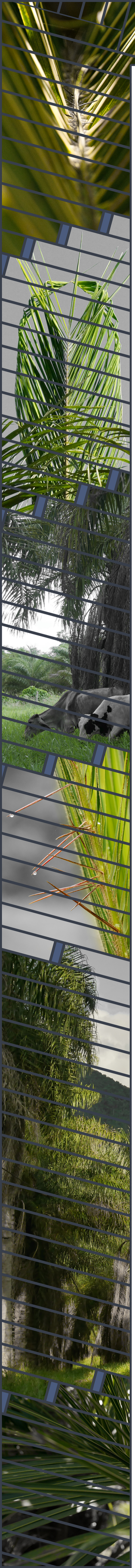

The Effect of Drought on Leaf Emergence and Development in the Oilseed Palm *Acrocomia aculeata*

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Introduction

Acrocomia aculeata is an oilseed palm endemic to the semi-arid and arid regions of Central and South America. Having comparable yields and oil composition to oil palm (*Elaeis guineensis*), however showing a resilience to drought in contrast to the latter makes Acrocomia an eminent alternative to expand oilseed growing areas into semi-arid regions of the tropics and subtropics. *Acrocomia* sp. are solitary palms with pinnate leaf blades of around two to three meters in length, which are formed throughout the year. Young leaves are emerging tightly furled, reminding of a spear, thus named spear leaves. The leaves unfurl and expand when completely emerged. As already mentioned, Acrocomia shows a resilience to drought, however knowledge is lacking on how water deficit affects the leaf formation and expansion.

This study aimed:

A. to determine the monthly leaf emergence and expansion (unfurling of leaves) in different Acrocomia ecotypes
B. to evaluate the effect of water deficit on leaf development using specific leaf area (SLA), leaf dry matter content (LDM) and leaf thickness (LT) as indicators.

It was hypothesized that

1. leaf emergence and unfurling of leaves are deaccelerated during the dry season
2. SLA and LDM decrease during the dry season whereas LT increases
3. Differences between Acrocomia ecotypes can be distinguished based on their provenance, with ecotypes coming from drier regions being less affected

Discussion and Conclusion

A. Leaf emergence and expansion

Dry Season
- Ecotypes from dry regions → formation of new leaves but deacceleration of expansion → accumulation of spear leaves
- Ecotypes from humid regions → deacceleration of formation of new leaves and expansion → vegetative growth is slowed down

Rainy Season
- Resuming of leaf formation and expansions after first rainfalls in all ecotypes
- Ecotypes from humid regions form in general more leaves than ecotypes from dry regions

Deaccelerated leaf emergence and expansion due to water deficit

B. Leaf dry matter content, specific leaf area and leaf thickness

- No clear trend and differences in leaf development across the ecotypes
- LDM, SLA and LT showing opposite trends of what was hypothesized

Potential Causes
- Relative water content high in both season (>80%) without major differences → minor changes in LDM
- Leaf expansion rate and photosynthetic rate both affected by season with the depressive effect in dry season being higher on photosynthetic rate → higher SLA in dry season
- Leaf age: slow development in dry season, fast development and maturation in rainy season → low LT in dry season

Further influencing factors need to be considered

Leaf emergence and expansion are affected in all ecotypes by seasonal change
Indication of different coping strategies with drought events influenced by climatic provenance
No differences between ecotypes in regard to leaf development

Results

A. Leaf formation and expansion

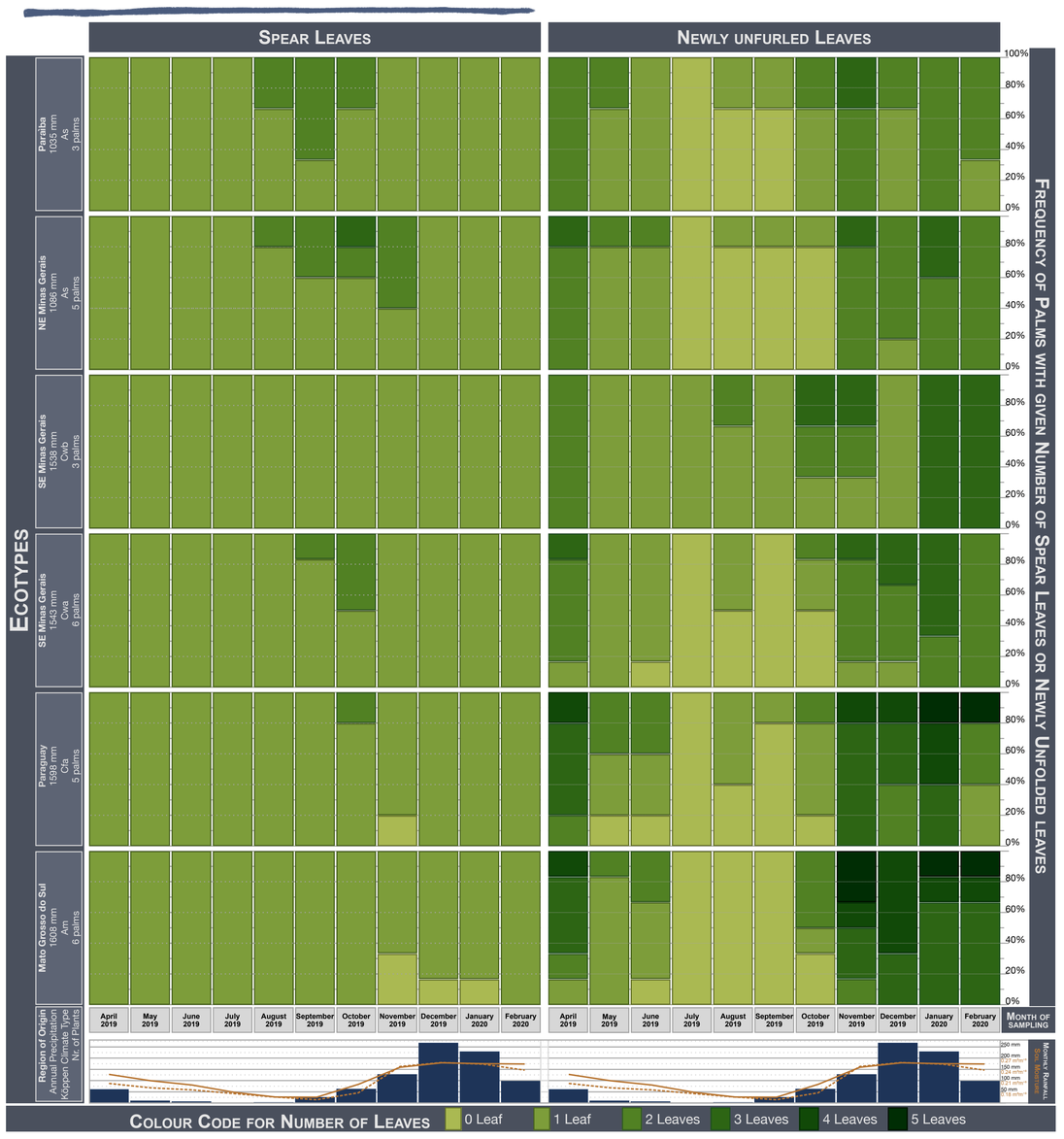

Figure 1. Number of newly emerged spear leaves and unfurled leaves per palm and month. Rainfall (blue bars) and soil moisture at 0.2 m depth (brown line) and 1 m depth (brown dotted line) are shown for the sampling period from May 2019 to January 2020.

B. Leaf Dry Matter Content, Specific Leaf Area and Leaf Thickness

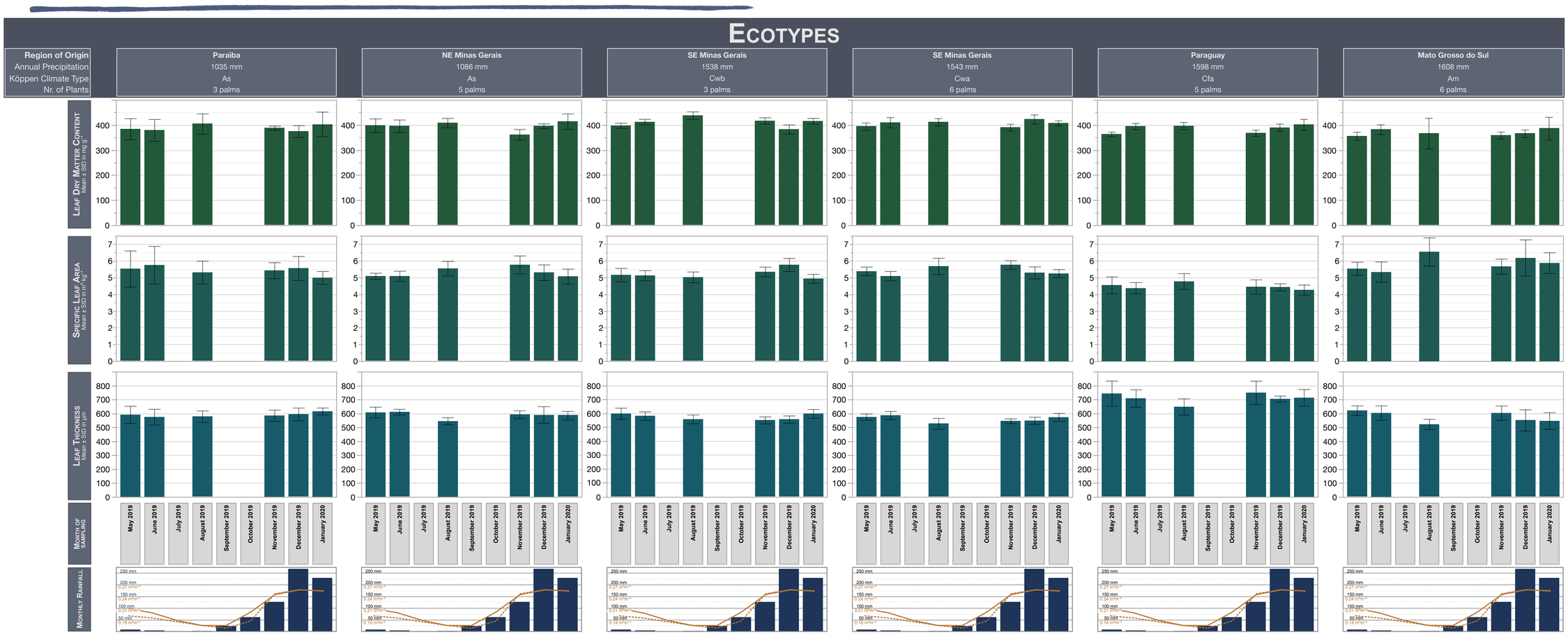

Figure 2. Leaf dry matter, specific leaf area and leaf thickness. Rainfall (blue bars) and soil moisture at 0.2 m depth (brown line) and 1 m depth (brown dotted line) are shown for the sampling period from May 2019 to January 2020. No collection fo leaves possible in July, September and October due to slowed unfurling of young leaves.

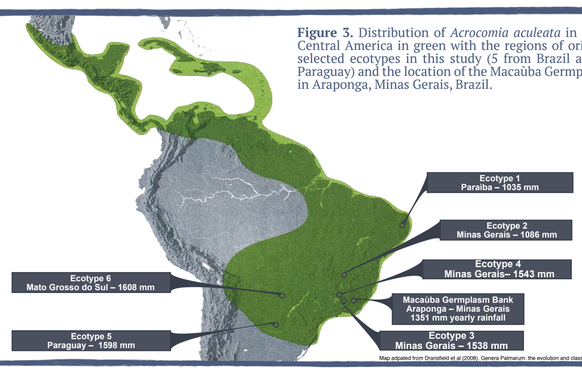

Figure 3. Distribution of *Acrocomia aculeata* in South and Central America in green with the regions of origin of the selected ecotypes in this study (5 from Brazil and 1 from Paraguay) and the location of the Macaúba Germplasm Bank in Araponga, Minas Gerais, Brazil.

Materials and Methods

- Study Area: Macaúba Germplasm Bank of the Universidade Federal de Viçosa in Araponga, MG, Brazil
- Selection of 6 Acrocomia ecotypes based on their climatic origin
- Data collection from April 2019 to March 2020 on monthly basis (Rainy Season: October to March, Dry Season: April to September)
  - A. Counting of newly emerged (spear) and unfurled leaves
  - B. LDM, SLA and LA
    - Sampling of leaflets from the petiole middle of one-month old leaves
    - Determination of fresh and dry weight, leaf length and width
    - Calculation of LDM, SLA and LT following Vile et al. (2005) and Garnier et al. (2001)
- Climate Data collected by an All-in-one weather-station.
- Relative Water content and photosynthetic rate determined in rainy and dry season (data not shown)
- Soil moisture measured with soil moisture/temperature combo sensors between two palms at 0.2 m and 1 m depth

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