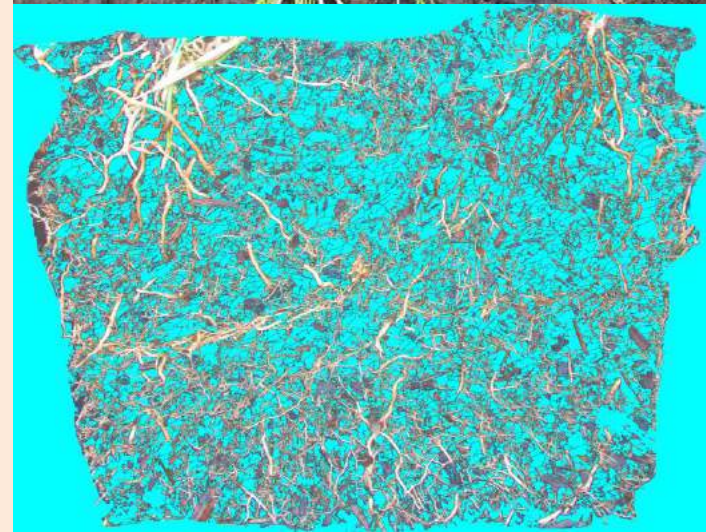
# Allelopathy trial

- March 2017- June 2017
- **3 week old *E. curvula* seedlings**
  - **5 seedlings**
  - **Alone, 1 vetiver, 2 vetiver**
  - **Pots divided using 32 micron Nitex mesh**
- 6 replicates
- Grass height, number of leaves & number of tillers
- Aboveground biomass at the end of the trial



# Roots density & data analysis

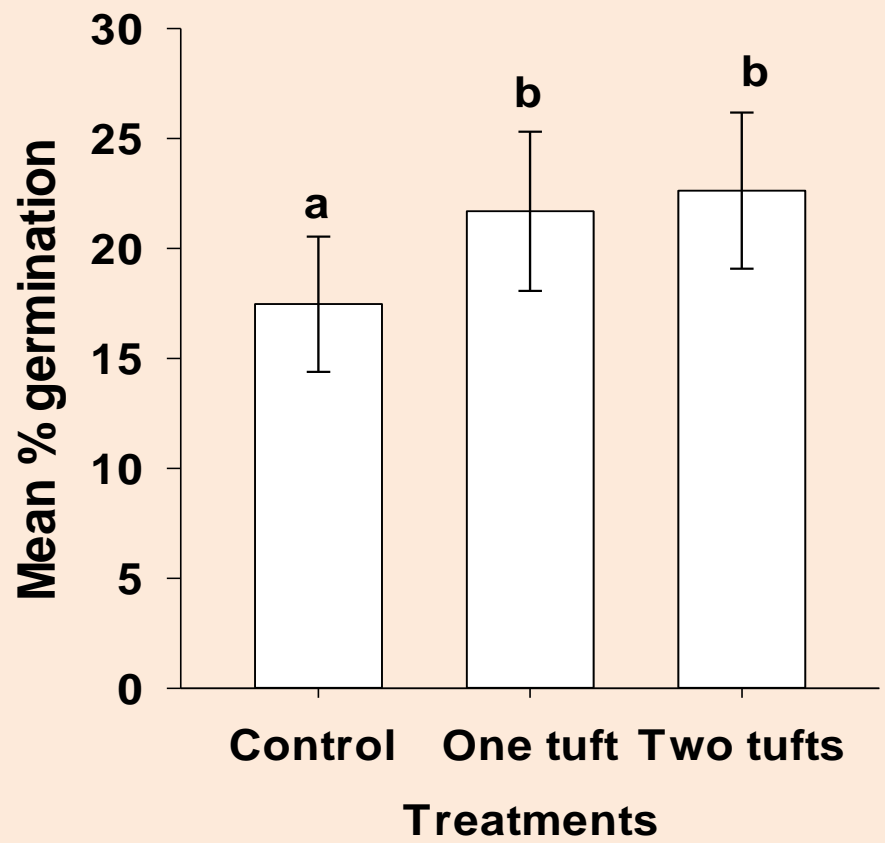
- Vetiver alone, with another vetiver tuft & *E. curvula* alone
- Cut in half and root profile picture taken
- **NIS-Element BR software** for fluorescence light microscope
  - Analyze pixel color
  - Separate soil and roots in picture
  - Gives % space taken by roots and soil in the picture
- **Generalized linear models**
  - Germination - Poisson
  - Growth traits - Linear & Gamma with log link
  - SPSS version 24



# 1. Do vetiver grass tufts inhibit or facilitate seed germination in native grasses?

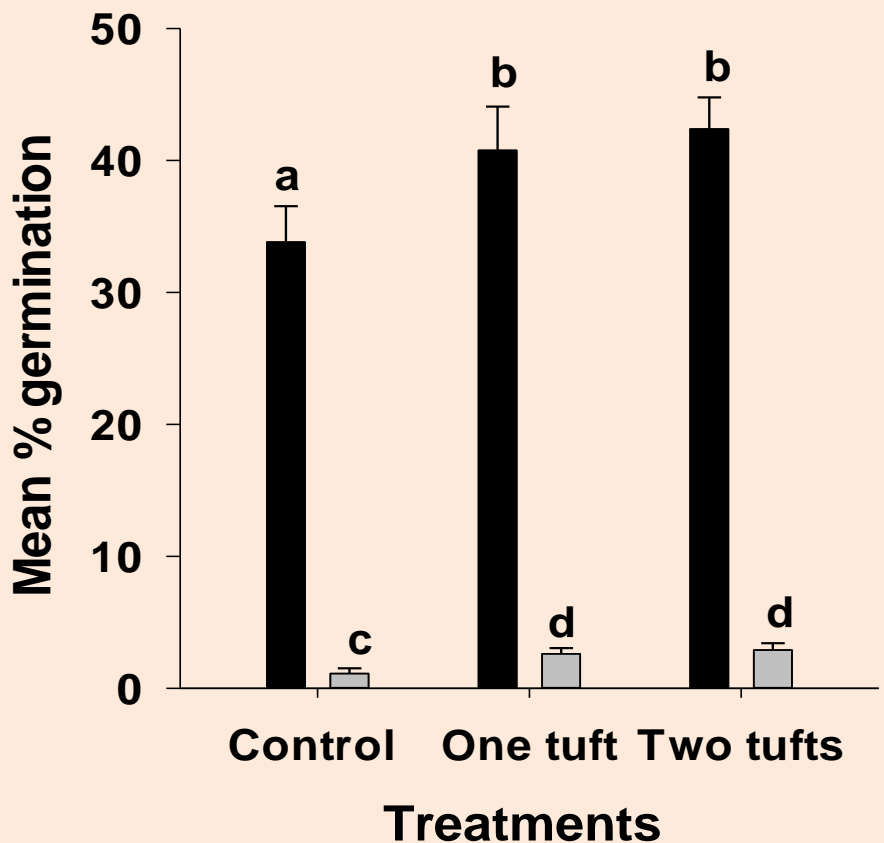
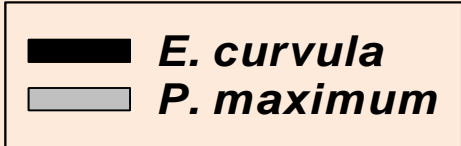
## Vetiver presence

$p < 0.001$ ,  $df = 2$



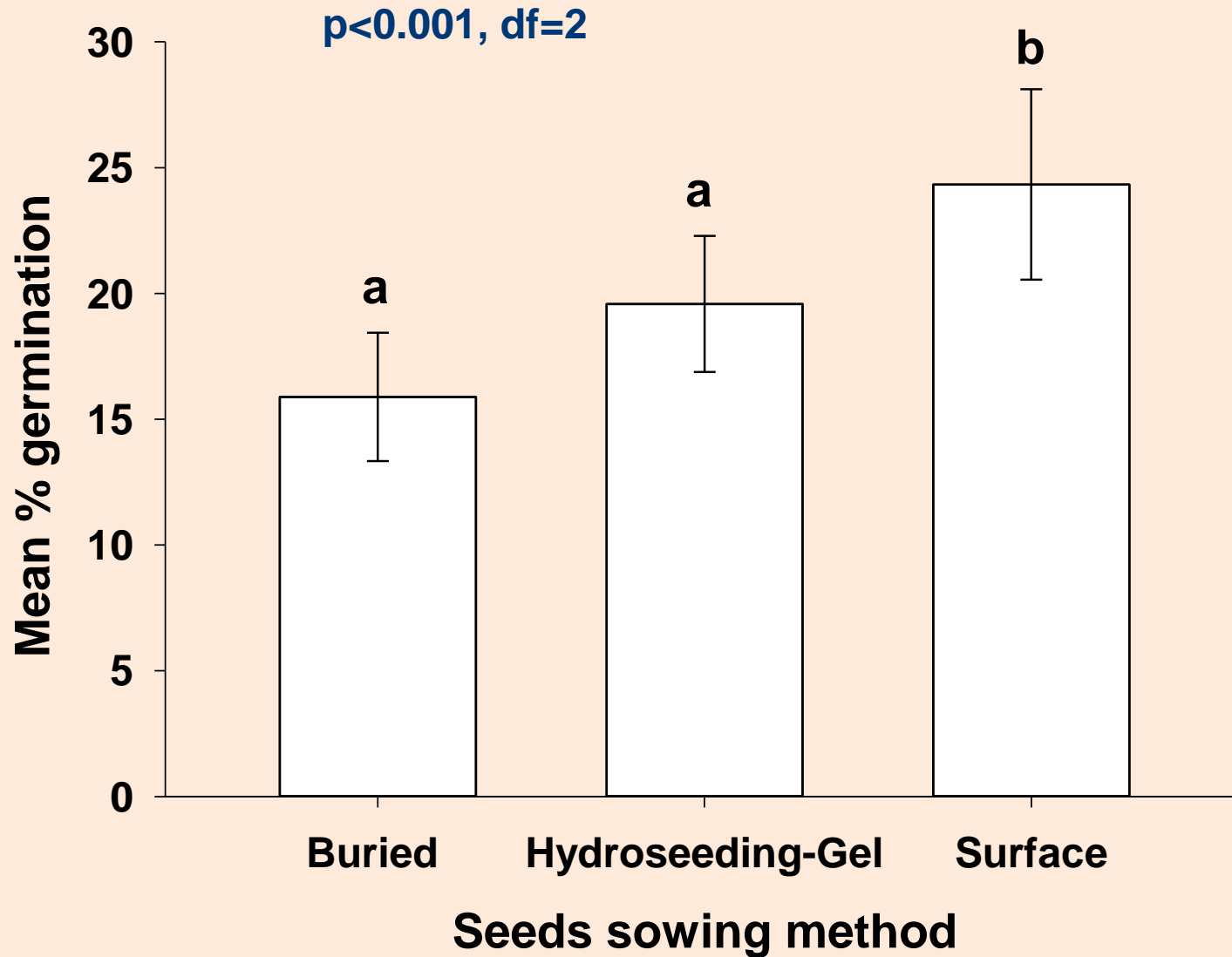
## Vetiver presence \* Species

$p < 0.001$ ,  $df = 2$





## 2. Is the germination % of native grass seeds affected by sowing method ?

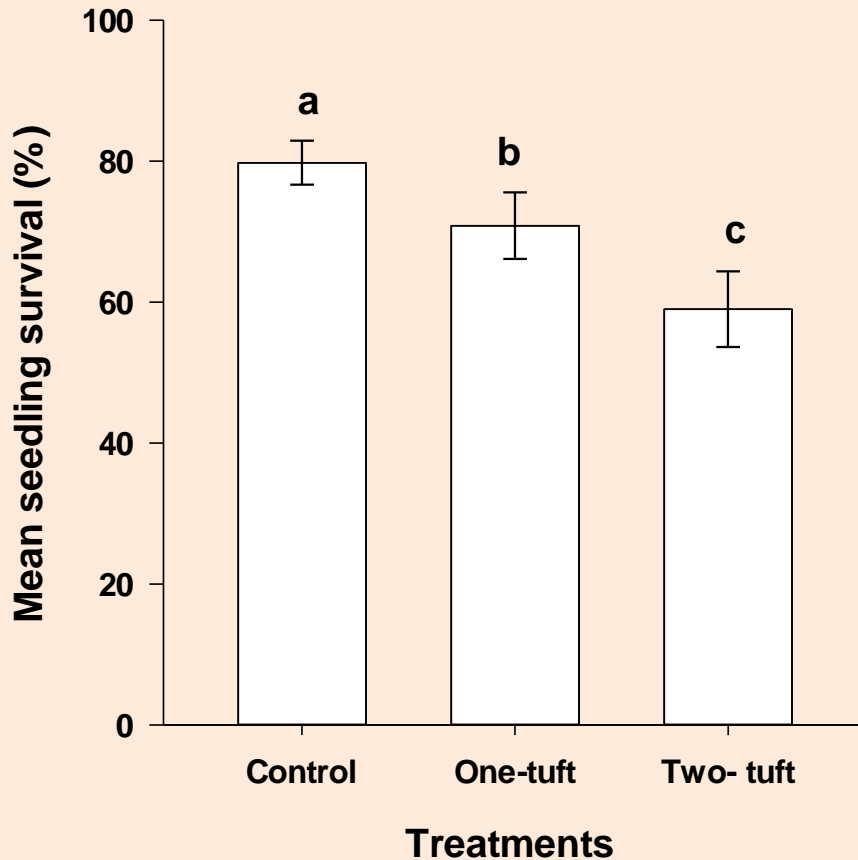


### 3. Do vetiver grass tufts affect seedling survival of native grasses ?

- Sowing method :  $p = 0.235$

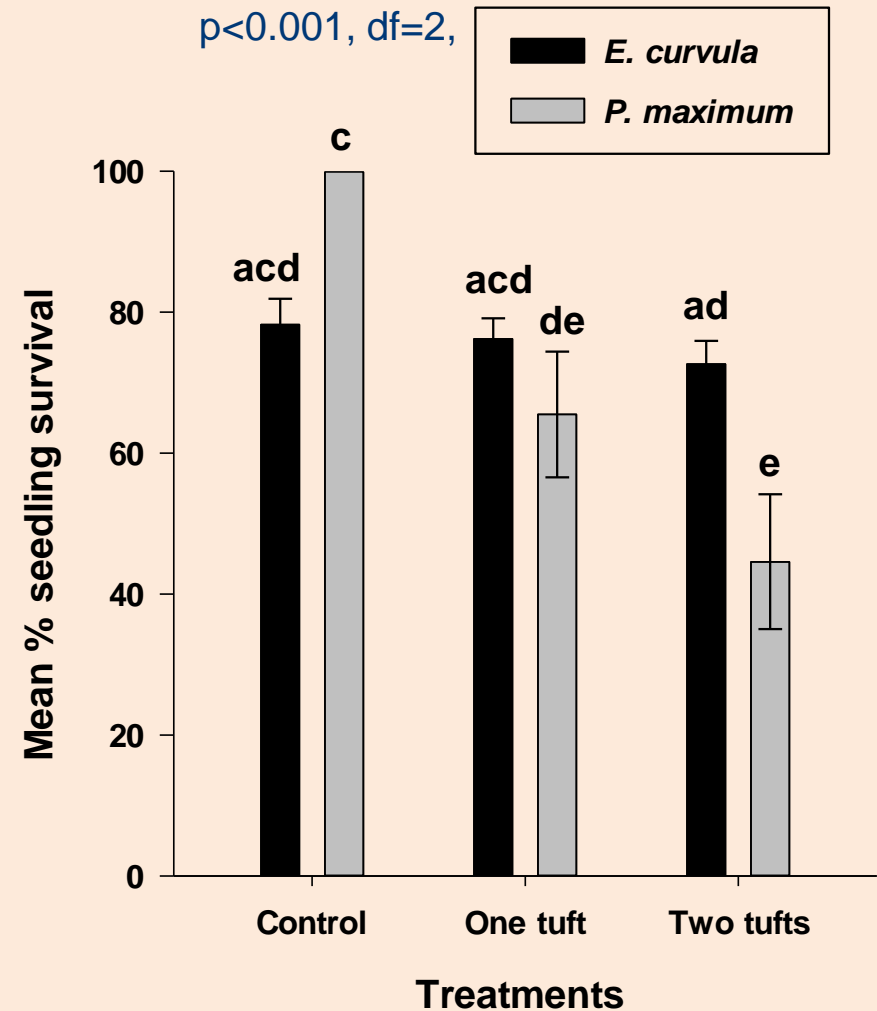
#### Vetiver presence

$p < 0.001$ ,  $df = 2$



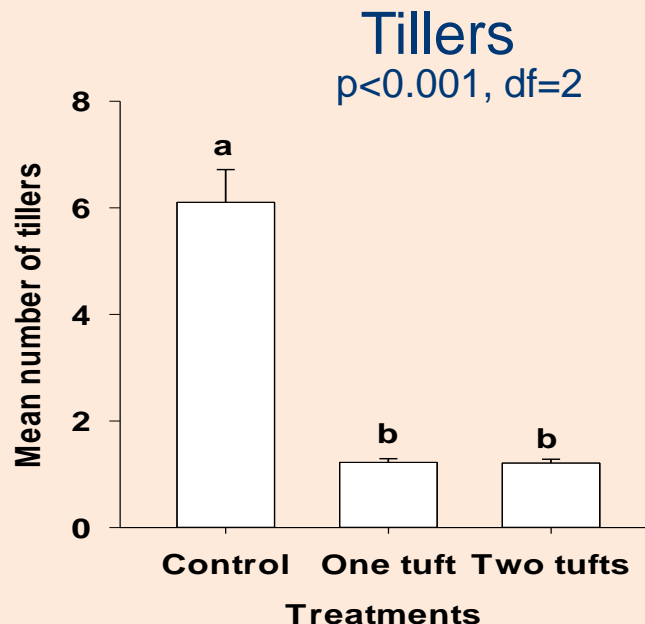
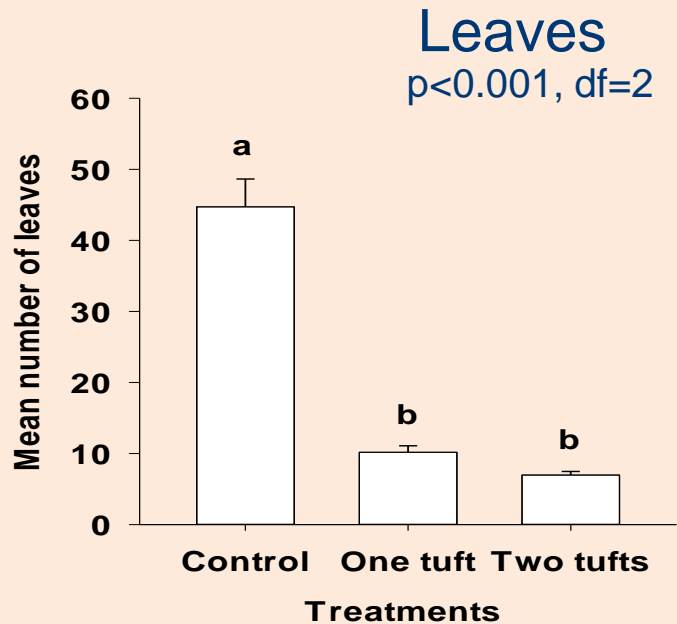
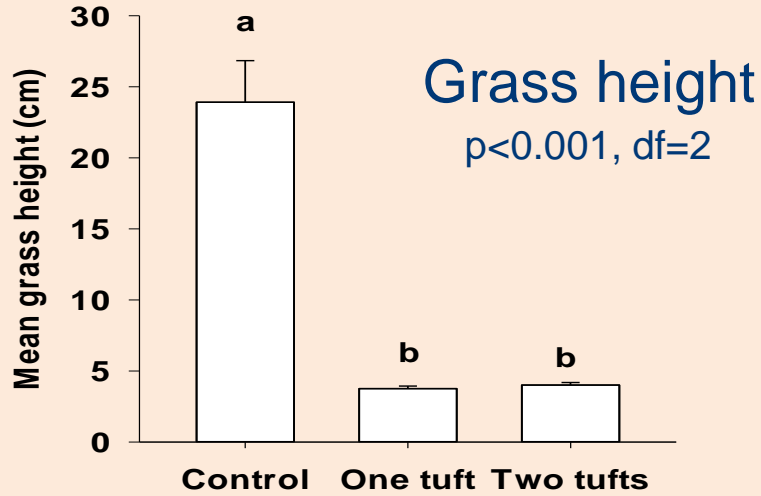
#### Vetiver presence \* Species

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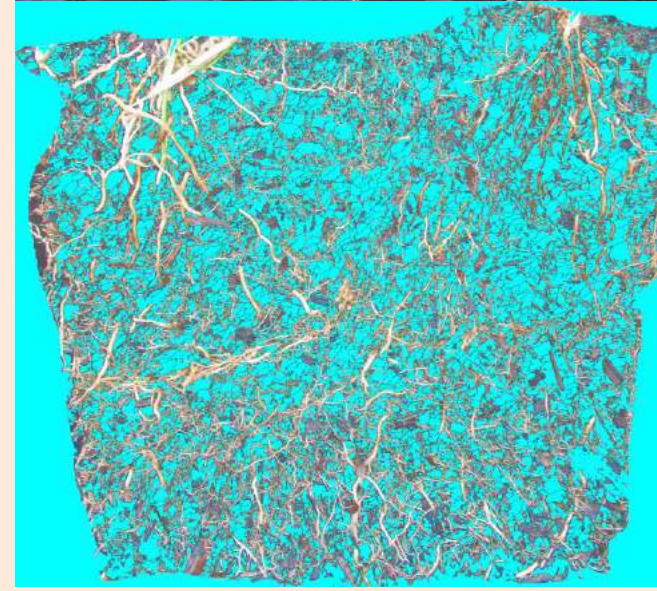
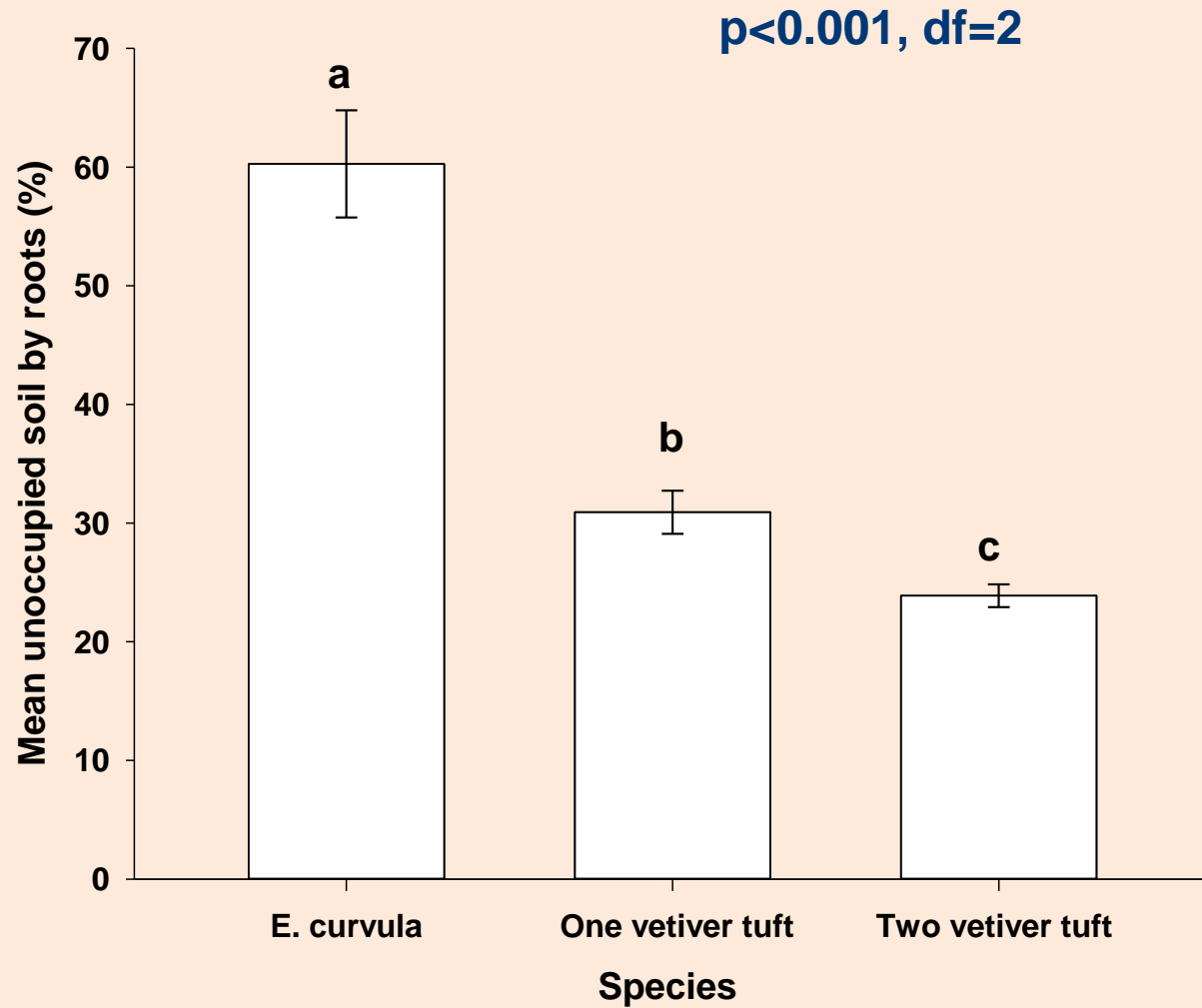


# 4. Do vetiver grass tufts inhibit establishment of native grasses?



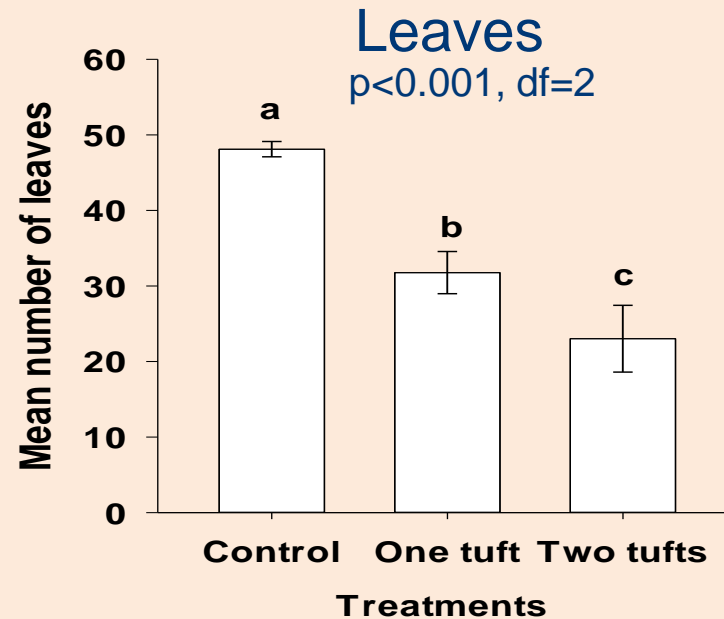
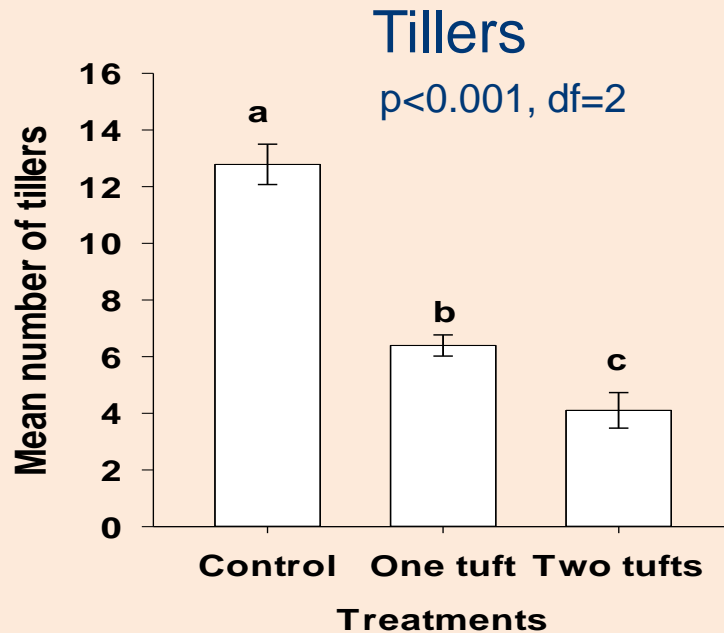
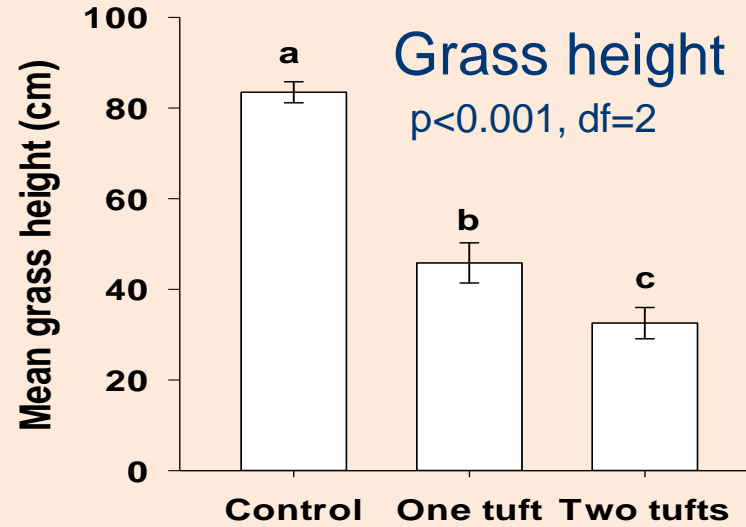
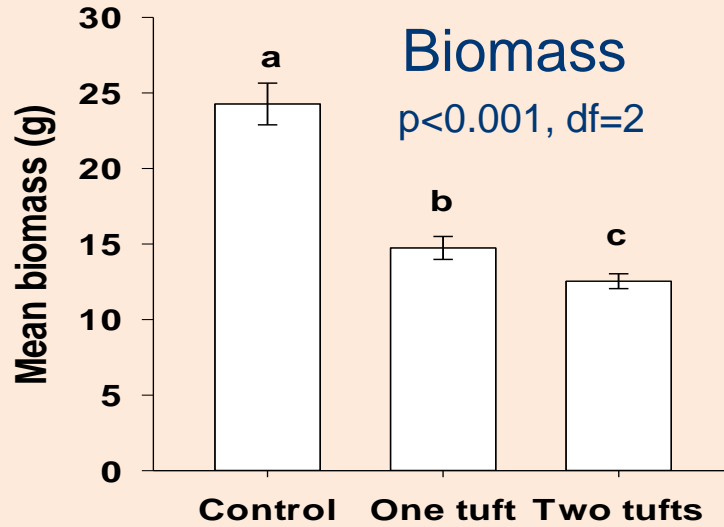
# 5. Is the establishment of native grasses inhibited by:

a) Vetiver root density?





## b) Allelopathic properties?



# Germination and establishment

- Vetiver facilitates germination
  - Nurse plant theory
  - Shade and soil moisture retention
- Vetiver affects establishment
  - Seedling survival & growth
  - One & two vetiver : similar effect
- Possible causes?
  - Direct root competition for space
  - Allelopathic behavior - **oil**
  - Novel weapon hypothesis





# Implications

- Vetiver grass is important
  - Soil erosion
  - Waste water treatment
  - Road side or river bank slope stabilization
- Suppress native grasses growth, reducing biodiversity.
  - No succession

## Recommendations

- Used for cover not for diversity
- Used in waste water treatment
- Gully erosions or heavily degraded sites
- Agriculture: Insect trap & wind barrier crop



# Acknowledgements

## Funders:

- National Research Fund
- UKZN

## Supervisors:

- Dr. Michelle Tedder
- Prof. Kevin Kirkman

## Field assistants :

- Naledi Zama
- Welcome Ngcobo
- Lindokuhle Ngcobo
- Ntombi Mamayo
- Nolwazi Hlongwane