

Soil moisture stress tolerance of a leading biofuel crop *Miscanthus x giganteus* is similar to the invasive weed *Arundo donax*

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Policy Initiatives

Federal:

- **Energy Independence and Security Act (EISA 2007)**
 - 36 billion gallons of renewable fuel by 2022

California:

- **Executive Order S-06-06**
 - 20% of electricity be biomass-derived by 2020
 - In-state biofuel production:
20% by 2010 - 40% by 2020 - 75% by 2050



Food, Conservation, and Energy Act 2008 (**Current Farm Bill**)

Title IX: Sec. 9011: *Biomass Crop Assistance Program*

Eligible crop does not include:

- “any **plant** that is **invasive or noxious** or has the **potential to become invasive or noxious**, as determined by the Secretary, in consultation with other appropriate Federal or State departments and agencies.”

Arundo donax

- non-native
- does not produce viable seed
- invasive
- proposed biofuel crop in the southeast US



Miscanthus

- non-native
- does not produce viable seed
- unknown invasive potential
- proposed biofuel crop in the central US and California



“If Miscanthus is grown on 9% of US farm land the potential ethanol will offset one fifth of current gasoline use”

Heaton et al 2008



Perennial rhizomatous habit
High annual biomass production
High nitrogen use efficiency
No reported pests



Miscanthus sinensis has been reported to be invasive
by the Southeast Exotic Pest Plant Council

In addition...

Escaped cultivation in California DiTomaso 2007

- The first documented introduction occurred in 1907 at a nursery near Asheville, NC



Miscanthus sacchariflorus has been prohibited in Massachusetts



Harding county, Iowa

Minneapolis, Minnesota



Soil Moisture Stress Study

20 g *Miscanthus* and *Arundo* rhizome fragments



All plants were in pots for 16 weeks

Group one: **8** weeks of treatment

Group two: **16** weeks of treatment

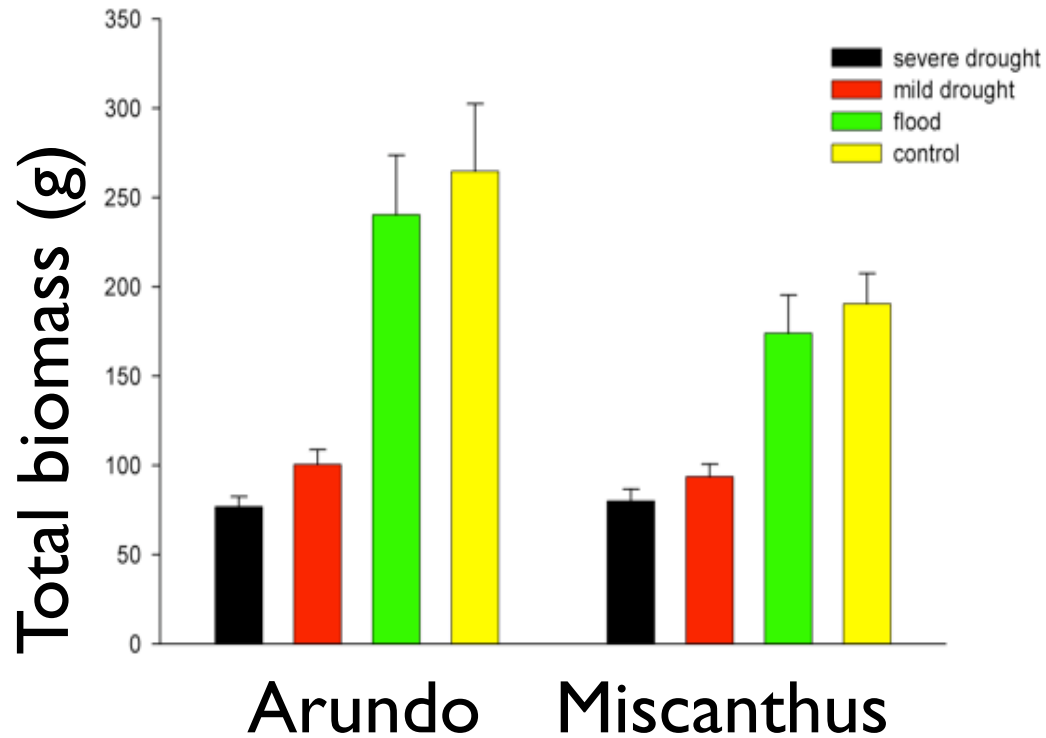
Stress treatments were:

1. control
2. flooded soil (10 reps each)
3. mild drought
4. severe drought

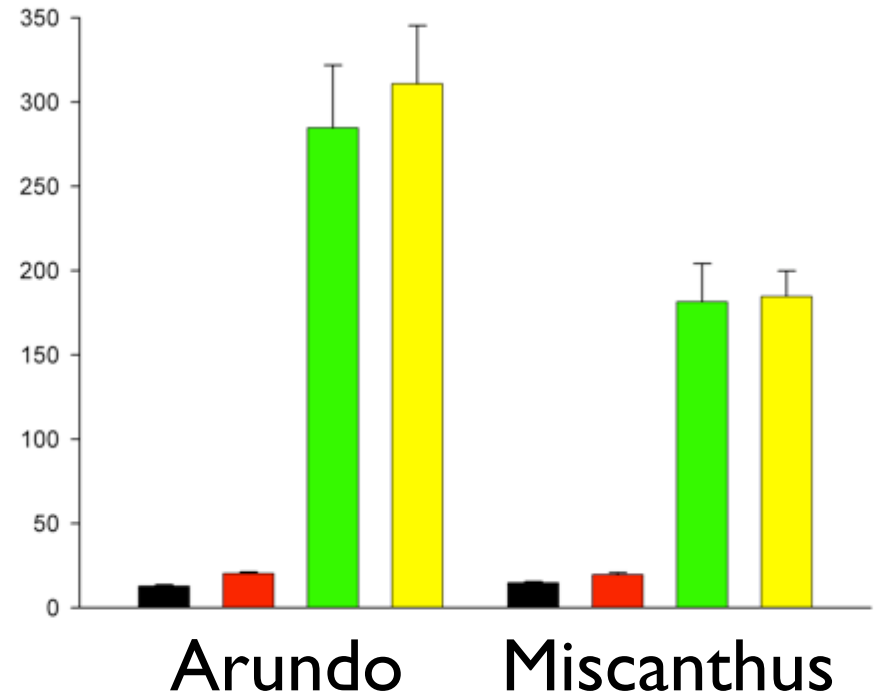


Biomass

8 weeks of treatment



16 weeks of treatment



8 weeks of treatment



16 weeks of treatment

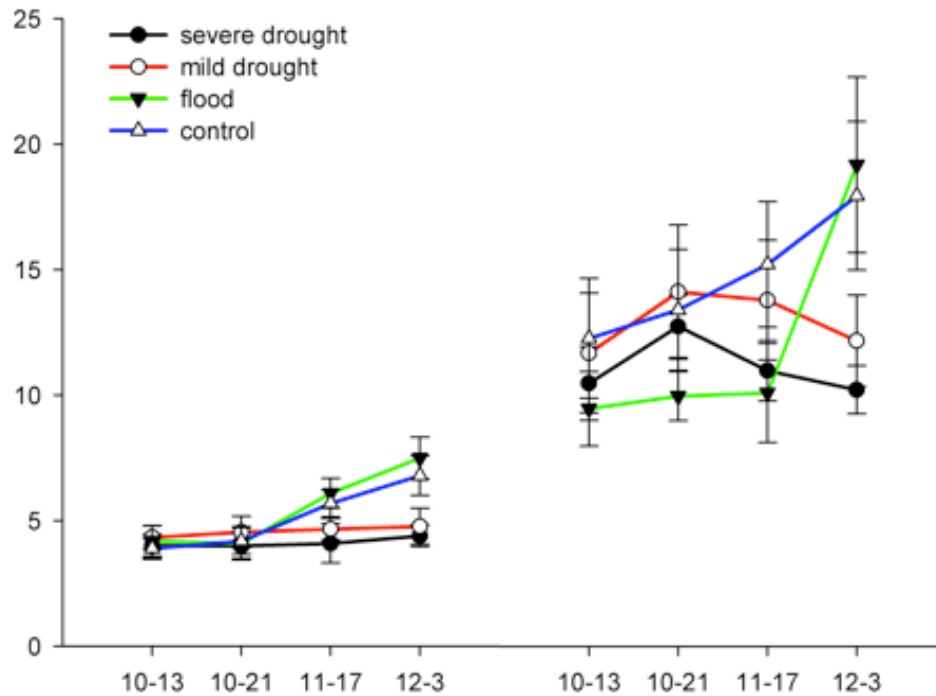


Stem count

8 weeks of treatment

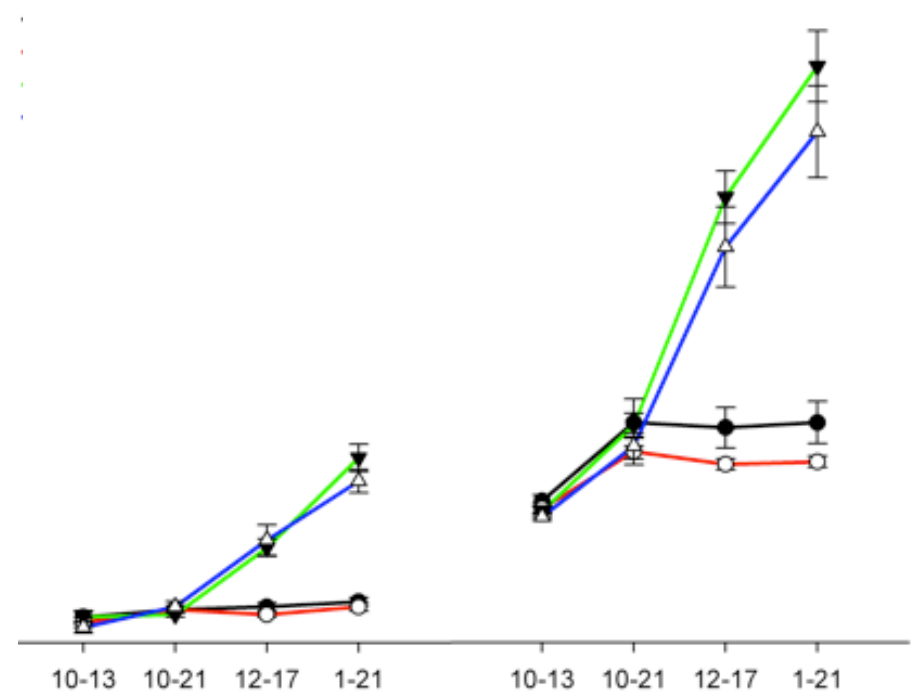
16 weeks of treatment

Number of stems



Arundo

Miscanthus

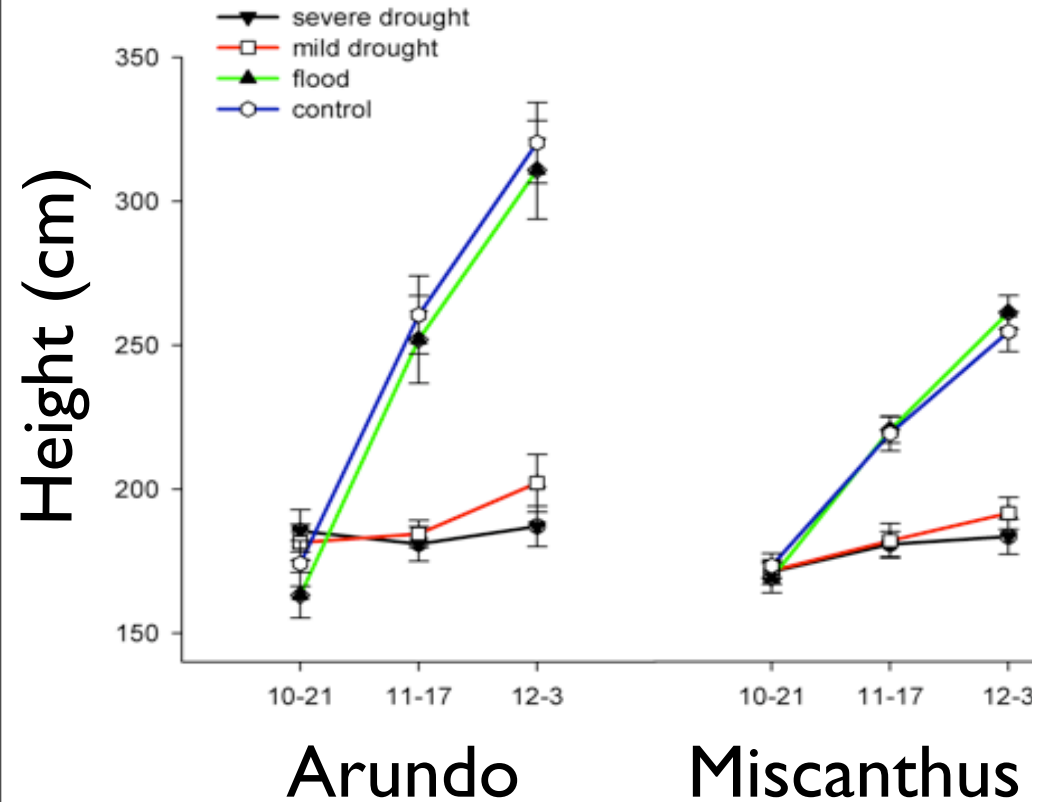


Arundo

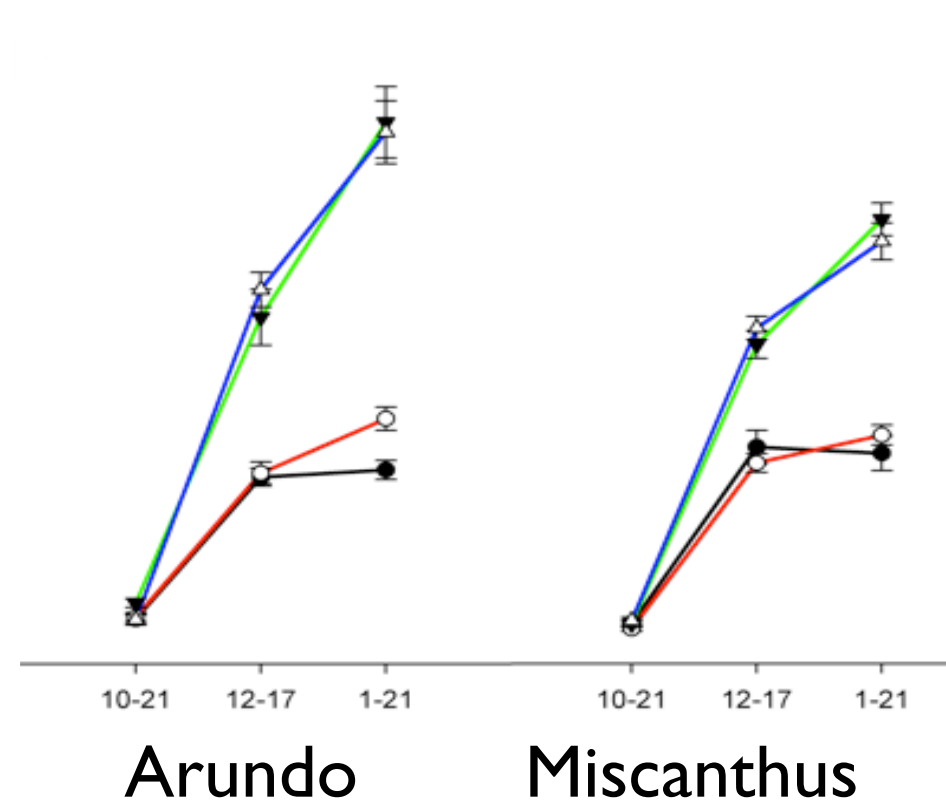
Miscanthus

Stem height

8 weeks of treatment

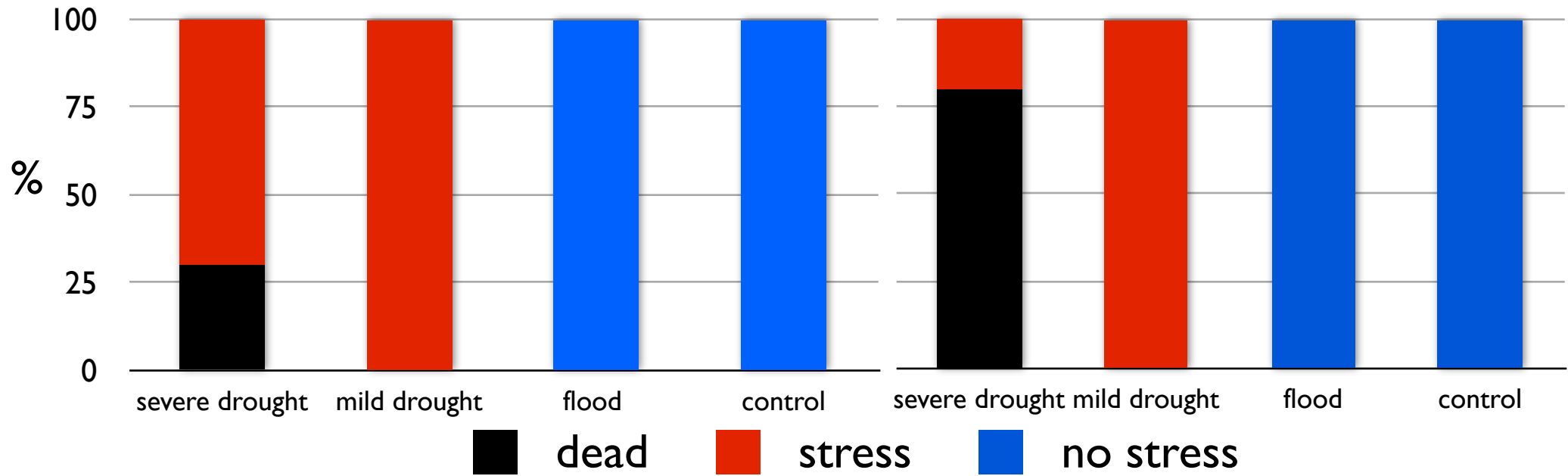


16 weeks of treatment

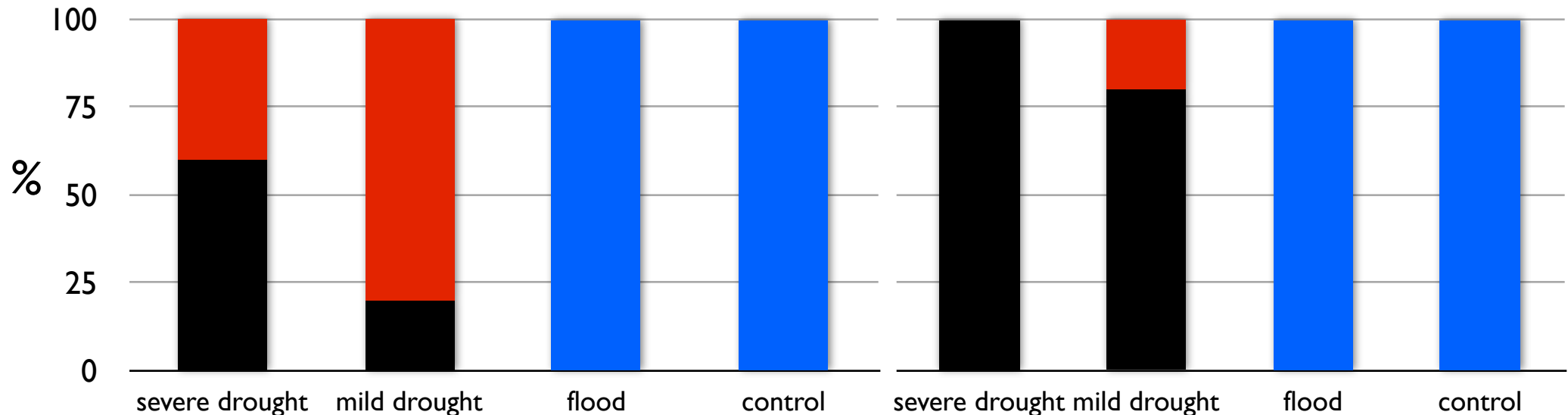


Above ground plant material damage

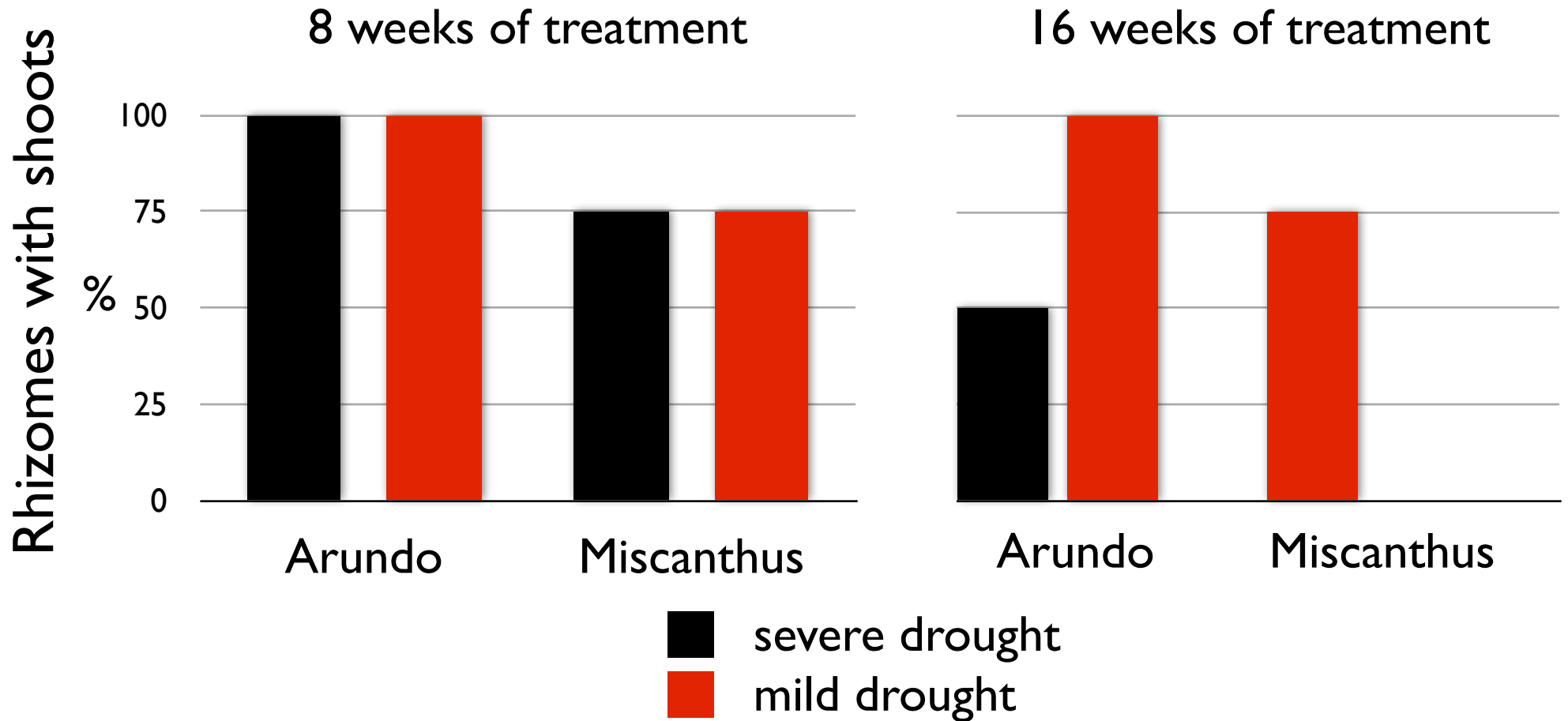
Arundo 8 weeks of treatment Miscanthus



Arundo 16 weeks of treatment Miscanthus



Rhizome survival



Summary

- Both *Miscanthus* and *Arundo* do well in flooded conditions
- The *not* established *Miscanthus* and *Arundo* suffered more than established plants under drought
- A greater number of *Miscanthus* shoots and rhizomes died compared to *Arundo* under drought
- Rhizome survival of both species was greater than indicated by shoot status for both species

Take home messages

- Do not allow *Miscanthus* rhizome into irrigation canal or riparian corridors
- *Miscanthus* stems are unlikely to survive summer drought in upland habitats, but rhizomes may survive
- Shoot death was not an accurate indicator of rhizome death for both species. Timing may be important for surveys of field edges or transport corridors
- *Miscanthus* has a narrower tolerance to drought compared to *Arundo*, but wide enough that continued evaluation is necessary

Acknowledgments

- Charlie Campbell
- Carlos Figueroa
- Ceres Inc.
- Brian Baldwin

Funding

- Cal Weed Science Society Graduate Student Scholarship
- Jastro-Shields Award
- Horticulture and Agronomy Block Grant
- Ben Madson Grant
- Bill and Jane Fischer Scholarship

Questions?