UNIVERSITÄT HOHENHEIM
Department of Plant Production and Agroecology in the Tropics and Subtropics
Section: Crop Water Stress Management

Description of the spatial arrangement of *Jatropha curcas* L. root system. A case study from Madagascar

Arisoa Rajaona[1], Holger Brueck[1], Folkard Asch[1]
[1]University of Hohenheim, Stuttgart, Germany (arajaona@uni-hohenheim.de)

Introduction

Jatropha curcas L. is a drought-resistant shrub. It is claimed to grow profitably on marginal or degraded land in arid and semi arid zones. While yield and physical properties of the oil have been assessed in several studies, nutrient and water demand of Physic nut is not well characterized. Due to the fact that Physic nut is often cultivated on marginal land, the efficient acquisition of limited resources is likely related to root features, including depth of rooting and spatial distribution around the stem. In order to gain insight into these features, a root study was performed on a Jatropha plantation in Fenoarivo, South-West Madagascar.

Conclusions and Outlook

- Jatropha exhibits a well developed tap root and highest density of roots around the root stock.
- Patterns of root distribution down the soil profile are likely related to water availability.
- Coarse root biomass was not correlated with any of the shoot parameters.
- Information about spatial root system distribution can be used for modelling purposes of nutrient and water acquisition and irrigation scheduling.
- Ongoing research concentrates on rooting dynamics.

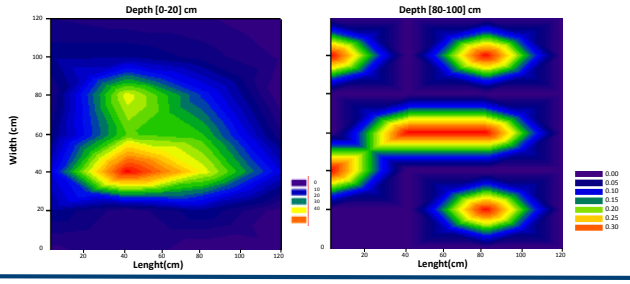
Results

Above- and below-ground morphometric characteristics of 1 and 2-year-old jatropha (n = 3)

Tree age	Rooting depth	Root spread	Stem diameter	Crown height	Crown width	Total coarse root DRM
1 year	0.6 m	1.2 m	0.09 m	0.56 m	0.85 m	82 g m^{-3}
2 year	1.2 m	1.2 m	0.23 m	0.95 m	1.04 m	1 670 g m^{-3}

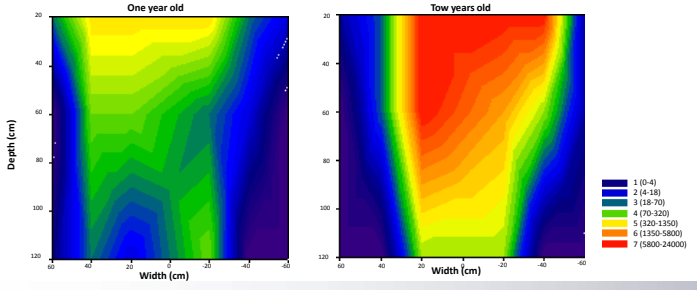
- Rooting depths increases with plant age reaching a maximum of 1.20 m.
- Root system extension exceeded crown width.
- With a planting density of 1 250 plants ha^{-1}, the total coarse root DRM was roughly 10 t ha^{-1}.

Spatial root distribution, (No. of root tips)



- In the topsoil, root tip density is highest around the stem base.
- Spatial distribution of roots in the subsoil is heterogeneous.
- Modelling of water and nutrient uptake has to consider this heterogeneity.

Spatial differences in root biomass (g m^{-3})



- Root biomass of 2-year old plants is higher than that of 1-year plants.
- 59–68% of coarse roots were located in the topsoil layer. Root biomass decreased with increasing soil depth.
- Plant age had no effect on the radius of roots spread (roughly 40 cm from the stem base)

Notes on Materials and Methods

Study carried out on reddish lateritic soil, planting density: 1 250 plants ha^{-1}.
Plants excavated, vertical root distribution down to 1.20 m depth analyzed with the trench-wall method: number of visible root tips counted and soil samples taken to determine coarse root biomass distribution, sampling performed at 20, 40, and 60 cm distance from the stem on both sides. Maps constructed with SigmaPlot for Windows version 10.0, plot type: Filled Contour Plot, Data format: XYZ Triplet.

1 and 2 year old Jatropha

Jatropha tap root

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