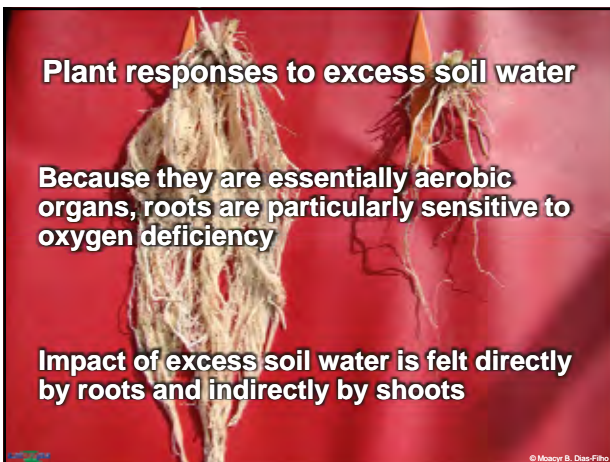


Waterlogging in pastures

Recurrent problem in many tropical areas

Natural causes (long rainy periods, natural poor soil drainage, seasonal groundwater elevation)

Anthropogenic origin – management practices that lead to soil compaction (trampling in areas with no vegetation cover, frequent tillage, fire etc.)



Plant responses to excess soil water

Because they are essentially aerobic organs, roots are particularly sensitive to oxygen deficiency

Impact of excess soil water is felt directly by roots and indirectly by shoots



Plant responses to excess soil water

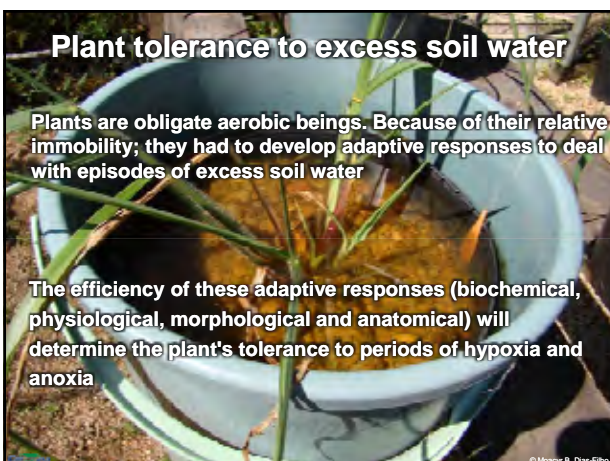
Chlorosis

Premature wilting

Decreased photosynthetic capacity

Decreased leaf nutrient concentration

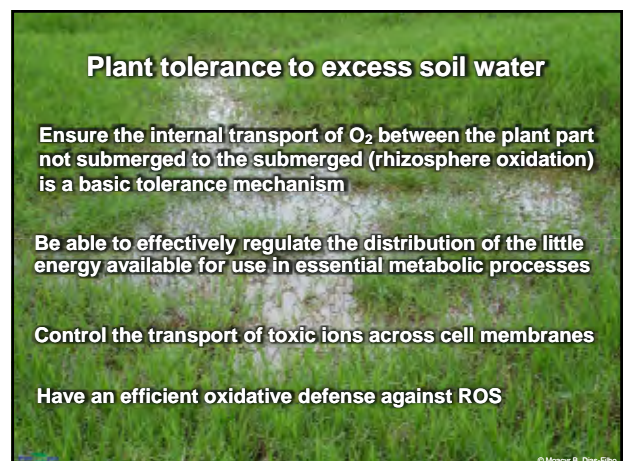
Decreased growth



Plant tolerance to excess soil water

Plants are obligate aerobic beings. Because of their relative immobility; they had to develop adaptive responses to deal with episodes of excess soil water

The efficiency of these adaptive responses (biochemical, physiological, morphological and anatomical) will determine the plant's tolerance to periods of hypoxia and anoxia



Plant tolerance to excess soil water

Ensure the internal transport of O₂ between the plant part not submerged to the submerged (rhizosphere oxidation) is a basic tolerance mechanism

Be able to effectively regulate the distribution of the little energy available for use in essential metabolic processes

Control the transport of toxic ions across cell membranes

Have an efficient oxidative defense against ROS

Screening strategies to excess soil water

- Efficiency of the observed plant attributes as indicators of tolerance
- Objectivity and practicality of the methods used for observing and measuring these attributes
- Efficiency in the use and interpretation of the data
- Reliability of the results

Screening strategies to excess soil water

- Biomass production (green leaves and roots)
- Leaf elongation rate
- Gas exchange (net photosynthesis and stomatal conductance)
- Leaf chlorophyll content (SPAD)
- Other attributes: the activity of alcohol dehydrogenase (ADH), dead leaf biomass, mineral concentration and starch content in leaves and soluble sugars in roots

Screening strategies to excess soil water

- Caution in the use of absolute biomass production as a screening strategy
- Higher biomass production of a genotype under excess soil water always indicates a higher waterlogging tolerance?

Waterlogged *Brachiaria brizantha* plants

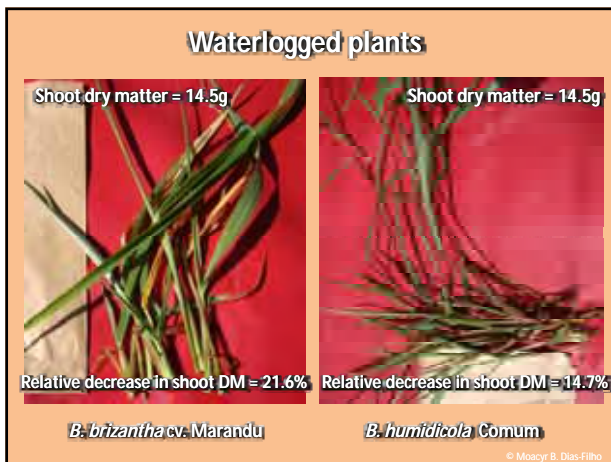
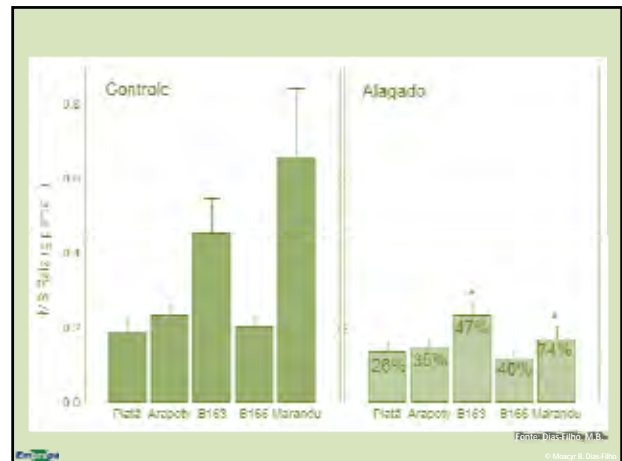
| | |
|---------------------------------|---------------------------------|
| | |
| Root biomass = 0.518g | Root biomass = 0.236g |
| <i>B. brizantha</i> cv. Marandu | <i>B. brizantha</i> cv. Arapoty |

Waterlogged *Brachiaria* plants

| | |
|---------------------------------|----------------------------|
| | |
| Shoot biomass = 14.5g | Shoot biomass = 14.5g |
| <i>B. brizantha</i> cv. Marandu | <i>B. humidicola</i> Comum |

Screening strategies to excess soil water

- Caution in the use of absolute biomass production (or other parameter) as a screening strategy
- A more appropriate tolerance meter could be the relative difference between control and waterlogged plants, within the same genotype



Screening strategies to excess soil water

Caution in the interpretation of data of screening trials conducted in pots

Excessive root growth in pots of control treatment may make control plants more prone to water deficit and nutritional stress

This drop in the performance of control plants may confound comparison with waterlogged plants

Screening strategies to excess soil water

Caution in the interpretation of data of screening trials conducted in pots

An alternative is planning experiments with shorter evaluation periods

Use of higher-capacity pots (not always practical)

Conclusions

When screening forage plants for tolerance to waterlogging:

The tolerance meter should be the relative difference between control and waterlogged plants, within the same genotype

Screening trials should have a short duration



Contat information

Moacyr Bernardino Dias-Filho
Embrapa Amazônia Oriental, Belém, PA
moacyr@cpatu.embrapa.br

www.diasfilho.com.br
<http://twitter.com/MoacyrDiasFilho>