Fully integrated operations – production capacity*

A leading, technologically advanced and efficient maker of renewable, bio-based products.

High capacity single-site pulp mill
**2,800,000** tons of pulp capacity/year

One of the world’s fastest fine paper mills
**1,200,000** tons of paper capacity/year

First fully integrated viscose rayon producer in Asia
**300,000** tons of viscose capacity/year

**35,092** workforce

* As at 31 Dec 2022
Land stewardship

1,045,557 ha Total concession area

454,045 ha plantation area

42,353 ha livelihood plantation

361,231 ha conservation and restoration

- APRIL manages more area on peatland than on mineral soil;
- APRIL conserves ~1.2 ha intact peatland for every one ha plantation on peat
Plantation MAI Improvement 2016 - 2022

Key Focus Area

Genetic Improvement & Integrated Pest and Disease Management
- Acacia & Eucalyptus genetic improvement
- Genetic screening for pest & diseases
- Improve capacity in identification and monitoring of pest & diseases
- Expansion of bio-controls in pest and diseases

MAI (Mean Annual Increment) - m³/ha/year

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All Species (ACRA, EUCA, AMAN)
Fiber Research and Development

Alvaro J. Duran S. PhD
Head of Fiber Research and Development

Sabar T.H Siregar MSc
Dy. Head of Fiber Research and Development
• APRIL R&D consists of a team of more than 250 staffs, including people from 8 nationalities, of which, there are 17 and 31 staffs with PhD and Master degrees respectively.

• State of the Art Research & Development Facility:
  ▪ RGE Technology Center with more than 5,000 $m^2$
  ▪ Kerinci Research Nursery (KRN) with area of 53,616 $m^2$
  ▪ Kerinci Tissue Culture (KTC) with an area of 3,862 $m^2$ and capacity to produce up to 50 millions of TC

• More than 90 publications on international peer reviewed journals by R&D staffs in the last 10 years

• More than USD 11 Million Capex investment over 10 years with annual operation budget of more than USD 9 Million
Goal
Add value to company operations by improving sustainable, cost-effective production of fiber for the mill.

Objective
• Improve pulp productivity from plantation through improvements in best plantation silviculture practice, tree nutrition, tree genetics, wood properties and plant health.
• Competitive pulp production cost from efficient, sustainable plantation management and environmentally-friendly technologies
**Silviculture**

**Objectives**
- Sustainable Wood Production
- Soil conservation
- Circular Economy (Mill waste to Forest value)
- Rational use of Herbicides

**Eucalyptus Silviculture**

**Soil Conservation and Management**
- Detailed Soil Map (updated 2023)
- Soil Fertility Monitoring
- Soil Cultivation Matrix
- Harvesting Technique to keep soil coverage and avoid soil compaction

**Industrial Forest Management**
- Clonal Site Interaction Trials
- Alternative Source of Nutrients (Waste to Value)
- Nutrient-use efficiency by clone
- Spacing and proper allocation per clone

**Weed Science**
- Precision weed control with digital pre-assessment
- Use of selective and pre-emergent herbicides
- Reduced use of glyphosate
- Improvement of application technology:  
  - Drones application
  - Planting line weed control.

**Acacia Silviculture**

**Peat Management**
- Detailed Soil Map (updated 2024)
- Peat Management Unit
- Species Allocation Matrix
  - *Acacia crassicarpa*
  - Acacia hybrids
- Acid Sulfate Soil Risk Map

**Industrial Forest Management**
- Waste to Value
- Cost effective fertilizer regime
- Spacing
- Tree stability and root development
  - Singling
  - Propagation technique
  - Planting technique

**Weed Science**
- Precision weed control – monitoring based control (digital pre-assessment)
- Use of safer contact herbicides for *Acacia crassicarpa*
- Reduced use of glyphosate
Plant Health

Diagnostic, identification and monitoring

**Diagnostic**
- Accurate identification of major P&D through morphological and molecular analysis
- Regular quality control for nursery sanitization

**Monitoring**
- On time P&D monitoring in nurseries and plantations
- Digitalization of P&D monitoring
- Quality check by validation

**Screening Program**
- Artificial inoculation in green house followed by field validation
- Selection of tolerant plant materials used for planting program

Objectives
- Effective & on-time detection and monitoring of relevant P&D
- Reduction of P&D damage below the economic threshold
- Use tolerant plant materials & develop biological control strategy
- Efficient use of pesticides

Integrated pest management

**Biological Control**
- Identification and evaluation of biological control agents
- Scale up of Trichogramma sp. release for pest control
- Endophytic Trichoderma application for nursery diseases at 15 ton/year

**Chemical Control**
- Using FSC approved pesticides
- Research toward greener molecules
- Improved pesticide application technology to increase efficacy, safety and reduce chemical consumption, reduction of 23% in nursery and 27% in plantation chemical consumption over the last 5 years

All products evaluated and used for pest & disease control follow WHO and FSC guidelines.
Tree Improvement

Eucalyptus Tree Improvement

Main Breeding Species
- E. pellita
- E. robusta
- E. grandis
- E. creba
- E. urophylla
- E. cullenii
- E. brassiana
- E. melanophloia
- E. tereticornis
- Corymbia sp.

Breeding strategies
- Industrial and Conservation Breeding
- Mid and Long Term Breeding using Simple Recurrent Selection Method
- Biotech tools to speed up classical breeding

Acacia Tree Improvement Program

Main Breeding Species
- A. crassicarpa
- A. auriculiformis
- A. aulolocarpa

Breeding strategies
- Secure a broad genetic diversity

Objectives
- Continue productivity improvement
- Resilient plantations to biotic and abiotic stressors
- Improved wood properties
- Proper genetic site matching

Main Breeding Species
  MAI 25 t/ha/yr (72 months)
- Acra 2nd Generation (2010)
  MAI 27 t/ha/yr (42 months)
- Acra 3rd Generation (2023)
  MAI 31 t/ha/yr (72 months)

Breeding strategies
- Secure a broad genetic diversity

Genetic Diversity Dendrogram
800 F1 genotypes

APRIL does not use any genetically modified organisms (GMOs) in any of its research programs and initiatives, or in any areas where research takes place under the company’s direct or indirect responsibility.
Plant Propagation

Tissue Culture

Objectives
- Produce high quality plants for mother plants
- Fast production of high valuable genetic materials
- Rejuvenate genetic material for efficient multiplication
- Multiply genetic materials for trials

Mother plants production
- Fast multiplication of high valuable genetic materials
- Genetic integrity and archive of selected genotypes
- Pest and disease - free initiation of mother plants
- Rejuvenate genetic materials for efficient multiplication

Strategic multiplication
- Movement of genetic materials national and internationally
- Cloning difficult plant material
- Use state of the art technologies for massive production of high valuable genetic material

Nursery Research

Nutrition and environmental management
- Clone or family specific multiplication protocol
- Develop protocols for optimized use of fertilizer, water, light and temperature
- Rejuvenate genetic material for efficient multiplication

Production of plant material for genetic trials
- Production of plant material for trials
- Rescue high valuable clones and families
R&D provides science-based knowledge to increase plantation productivity and efficiencies. For that, having a highly qualified team of researchers is important.

The main focus of research are Tree Improvement, Plant Health, Silviculture and Plant Propagation with specific objectives aligned with company’s targets and commitments.

R&D activities have resulted in a sustainable increase of plantation productivity and aim to keep doing so to achieve the company’s target to increase plantation productivity by 50% by 2030.
Plantation MAI Improvement 2016 - 2022

Key Focus Area

Site Specific Management Regimes
- Enhance and refine site quality characterisation at compartment level
- Site species genotype matching with silvicultural best practices
- Site specific silvicultural prescriptions

MAI (Mean Annual Increment) - m³/ha/year

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All Species (ACRA, EUCA, AMAN)
Fiber Productivity Improvement

Mark Holmes
Plantation Head

Jelo Singh
Dy. Fiber Director
FOREST PLANNING - Implementation for Precision Forestry

INTEGRATED OPERATIONAL PLAN

- **MILL - CUSTOMER**
  - Wood Requirements
  - Wood Delivery

- **PLANNING**
  - License
  - Attribute Data
  - Spatial Data
  - Inventory

- **FIBER SUPPLY**
  - Resources
  - Delivery Plan
  - Harvest Schedule
  - HOA Schedule

- **PLANTATION**
  - Resources
  - MSC Schedule
  - Planting Schedule
  - Seedling Requirement
  - Clone Allocation (R&D)

- **NURSERY**
  - Resources
  - Seedling Production Schedule

- **HOA**
  - Ready for Planting

- **Seedling Delivery**

- **Harvest Area**

- **Integration** across business value chain

- **Phasing & scheduling of requirements**, to ensure right activities are done on-time and at the right time

- **Ensure that R&D recommendations and SOP are followed**, including Clone / Family, soil cultivation, spacing, fertilizer regimes
**FOREST PLANNING**

**DIGITAL TRANSFORMATION TOWARD PRECISION FORESTRY**

**TRADITIONAL FORESTRY MANAGEMENT**
- Manual data capture
- Reactive decision making
- Multiple silo systems
- Lots of data, less information, less insights!

**NEXT GENERATION**
- Connected – Intelligent – Scalable – Rapid
- **Data Accuracy** & Data Availability
- Near **real time** to access data
- **Proactive** decision making
- **Single source** of data
Mechanized Silviculture

Objective
- Introduce appropriate technology to develop and scale up to improve quality of plantation activities.

Drone Based

• Diverse applications:
  • Pre-emergent Chemical application
  • Herbicide Spraying application
  • Pesticide Spraying application

• Improvement in quality of results due to
  • Increased on-time application
  • Consistent application quality since flight speed, height and application are set at time of operation

• More resource efficient (lower application rate)

• 40% Reduced labour requirement, however maintenance and support required

Ground Based

• Herbicide application in later weeding rounds

• Reduced labour requirement, however maintenance and support required

• Best suited to work in flatter areas
Peatland Water Management

Hydrological water balance, Water Table (WT) management, and Plantation Productivity

- WT management across an elevation range (5masl to 20masl) is achieved using water zones (similar elevation)
  - 1,593 units established Dams
  - 2,685 units of Water Control structures
  - Managed by 140 dedicated staff

- Production area WT is managed between -40 and -60cm

- Achievement of Plantation productivity (Achieved target MAI=29.3 m³/ha in 2022)

Fire Prevention
- Minimize fire risk when WT is in the range -40 and -60cm
- Canal functions as fire breaks, patrol access & water storage

Transportation
- Canal functions as transportation for logistics and wood
FIRE PREVENTION & SUPPRESSION

More than USD 9 Million invested in fire equipment

No-burn policy since 1994

Focused on fire prevention in and around concession areas

Monitor, detect and suppress fire threats in and around concession areas

More than USD 2 Mio annual budget for fire team

Support local and national government in fire suppression activities

Monitor fire threats via two NASA based system hotspot monitoring, CCTV, UAVs

989 firefighters / rapid response team

Provides training to 724 volunteers
Fire Prevention and Suppression

**Objectives**
- Zero Fire within concessions
- Prevention rather than suppression
- Increased awareness amongst communities

**Fire Prevention and Monitoring**
- No Burn policy since 1994
- **CCTV**, Fire Towers & Command Center
- UAV, Vehicle and Foot Patrols
- **Educating communities**
- Fire Free Village Program

**Detection and Suppression**
- **Training** firefighters
- Rapid Response team at each estate & FERT team in HO
- Perform regular drills
- **Equipment** as per Govt regulation
- Support local and national government in fire suppression activities
EUCALYPTUS PLANTATION

- High productivity
- Uniform growth and stocking
- Good soil conservation for future rotations
**Key Focus Area**

**Contractor Development & Mechanization**
- Professional contractor development
- Plantation mechanisation to support precision forestry

**Improving log quality & reducing fiber losses from Plantation to Mill**

### MAI (Mean Annual Increment) - m³/ha/year

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All Species (ACRA, EUCA, AMAN)
Mechanized Harvesting

**Harvesting Mechanization** enables APRIL to increase productivity via greater efficiency and reduced reliance on manual labour.

Harvesting mechanization benefits:

- Ensuring safety and more sustainable practices with specialized manpower
- Optimizing efficiency (including fuel) and productivity
- Providing consistent wood delivery to mill all year round
- Cut-to-length: Even spreading of harvest residues improving sustainable operations and soil conservation

35% of all our fuel comes from renewable sources
Mineral Soil: Full Mechanized Harvesting

1. Felling
2. Extraction with Forwarder or Sleigh
3. Truck loading

Lowland: Full Mechanized Harvesting
Plantation MAI Improvement 2016 - 2022

MAI (Mean Annual Increment) - m³/ha/year

Key Focus Areas

- Genetic Improvement & Integrated Pest and Disease Management
- Site Specific Management Regimes
- Contractor Development & Mechanization
- Improving log quality & reducing fiber losses from Plantation to Mill

All Species (ACRA, EUCA, AMAN)

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Wood Supply Sourcing Due Diligence and Verification Process

Meets SFMP2.0 criteria
- No deforestation
- Legally compliant
- Traceable
- Subject to due diligence check and Sustainability sign off prior to contract
  - Internal audit
  - External audit
  - Land cover change monitoring
  - Ground verification
### OWN WOOD DELIVERY (M TONNES)

<table>
<thead>
<tr>
<th>Year</th>
<th>Euca</th>
<th>Aman</th>
<th>Acra</th>
<th>All Species</th>
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Baseline 7MT $\rightarrow$ 10MT (+40%)
From same plantation footprint (450KHa)
In 2022, Own & LT Supply Partner = **10.2 MT** or 85% of the Wood Delivery