





Understanding novel value chains and webs of the macauba palm, an alternative oil crop in Brazil

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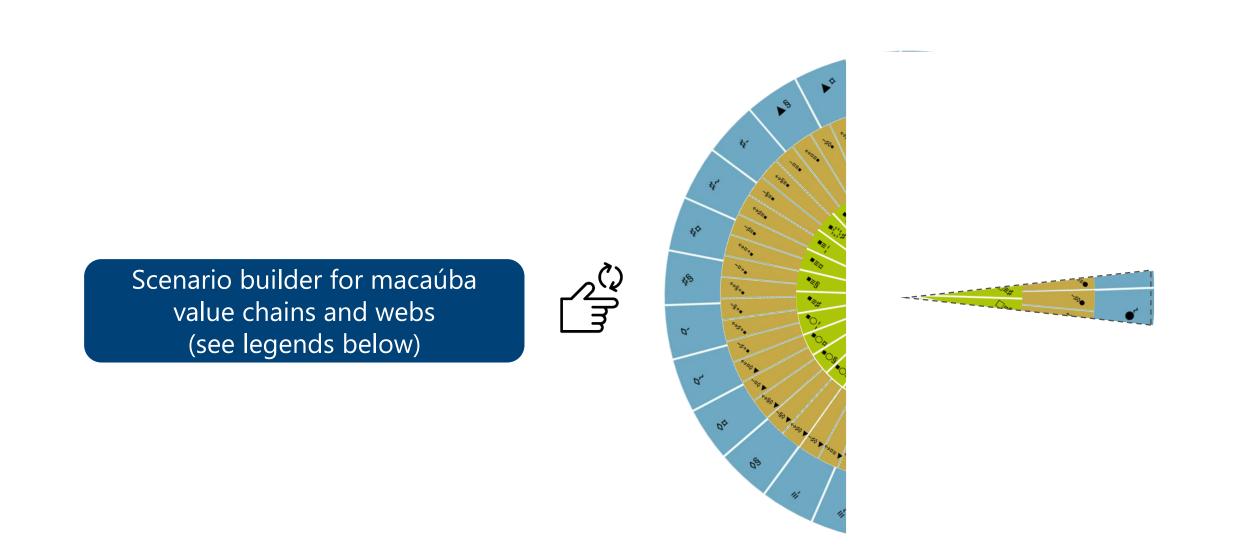
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Context

- The macaúba palm (Acrocomia aculeata) is a novel crop, currently entering the cultivation phase in Brazil
- Macaúba fruits yield vegetable oils (from pulp and kernel) as bases for a variety of applications in biobased sectors, as well as a range of materials from fruit by-products
- Research and development from pre-breeding to value-added products support the implementation of macaúba value chains and webs (MVCW)
- Entrepreneurs lead knowledge transfer and the development of MVCW processes, while governance strategies are being established
- Ensuring a successful crop introduction and steering MVCW towards sustainability are strategic goals of the macaúba innovation system in Brazil

Value chain and web scenarios

The building blocks of the MVCW – agricultural production, fruit processing, products and markets – display different and non-mutually exclusive scenarios based on varying parameters:



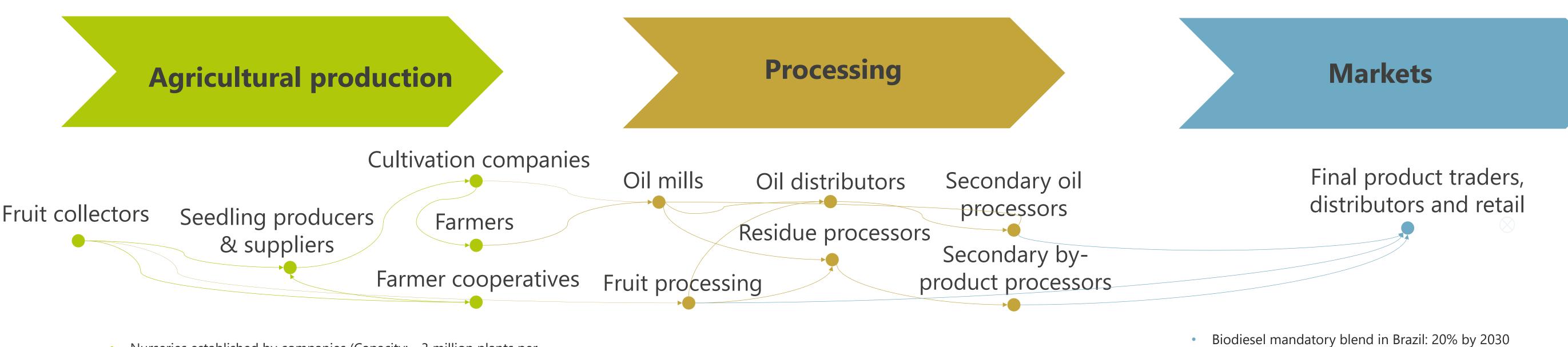
Research aims

The work package Value web analysis and implementation strategies of the project AcroAlliance aims at:

- Integrating knowledge related to seed, agronomy, post-harvest, biorefining and product development
- Identify stakeholders and key criteria for MVCW implementation
- Identify, assess and conceptualize MVCW scenarios
- Identify strategies for the development of MVCW

Processing Markets Agricultural production **Production Markets Products** model ▲ Oil as commodity in food # Extraction ▲ Physical □ Standardized + Mechanical Oil as commodity for O Monocropping farming with § Regional of compounds planting material processes pressing bioenergy (e.g. biodiesel) ∍**≡** Silvopastoral ~Large-scale smallholders from bywith desirable traits (drying, Oil as specialty product centralized ≡ Chemical oil products separation) (e.g. premium food, natural \[\times_{\tilde{x},\tilde{x}}^{\tilde{x}} \] Intercropping \[\tilde{y} \] Intercroppi § Large-scale ¤ National →Small-scale, plantations own Chemical § Use of cosmetics, pharma) Planting material **≡** Wild extraction residues + High-value added processes without compounds (e.g. proteins populations extraction (e.g. ~ Latin ¤ Farmer processing and fibers) enzymatic Advanced America cooperatives ≡ Low-value added bymethods extraction) ¤ Oil refining products (e.g. cattle feed) (e.g. gama ¦ Independent radiation) ♦ Low-tech applications (e.g. fractioning farmers flour, soap, ice cream) # Ecosystem services (e.g. carbon credits)

Value chain and web structure



- Nurseries established by companies (Capacity: ~3 million plants per year)
- Commercial varieties lack. Planting material from natural stands 2400 ha planted with macaúba mainly in degraded pastures in the state of Minas Gerais (Cerrado biome), as well as Sao Paulo (Mata Atlântica biome) and the state of Pará (Amazon biome).
- 400.000 ha expected by 2030, expanding in the state of Bahia (Caatinga biome)
- Projected yield: 13.7 25.5 tons fresh fruit per ha, 3.4 6.7 tons crude oils per ha
- Lack of a mechanized harvesting process
- Market price: no defined yet. Minimum guarantee price under wild extraction: 570 R\$/ton fruit
- Initial pilot plants for oil extraction with processing equipment adapted to macaúba fruits
- Multiple post-harvest processing pathways, depending on
- harvesting conditions, fruit quality and targeted product Lack of a standardized post-harvest processing
- Potential use of existing facilities for secondary vegetable oil processing (e.g. biodiesel production, crude oil refining from soybean)
- Multiple pathways for the valorization of fruit residues from oil
- Existing small-scale fruit processing facilities for oil production, soap elaboration and ice cream manufacturing
- Developing market for sustainable aviation fuel in Europe (ReFuelEU Aviation regulation)
- Collaboration with multinational firms from chemical and cosmetic industries
- Niche regional markets small-scale produced goods such as ice
- Emerging sustainability regulations: EU's Deforestation-free
- regulation (EUDR), German Supply Chain Act
- Regulatory framework for use in food sector: Novel Food Regulation in EU
- Regulatory framework for use in bioenergy sector: Renewable energy directive (REDIII)

Enabling environment and supporting services

Government:

- Agricultural Zoning of Climate Risk (ZARC) Embrapa
- Minimum Price Guarantee Policy for Sociobiodiversity Products (PGPMBio)
- Pro-macaúba law (19.485/2011)
- National Program for Biodiesel Production and Use/Social **Biofuel Seal**

Research and innovation:

- R&D led by federal and state research institutes and universities of Brazil
- R&D in start-up and companies
- Open innovation models through partnerships between industry and research institutions (national and international)

- **Funding mechanisms:** IADB - Climate Investment Funds
- Restoration Seed Capital
- Carbon credit markets
- Private investment in start-ups and incumbent firms

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