El Tor Circular Economy

Integrated Sustainable Agricultural System

FAAS - Takamol Initiative

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Contents

Chapter 1

Introduction to El Tor Circular Economy

1.1 Project Overview

The El Tor Circular Economy project represents a pioneering integrated sustainable agricultural system designed for the unique conditions of the Sinai Peninsula. This innovative model combines traditional knowledge with cutting-edge technologies to create a closed-loop system where waste from one process becomes a valuable input for another.

1.2 Circular Economy Foundation

At the heart of the El Tor Circular Economy lies the principle of resource optimization and waste elimination. The project demonstrates how interconnected agricultural units can create a resilient, productive, and environmentally positive system that maximizes resource efficiency while minimizing environmental impact.

1.3 Azolla Integration in the Circular Economy

Azolla, a fast-growing aquatic fern, serves as a cornerstone of the El Tor Circular Economy by providing a renewable feedstock for biodiesel production. This remarkable plant creates multiple value streams within the system:

- **Renewable Energy Source:** Azolla biomass provides a sustainable feedstock for biodiesel production, reducing dependence on fossil fuels.
- **Nitrogen Fixation:** Through its symbiotic relationship with cyanobacteria, Azolla naturally enriches soil and water with nitrogen.
- **High-Protein Feed:** With protein content ranging from 19-30%, Azolla serves as a nutritious supplement for livestock.
- **Carbon Sequestration:** The rapid growth of Azolla contributes to carbon capture, supporting climate change mitigation efforts.

1.4 Alignment with Egypt's National Strategies

The El Tor Circular Economy project directly supports Egypt's national development goals:

- **Egypt's 2030 Vision:** The project aligns with Egypt's sustainable development strategy by promoting resource efficiency, environmental sustainability, and rural economic development.
- **2035 Sustainable Energy Strategy:** By producing biodiesel from Azolla, the project contributes to Egypt's goal of increasing renewable energy's share in the national energy mix to 42% by 2035.
- **National Climate Change Strategy:** The project supports Egypt's climate commitments through carbon sequestration, renewable energy production, and sustainable land management practices.

1.5 Economic and Environmental Impact

The El Tor Circular Economy project delivers significant benefits:

- **Energy Security:** Local biodiesel production reduces dependence on imported diesel, enhancing energy security and reducing foreign exchange expenditure.
- **Carbon Credit Potential:** The project's carbon sequestration activities create opportunities for participation in carbon credit trading markets, generating additional revenue streams.
- **Rural Development:** By creating sustainable livelihoods in the Sinai Peninsula, the project contributes to regional development and population redistribution goals.
- **Water Conservation:** The system utilizes greywater and treated wastewater for Azolla cultivation, demonstrating efficient water use in water-scarce regions.

1.6 Innovation and Replicability

The El Tor Circular Economy model serves as a demonstration of how integrated agricultural systems can transform arid and semi-arid regions into productive landscapes. The principles and technologies employed can be adapted and scaled to similar environments across Egypt and the broader Middle East and North Africa region.

Chapter 2

Nursery

2.1 Nursery Unit Overview

2.1.1 Purpose and Scope

The nursery unit serves as a central facility for propagating, growing, and supplying high-quality seedlings and young plants primarily for the olive cultivation and date palm cultivation units within the El Tor Circular Economy project. The unit ensures genetic quality, disease resistance, and optimal growth conditions for young plants before their transfer to permanent cultivation sites.

2.1.2 Key Functions

- **Plant Propagation:**
  - Olive tree propagation through cuttings and grafting
  - Date palm propagation through offshoots and tissue culture
  - Management of mother plants for genetic preservation
  - Implementation of advanced propagation techniques
- **Seedling Care:**
  - Climate-controlled growing environments
  - Precision irrigation and fertigation systems
  - Disease monitoring and prevention
  - Growth stage management
- **Research and Development:**
  - Variety trials and selection
  - Propagation technique optimization
  - Climate adaptation research
  - Disease resistance studies

2.1.3 Capacity and Infrastructure

- **Production Capacity:**
  - Annual production of 2,000 olive seedlings
  - Annual production of 1,000 date palm offshoots
  - Expansion capability up to 5,000 total plants annually
- **Facilities:**
  - 2,000 m^2 greenhouse space
  - 1,000 m^2 shadehouse area
  - 500 m^2 mother plant section
  - Laboratory and tissue culture facility
  - Storage and processing areas

2.1.4 Integration with Other Units

- **Input Integration:**
  - Vermicompost and biochar for growing media
  - Treated water from water management unit
  - Organic pest control materials
  - Renewable energy for climate control
- **Output Integration:**
  - High-quality seedlings for cultivation units
  - Research data and best practices
  - Genetic material preservation
  - Training and capacity building

2.1.5 Key Success Metrics

- Seedling survival rate (target: ¿90%)
- Genetic purity maintenance (100%)
- Disease resistance levels
- Growth rate and uniformity
- Resource use efficiency
- Research and innovation outputs

This nursery unit plays a crucial role in ensuring the success of the olive and date palm cultivation units by providing high-quality, well-adapted planting material while contributing to the project's research and development objectives.

2.2 Strategic Plan for Nursery Unit

2.2.1 Vision and Mission

- **Vision:** To become the premier source of high-quality, genetically superior olive and date palm planting material in the Sinai region, supporting sustainable agricultural development through innovation and excellence in plant propagation.
- **Mission:** To produce, research, and supply superior olive and date palm planting material that meets the highest standards of genetic purity, health, and productivity, while advancing propagation techniques through continuous research and development.

2.2.2 Strategic Objectives

- **Production Excellence:**
  - Achieve annual production capacity of 2,000 olive seedlings and 1,000 date palm offshoots by 2028
  - Maintain seedling survival rates above 90% post-transplantation
  - Develop and implement advanced propagation protocols for key varieties
  - Establish a genetic preservation program for valuable local varieties
- **Research and Innovation:**
  - Develop at least two improved propagation techniques by 2028
  - Establish collaborative research programs with agricultural institutions
  - Create a variety testing and improvement program
  - Publish research findings in relevant scientific journals
- **Operational Sustainability:**
  - Reduce water consumption per plant by 25% through improved irrigation techniques
  - Integrate renewable energy for at least 60% of energy needs
  - Implement closed-loop nutrient cycling with other project units
  - Achieve zero-waste operations through recycling and repurposing
- **Market Development:**
  - Establish the nursery as the preferred supplier for regional agricultural projects
  - Develop training and extension services for farmers and agricultural professionals
  - Create certification standards for premium planting material
  - Build partnerships with agricultural development programs

2.2.3 Strategic Analysis

SWOT Analysis

- **Strengths:**
  - Integration with other units in the circular economy project
  - Access to advanced research and development resources
  - Controlled growing environment optimized for desert conditions
  - Specialized focus on olive and date palm varieties
  - Ability to implement tissue culture and advanced propagation techniques
- **Weaknesses:**
  - High initial capital investment requirements
  - Long lead time for full production capacity
  - Specialized skill requirements for technical staff
  - Limited initial variety selection
  - Dependency on consistent water and energy supply
- **Opportunities:**
  - Growing demand for high-quality planting material in the region
  - Government support for agricultural development in Sinai
  - Potential for research grants and collaborative projects
  - Emerging market for specialized varieties and organic certification
  - Knowledge transfer and capacity building services
- **Threats:**
  - Climate variability and extreme weather events
  - Potential introduction of new pests and diseases
  - Competition from established nurseries
  - Regulatory changes affecting propagation and distribution
  - Market price fluctuations for planting material

2.2.4 Strategic Implementation Plan

Phase 1: Establishment (2026-2027)

- **Infrastructure Development:**
  - Construct initial greenhouse (800 m^2)
  - Establish basic irrigation and climate control systems
  - Set up initial laboratory facilities
  - Develop mother plant section

- **Operational Setup:**
  - Recruit and train core technical team
  - Establish propagation protocols for primary varieties
  - Source initial genetic material from certified suppliers
  - Implement quality control systems
- **Market Preparation:**
  - Develop relationships with olive and date palm cultivation units
  - Create initial product catalog and specifications
  - Establish pricing structure and supply agreements
  - Develop branding and marketing materials

Phase 2: Growth and Development (2027-2028)

- **Capacity Expansion:**
  - Construct additional greenhouse space (600 m^2)
  - Develop shadehouse facilities
  - Expand laboratory capabilities
  - Enhance irrigation and climate control systems
- **Production Enhancement:**
  - Increase variety selection
  - Implement advanced propagation techniques
  - Optimize growing conditions and protocols
  - Establish disease testing and certification program
- **Research Initiatives:**
  - Launch variety trials and selection program
  - Develop collaborative research projects
  - Implement data collection and analysis systems
  - Begin publication of research findings

Phase 3: Maturity and Excellence (2028-2029)

- **Facility Completion:**
  - Construct final greenhouse section (600 m^2)
  - Implement advanced climate control systems
  - Complete laboratory facilities
  - Finalize irrigation and resource management systems

- **Operational Excellence:**
  - Achieve full production capacity
  - Implement comprehensive quality management system
  - Develop specialized production lines for premium varieties
  - Establish genetic preservation program
- **Market Leadership:**
  - Develop training and extension programs
  - Establish certification standards
  - Create demonstration and visitor facilities
  - Build regional partnerships and networks

2.2.5 Strategic Performance Indicators

- **Production Metrics:**
  - Annual production volume by variety
  - Propagation success rates
  - Post-transplantation survival rates
  - Production cycle duration
  - Genetic purity maintenance
- **Research Metrics:**
  - Number of research projects completed
  - Publications and presentations
  - New techniques developed
  - Variety improvements achieved
  - Collaborative research initiatives
- **Sustainability Metrics:**
  - Water use efficiency
  - Energy consumption per plant
  - Waste reduction and recycling rates
  - Carbon footprint
  - Biodiversity preservation
- **Financial Metrics:**
  - Revenue growth
  - Cost per plant
  - Return on investment
  - Market share
  - Value of research outputs

2.2.6 Strategic Partnerships

- **Research Institutions:**
  - Agricultural research centers
  - Universities and technical colleges
  - International research networks
  - Genetic preservation organizations
- **Industry Partners:**
  - Agricultural development projects
  - Commercial farming operations
  - Horticultural suppliers
  - Technology providers
- **Government and NGO Partners:**
  - Agricultural extension services
  - Development agencies
  - Certification bodies
  - Funding organizations

This strategic plan provides a comprehensive roadmap for the development and operation of the nursery unit, ensuring its alignment with the overall objectives of the El Tor Circular Economy project while establishing a foundation for long-term success and sustainability.

2.3 Operational Plan for Nursery Unit

2.3.1 Production Operations

- **Olive Tree Propagation:**
  - **Methods:**
    - Semi-hardwood cutting propagation
    - Grafting on rootstocks
    - Tissue culture for selected varieties
  - **Timeline:**
    - Cutting collection: February-March
    - Rooting period: 60-90 days
    - Hardening: 30-45 days
    - Total production cycle: 6-8 months
- **Date Palm Propagation:**
  - **Methods:**

        * Offshoot separation and cultivation
        * Tissue culture multiplication
        * Direct seeding for breeding
    - **Timeline:**
        * Offshoot separation: March-April
        * Initial establishment: 3-4 months
        * Tissue culture cycle: 18-24 months

2.3.2 Facility Management

- **Greenhouse Operations:**
    - Temperature control (18-28°C)
    - Humidity management (60-80%)
    - Light intensity regulation
    - Ventilation system operation
    - Daily monitoring and adjustment
- **Irrigation Systems:**
    - Automated misting for cuttings
    - Drip irrigation for established plants
    - Fertigation scheduling
    - Water quality monitoring
    - System maintenance
- **Growing Media Management:**
    - Substrate preparation and sterilization
    - Vermicompost integration
    - Biochar incorporation
    - pH and EC monitoring
    - Storage and handling

2.3.3 Plant Health Management

- **Disease Prevention:**
    - Regular plant inspection
    - Sanitation protocols
    - Preventive treatments
    - Quarantine procedures
    - Disease monitoring system

- **Pest Management:**
  - Integrated pest management
  - Biological control agents
  - Physical barriers
  - Monitoring and scouting
  - Treatment protocols
- **Quality Control:**
  - Growth stage assessment
  - Genetic purity verification
  - Health certification
  - Performance testing
  - Documentation system

2.3.4 Resource Management

- **Material Requirements:**
  - Growing media components
  - Propagation supplies
  - Plant protection materials
  - Fertilizers and amendments
  - Laboratory supplies
- **Labor Organization:**
  - Skilled technicians (4-6)
  - General workers (8-10)
  - Research staff (2-3)
  - Training programs
  - Work scheduling
- **Equipment Maintenance:**
  - Preventive maintenance schedule
  - Equipment calibration
  - Repair protocols
  - Spare parts inventory
  - Service documentation

2.3.5 Research and Development Activities

- **Variety Trials:**
  - Performance evaluation
  - Adaptation assessment
  - Selection criteria
  - Data collection
  - Result analysis
- **Propagation Research:**
  - Method optimization
  - Protocol development
  - Success rate improvement
  - Cost reduction studies
  - Technology transfer

2.3.6 Quality Assurance

- **Standards and Protocols:**
  - Production procedures
  - Health certification
  - Genetic authentication
  - Documentation systems
  - Traceability measures
- **Monitoring and Evaluation:**
  - Growth parameters
  - Success rates
  - Quality metrics
  - Resource efficiency
  - Customer feedback

This operational plan provides a comprehensive framework for managing the nursery unit's daily activities, ensuring efficient production of high-quality planting material for the olive and date palm cultivation units.

Investment Category	Amount (USD)
Greenhouse Construction	200,000
Shadehouse Construction	100,000
Laboratory Setup	150,000
Irrigation Systems	75,000
Climate Control Systems	100,000
Equipment and Tools	50,000
Total Capital Investment	**675,000**

Table 2.1: Capital Investment Breakdown

2.4 Financial Plan for Nursery Unit

2.4.1 Capital Investment Requirements

Phased Investment Schedule

- **Phase 1 (2026-2027):** USD 270,000
  - Initial greenhouse (800 m^2): 80,000
  - Basic irrigation system: 30,000
  - Essential equipment: 20,000
  - Initial laboratory setup: 60,000
  - Basic climate control: 40,000
  - Site preparation: 25,000
  - Utility connections: 15,000
- **Phase 2 (2027-2028):** USD 202,500
  - Additional greenhouse (600 m^2): 60,000
  - Shadehouse construction: 50,000
  - Laboratory expansion: 45,000
  - Irrigation system expansion: 22,500
  - Additional equipment: 25,000
- **Phase 3 (2028-2029):** USD 202,500
  - Final greenhouse (600 m^2): 60,000
  - Advanced climate control: 60,000
  - Laboratory completion: 45,000
  - Final irrigation components: 22,500
  - Specialized equipment: 15,000

Cost Category	Year 1	Year 2	Year 3	Year 4	Year 5
Labor	120,000	150,000	180,000	210,000	240,000
Materials	60,000	75,000	90,000	105,000	120,000
Utilities	30,000	37,500	45,000	52,500	60,000
Maintenance	40,000	50,000	60,000	70,000	80,000
Research	50,000	62,500	75,000	87,500	100,000
Total Annual Operating Costs	**300,000**	**375,000**	**450,000**	**525,000**	**600,000**

Table 2.2: Annual Operating Cost Projections

2.4.2 Operating Costs

Operating Cost Details

- **Labor:**
  - Skilled technicians: 60,000-120,000/year
  - General workers: 40,000-80,000/year
  - Research staff: 20,000-40,000/year
- **Materials:**
  - Growing media: 20,000-40,000/year
  - Plant protection: 15,000-30,000/year
  - Laboratory supplies: 15,000-30,000/year
  - Other supplies: 10,000-20,000/year
- **Utilities:**
  - Electricity: 15,000-30,000/year
  - Water: 10,000-20,000/year
  - Climate control: 5,000-10,000/year
- **Maintenance:**
  - Greenhouse systems: 15,000-30,000/year
  - Laboratory equipment: 15,000-30,000/year
  - Irrigation systems: 10,000-20,000/year
- **Research:**
  - Variety trials: 20,000-40,000/year
  - Protocol development: 15,000-30,000/year
  - Quality testing: 15,000-30,000/year

Revenue Source	Year 1	Year 2	Year 3	Year 4	Year 5
Olive Seedlings	100,000	200,000	300,000	400,000	500,000
Date Palm Offshoots	150,000	300,000	450,000	600,000	750,000
Research Services	50,000	75,000	100,000	125,000	150,000
Training Programs	25,000	50,000	75,000	100,000	125,000
Total Annual Revenue	**325,000**	**625,000**	**925,000**	**1,225,000**	**1,525,000**

Table 2.3: Annual Revenue Projections

2.4.3 Revenue Projections

Revenue Source Details

- **Olive Seedlings:**
  - Standard varieties: 40-50 USD/seedling
  - Premium varieties: 60-80 USD/seedling
  - Bulk discounts available
- **Date Palm Offshoots:**
  - Standard varieties: 100-150 USD/offshoot
  - Premium varieties: 200-300 USD/offshoot
  - Tissue culture plants: 80-120 USD/plant
- **Research Services:**
  - Variety testing: 20,000-40,000/year
  - Protocol development: 15,000-30,000/year
  - Consulting services: 15,000-30,000/year
- **Training Programs:**
  - Technical workshops: 10,000-20,000/year
  - Professional training: 10,000-20,000/year
  - Student programs: 5,000-10,000/year

2.4.4 Financial Analysis

Financial Indicator	Year 1	Year 2	Year 3	Year 4	Year 5
Total Revenue	325,000	625,000	925,000	1,225,000	1,525,000
Operating Costs	300,000	375,000	450,000	525,000	600,000
Capital Investment	270,000	202,500	202,500	0	0
Net Cash Flow	-245,000	47,500	272,500	700,000	925,000
Cumulative Cash Flow	-245,000	-197,500	75,000	775,000	1,700,000

Table 2.4: Cash Flow Projections (First Five Years)

Long-term Financial Projections

- **Break-even Point:** Year 3 (2028)
- **Return on Investment:** 25-30% after full maturity
- **Internal Rate of Return (IRR):** 22-25% (10-year horizon)
- **Net Present Value (NPV):** USD 2.8-3.2 million (10-year horizon, 8% discount rate)
- **Profitability Index:** 2.2-2.5

2.4.5 Funding Strategy

- **Equity Investment:** 45% (303,750 USD)
- **Debt Financing:** 35% (236,250 USD)
- **Grants and Subsidies:** 20% (135,000 USD)

Potential Funding Sources

- Agricultural development banks
- Research and innovation grants
- Sustainable agriculture funds
- Government subsidies for agricultural technology
- Private investors in agtech
- Partnership with agricultural institutions

2.4.6 Risk Management

- **Market Risks:**
  - Diversified product portfolio
  - Long-term supply contracts
  - Market research and adaptation
- **Production Risks:**
  - Disease prevention protocols
  - Backup systems for critical infrastructure
  - Staff training and development
- **Financial Risks:**
  - Phased investment approach
  - Multiple revenue streams

- Operating cost control measures

This financial plan demonstrates the economic viability of the nursery unit within the El Tor Circular Economy project, showing strong returns after the initial investment period. The integration with other project units creates operational synergies that enhance overall financial performance.

2.5 Resource Requirements for Nursery Unit

2.5.1 Land and Infrastructure Requirements

Land Requirements

- **Total Land Area:** 1.5 hectares (15,000 m^2)
  - Greenhouse area: 2,000 m^2
  - Shadehouse area: 1,000 m^2
  - Mother plant section: 500 m^2
  - Laboratory and facilities: 800 m^2
  - Storage and processing: 700 m^2
  - Access roads and utilities: 5,000 m^2
  - Buffer and expansion area: 5,000 m^2
- **Land Characteristics:**
  - Well-drained soil
  - Protection from strong winds
  - Accessible for transportation
  - Proximity to cultivation units
  - Suitable for utility connections

Building Infrastructure

- **Greenhouse Facilities:**
  - Climate-controlled greenhouses: 2,000 m^2
  - Polycarbonate or glass construction
  - Automated ventilation systems
  - Thermal screens for temperature regulation
  - Raised benches for container production
- **Shadehouse Facilities:**
  - Shade structures: 1,000 m^2
  - 30-50% shade cloth coverage
  - Reinforced frame construction

  - Wind protection barriers
  - Concrete flooring with drainage

- **Laboratory and Office Facilities:**
  - Tissue culture laboratory: 200 m^2
  - Quality testing area: 100 m^2
  - Research and development space: 150 m^2
  - Staff offices: 150 m^2
  - Meeting and training room: 100 m^2
  - Sanitation and changing areas: 100 m^2

- **Storage and Processing:**
  - Growing media preparation area: 200 m^2
  - Container and supply storage: 200 m^2
  - Equipment storage: 150 m^2
  - Plant processing and staging area: 150 m^2

2.5.2 Equipment and Technology Requirements

Propagation Equipment

- **Tissue Culture Equipment:**
  - Laminar flow cabinets (3 units)
  - Autoclaves (2 units)
  - Incubation chambers (4 units)
  - Microscopes (2 units)
  - Growth medium preparation equipment
  - Sterilization equipment

- **Conventional Propagation:**
  - Mist propagation systems
  - Heated propagation benches
  - Grafting and cutting tools
  - Rooting hormone applicators
  - Seed germination chambers

Climate Control Systems

- **Temperature Management:**
  - Heating systems (solar-assisted)
  - Cooling systems (evaporative cooling)
  - Thermal screens
  - Temperature sensors and controllers
  - Emergency backup systems
- **Humidity Control:**
  - Misting systems
  - Dehumidifiers
  - Humidity sensors
  - Ventilation fans
  - Automated vent controls
- **Light Management:**
  - Supplemental LED lighting
  - Shade control systems
  - Light sensors
  - Photoperiod control timers
  - Light spectrum analyzers

Irrigation and Fertigation Systems

- **Water Management:**
  - Water storage tanks (50,000 liters)
  - Filtration systems
  - Water quality monitoring equipment
  - Recirculation systems
  - Rainwater harvesting system
- **Irrigation Equipment:**
  - Automated drip irrigation systems
  - Misting systems for propagation
  - Irrigation controllers
  - Moisture sensors
  - Flow meters and pressure regulators
- **Fertigation Equipment:**

  - Fertilizer injectors
  - Nutrient solution tanks
  - EC and pH controllers
  - Dosing pumps
  - Nutrient analyzers

Laboratory and Testing Equipment

- **Quality Testing:**
  - Plant health testing equipment
  - Genetic verification tools
  - Soil and media testing equipment
  - Water quality analyzers
  - Pathogen detection kits
- **Research Equipment:**
  - Data collection devices
  - Environmental monitoring systems
  - Experimental growth chambers
  - Documentation equipment
  - Sample processing tools

2.5.3 Human Resource Requirements

Technical Staff

- **Management:**
  - Nursery Manager (1): Overall operations and coordination
  - Technical Supervisor (1): Production oversight and quality control
  - Research Coordinator (1): R&D activities and knowledge management
- **Specialized Technicians:**
  - Propagation Specialists (2): Cutting, grafting, and tissue culture
  - Climate Control Technician (1): Environmental systems management
  - Laboratory Technician (2): Tissue culture and testing
  - Irrigation Specialist (1): Water and nutrient management
- **General Staff:**
  - Nursery Workers (6-8): Plant care, potting, and maintenance
  - Maintenance Technician (1): Equipment and facility upkeep
  - Administrative Assistant (1): Record keeping and logistics

Skill Requirements

- **Technical Knowledge:**
  - Plant propagation techniques
  - Olive and date palm cultivation
  - Greenhouse management
  - Pest and disease management
  - Irrigation and fertigation systems
  - Laboratory procedures
- **Operational Skills:**
  - Climate control system operation
  - Equipment maintenance
  - Quality control procedures
  - Data collection and analysis
  - Resource management
  - Scheduling and planning

Training Requirements

- **Initial Training:**
  - Propagation techniques for olive and date palm
  - Greenhouse and shadehouse management
  - Laboratory procedures and protocols
  - Equipment operation and maintenance
  - Quality control standards
- **Ongoing Development:**
  - Advanced propagation methods
  - New variety management
  - Research methodologies
  - Sustainable nursery practices
  - Technology updates and applications

2.5.4 Material and Supply Requirements

Growing Media and Amendments

- **Base Components:**
  - Peat moss or coconut coir: 50 m^3/year
  - Perlite: 30 m^3/year

  - Vermiculite: 20 m^3/year
  - Sand (washed): 40 m^3/year
  - Compost: 60 m^3/year (primarily from project units)
- **Amendments:**
  - Biochar: 20 m^3/year (from project pyrolysis unit)
  - Vermicompost: 15 m^3/year (from project units)
  - Lime: 2 tons/year
  - Mycorrhizal inoculants: 500 kg/year
  - Beneficial bacteria products: 200 kg/year

Containers and Propagation Supplies

- **Containers:**
  - Propagation trays: 5,000 units
  - Small pots (1-2L): 10,000 units
  - Medium pots (5-10L): 5,000 units
  - Large pots (15-25L): 3,000 units
  - Specialized root trainers: 2,000 units
- **Propagation Materials:**
  - Rooting hormones: 50 kg/year
  - Grafting supplies: 5,000 units/year
  - Grafting tape and wax: 100 kg/year
  - Propagation labels: 20,000 units/year
  - Tissue culture media components: as needed

Nutrients and Plant Protection

- **Fertilizers:**
  - Controlled-release fertilizers: 2 tons/year
  - Water-soluble fertilizers: 1 ton/year
  - Micronutrient supplements: 500 kg/year
  - Organic fertilizers: 5 tons/year
  - Specialty propagation nutrients: 200 kg/year
- **Plant Protection:**
  - Biological control agents: as needed
  - Organic fungicides: 200 kg/year
  - Insecticidal soaps: 300 liters/year
  - Sticky traps: 5,000 units/year
  - Beneficial insects: as needed

2.5.5 Utility Requirements

Water Requirements

- **Quantity:**
  - Total annual requirement: 15,000-20,000 m^3
  - Peak daily demand: 80-100 m^3
  - Recirculation capacity: 40-50% of total
- **Quality Parameters:**
  - EC: ¡ 1.0 mS/cm
  - pH: 6.0-7.0
  - Sodium: ¡ 50 ppm
  - Chloride: ¡ 100 ppm
  - Pathogen-free status

Energy Requirements

- **Electricity:**
  - Connected load: 100-120 kW
  - Annual consumption: 180,000-220,000 kWh
  - Solar generation capacity: 150 kW (target)
  - Battery storage: 300 kWh
- **Heating (if needed):**
  - Heating capacity: 500 kW
  - Annual consumption: dependent on climate
  - Solar thermal contribution: 60% (target)

2.5.6 Phased Resource Acquisition

Phase 1 (2026-2027)

- Land preparation and basic infrastructure
- Initial greenhouse (800 m^2) and shadehouse (400 m^2)
- Basic laboratory setup
- Core propagation equipment
- Essential irrigation systems
- Hiring of key technical staff (6-8 personnel)
- Initial material and supply inventory

Phase 2 (2027-2028)

- Additional greenhouse (600 m^2) and shadehouse (300 m^2)
- Laboratory expansion
- Advanced climate control systems
- Enhanced irrigation and fertigation
- Additional technical staff (4-5 personnel)
- Expanded material supply chain

Phase 3 (2028-2029)

- Final greenhouse (600 m^2) and shadehouse (300 m^2)
- Specialized research equipment
- Advanced automation systems
- Complete staff complement (16-18 total personnel)
- Full material and supply inventory

This resource requirements plan outlines the land, infrastructure, equipment, human resources, materials, and utilities needed for the successful establishment and operation of the nursery unit within the El Tor Circular Economy project. The phased acquisition approach aligns with the overall project implementation timeline and financial plan.

2.6 Risk Management Plan for Nursery Unit

2.6.1 Risk Management Approach

This risk management plan identifies, analyzes, and establishes response strategies for potential risks that could impact the successful establishment and operation of the nursery unit within the El Tor Circular Economy project. The plan adopts a proactive approach to risk management, focusing on early identification, continuous monitoring, and adaptive response strategies to minimize negative impacts and maximize opportunities.

2.6.2 Risk Identification and Assessment

Environmental Risks

Technical and Operational Risks

Financial and Resource Risks

Market and Strategic Risks

2.6.3 Risk Response Strategies

Environmental Risk Mitigation

- **Extreme Weather Events:**

Risk	Description	Probability	Impact	Risk Level
Extreme Weather Events	Sandstorms, high winds, or extreme heat affecting greenhouse structures and plant health	High	High	Critical
Water Supply Disruption	Interruption or contamination of water supply affecting irrigation systems	Medium	High	High
Soil/Media Contamination	Introduction of pathogens or toxins into growing media	Low	High	Medium
Climate Variability	Unexpected temperature or humidity fluctuations affecting plant development	Medium	Medium	Medium
Pest Invasions	Introduction of new or resistant pests to the controlled environment	Medium	High	High

Table 2.5: Environmental Risk Assessment

  - Design greenhouse structures to withstand local wind conditions
  - Install protective barriers and windbreaks around facilities
  - Implement emergency protocols for extreme weather events
  - Develop evacuation procedures for sensitive plant material
  - Install early warning systems for weather events

- **Water Supply Disruption:**
  - Install water storage capacity for 7-10 days of operations
  - Implement water recycling and conservation systems
  - Develop contingency plans for alternative water sources
  - Install water quality monitoring and treatment systems
  - Establish backup water delivery arrangements

- **Pest and Disease Management:**
  - Implement strict biosecurity protocols for all incoming materials
  - Establish quarantine procedures for new plant material
  - Develop integrated pest management strategies
  - Train staff in early detection and response procedures
  - Maintain diversity in beneficial organism populations

Risk	Description	Probability	Impact	Risk Level
Equipment Failure	Critical system failures in climate control, irrigation, or laboratory equipment	Medium	High	High
Power Outages	Disruption to electricity supply affecting climate control and irrigation systems	Medium	High	High
Propagation Failure	Low success rates in propagation techniques for key varieties	Medium	High	High
Disease Outbreak	Spread of plant diseases within the nursery environment	Medium	Critical	High
Technical Skill Gaps	Insufficient technical expertise for specialized operations	Medium	Medium	Medium

Table 2.6: Technical and Operational Risk Assessment

Technical and Operational Risk Mitigation

- **Equipment and System Reliability:**
  - Implement preventive maintenance schedules for all critical systems
  - Install redundant systems for critical functions
  - Maintain inventory of essential spare parts
  - Train multiple staff members in equipment operation and troubleshooting
  - Establish service contracts with equipment suppliers
- **Power Supply Security:**
  - Install solar power systems with battery storage
  - Maintain backup generators with automatic switching
  - Develop manual override procedures for critical systems
  - Implement energy-efficient designs to reduce power requirements
  - Establish priority protocols for power allocation during shortages
- **Propagation Success:**
  - Develop and test multiple propagation methods for each species
  - Maintain detailed records of propagation success factors
  - Implement continuous improvement in propagation protocols
  - Establish partnerships with research institutions for technical support
  - Maintain diverse genetic material sources

Risk	Description	Probability	Impact	Risk Level
Budget Overruns	Costs exceeding planned budget for construction or operations	Medium	High	High
Supply Chain Disruptions	Delays or unavailability of critical supplies and materials	Medium	Medium	Medium
Staff Turnover	Loss of key technical staff with specialized knowledge	Medium	High	High
Resource Competition	Competition for resources with other project units	Low	Medium	Low
Funding Delays	Delays in receiving planned funding affecting implementation schedule	Medium	High	High

Table 2.7: Financial and Resource Risk Assessment

Financial and Resource Risk Mitigation

- **Budget Management:**
  - Implement phased development approach with clear milestones
  - Maintain contingency reserves (15% of total budget)
  - Conduct regular budget reviews and forecasting
  - Develop cost-sharing arrangements with other project units
  - Identify potential areas for cost reduction if needed
- **Supply Chain Security:**
  - Develop relationships with multiple suppliers for critical items
  - Maintain inventory of essential supplies for 3-6 months
  - Identify local alternatives for imported materials where possible
  - Implement just-in-time inventory management for non-critical items
  - Develop capacity to produce certain supplies internally
- **Human Resource Management:**
  - Implement competitive compensation and benefits packages
  - Develop career advancement opportunities for technical staff
  - Establish knowledge management systems to capture expertise
  - Implement cross-training programs for critical functions
  - Develop partnerships with educational institutions for talent pipeline

Risk	Description	Probability	Impact	Risk Level
Demand Fluctuations	Changes in demand for specific varieties or quantities	Medium	Medium	Medium
Quality Standards Changes	Evolution of quality requirements from cultivation units	Low	Medium	Low
Competitive Pressure	Competition from other nurseries or propagation facilities	Low	Medium	Low
Genetic Material Access	Difficulties accessing high-quality genetic material for propagation	Medium	High	High
Regulatory Changes	Changes in regulations affecting propagation or plant movement	Low	High	Medium

Table 2.8: Market and Strategic Risk Assessment

Market and Strategic Risk Mitigation

- **Demand Management:**
  - Implement flexible production planning systems
  - Develop diverse product portfolio beyond core varieties
  - Establish regular communication channels with cultivation units
  - Conduct market research for external sales opportunities
  - Develop capacity to adjust production volumes based on demand
- **Quality Assurance:**
  - Implement comprehensive quality management system
  - Develop clear quality standards and certification procedures
  - Establish regular quality review meetings with cultivation units
  - Implement traceability systems for all plant material
  - Develop capacity for continuous quality improvement
- **Genetic Resource Management:**
  - Establish genetic preservation program for key varieties
  - Develop relationships with multiple genetic material suppliers
  - Implement proper documentation and intellectual property management
  - Participate in genetic resource exchange networks
  - Develop capacity for in-house variety improvement

2.6.4 Contingency Planning

Emergency Response Procedures

- **Environmental Emergencies:**
  - Severe weather response protocol
  - Water contamination response plan
  - Pest and disease outbreak containment procedures
  - Environmental contamination management
- **Technical Emergencies:**
  - Power failure response protocol
  - Climate control system failure procedures
  - Irrigation system failure management
  - Laboratory contamination response
- **Operational Emergencies:**
  - Staff shortage management plan
  - Supply shortage response procedures
  - Communication failure protocols
  - Facility damage response plan

Business Continuity Planning

- **Critical Function Identification:**
  - Prioritization of plant material based on value and vulnerability
  - Identification of minimum viable operations
  - Critical staff and skill requirements
  - Essential resource requirements
- **Recovery Strategies:**
  - Temporary facility arrangements
  - Alternative propagation methods
  - External sourcing contingencies
  - Phased recovery planning
- **Communication Plan:**
  - Emergency contact procedures
  - Stakeholder notification protocols
  - Media communication guidelines
  - Internal information sharing procedures

2.6.5 Risk Monitoring and Control

Risk Monitoring Procedures

- Regular risk assessment reviews (quarterly)
- Key risk indicator monitoring and reporting
- Integration of risk monitoring with quality management system
- Staff reporting mechanisms for risk identification
- External environment scanning for emerging risks

Risk Response Evaluation

- Post-incident analysis procedures
- Effectiveness assessment of risk responses
- Lessons learned documentation and sharing
- Risk response strategy updates based on outcomes
- Continuous improvement in risk management practices

Risk Management Responsibilities

- Nursery Manager: Overall risk management responsibility
- Technical Supervisor: Technical and operational risk monitoring
- Research Coordinator: Research and development risk management
- All Staff: Risk identification and reporting
- Project Management Office: Risk oversight and integration

2.6.6 Opportunity Management

Opportunity Identification

- **Technical Innovation:**
  - Advanced propagation techniques development
  - Climate control optimization research
  - Growing media formulation improvements
  - Automation and efficiency enhancements
- **Market Development:**
  - Specialized variety development
  - External market expansion
  - Value-added service offerings

  - Knowledge transfer and training programs

- **Operational Excellence:**
  - Resource efficiency improvements
  - Quality certification achievements
  - Staff development and specialization
  - Process optimization and standardization

Opportunity Exploitation Strategies

- Research and development investment planning
- Strategic partnership development
- Staff innovation incentive programs
- Knowledge sharing and collaboration platforms
- Continuous improvement culture development

This risk management plan provides a comprehensive framework for identifying, assessing, and responding to risks that could affect the nursery unit's success. By implementing these strategies, the nursery unit will be better positioned to navigate challenges and capitalize on opportunities, ensuring its vital role in supporting the olive and date palm cultivation units within the El Tor Circular Economy project.

2.7 Sustainability Plan

2.7.1 Environmental Sustainability

The nursery unit is designed with environmental sustainability as a core principle. Our approach includes:

- **Water Conservation:** Implementation of drip irrigation systems, rainwater harvesting, and water recycling to minimize water usage.
- **Renewable Energy:** Solar panels provide energy for greenhouse climate control, irrigation systems, and lighting.
- **Waste Reduction:** Composting of plant waste, recycling of containers, and minimization of plastic usage.
- **Biodiversity Support:** Maintenance of native plant species and creation of habitat areas for beneficial insects and pollinators.

2.7.2 Economic Sustainability

To ensure long-term economic viability, the nursery implements:

- **Diversified Revenue Streams:** Multiple product lines including seedlings, saplings, ornamentals, and specialty crops.
- **Value-Added Products:** Development of premium products with higher margins, such as rare native species and pre-established polyculture sets.
- **Cost Optimization:** Efficient resource use, bulk purchasing, and strategic partnerships to reduce operational costs.
- **Market Adaptability:** Regular market research and flexible production planning to adapt to changing market demands.

2.7.3 Social Sustainability

The nursery contributes to social sustainability through:

- **Local Employment:** Prioritizing hiring from local communities and providing fair wages and benefits.
- **Knowledge Transfer:** Educational programs for local farmers, schools, and community members.
- **Cultural Preservation:** Propagation of culturally significant plant species and documentation of traditional knowledge.
- **Community Engagement:** Regular open days, workshops, and collaborative projects with community organizations.

2.7.4 Long-term Sustainability Metrics

The nursery will track the following key performance indicators to measure sustainability:

- Water usage per plant produced
- Energy consumption and percentage from renewable sources
- Waste generation and percentage recycled/composted
- Biodiversity index within the nursery grounds
- Economic indicators: profit margins, return on investment, market share
- Social impact: number of jobs created, training hours provided, community engagement events

2.7.5 Continuous Improvement

A sustainability committee will meet quarterly to review performance metrics, identify improvement opportunities, and update the sustainability plan. Annual sustainability audits will be conducted to ensure compliance with best practices and identify areas for innovation.

2.8 Integration Plan for Nursery Unit

2.8.1 Integration Overview

The nursery unit serves as a critical nexus within the El Tor Circular Economy project, providing essential planting material to the olive and date palm cultivation units while receiving inputs from and providing outputs to multiple other units. This integration plan outlines how the nursery unit connects with other components of the circular economy system, maximizing resource efficiency, minimizing waste, and creating synergistic relationships that enhance overall project sustainability.

2.8.2 Input Integration

Water Management Unit Integration

- **Treated Water Supply:**
  - Receive filtered and treated water from the water management unit
  - Implement precision irrigation systems calibrated to water quality parameters
  - Monitor water quality metrics for optimal plant development
  - Provide feedback on water quality requirements for different propagation stages
- **Water Conservation Measures:**
  - Implement water recirculation systems for greenhouse operations
  - Capture and reuse condensation from climate control systems
  - Install water-efficient misting and irrigation technologies
  - Share water usage data for system-wide optimization

Organic Waste Management Integration

- **Compost and Vermicompost Inputs:**
  - Receive processed compost and vermicompost for growing media
  - Utilize specialized compost blends for different plant varieties
  - Implement quality control testing for incoming organic materials
  - Provide feedback on compost performance for different plant types
- **Biochar Integration:**
  - Incorporate biochar from the pyrolysis unit into growing media
  - Test optimal biochar ratios for different plant varieties
  - Document improved water retention and nutrient availability
  - Develop specialized biochar-enhanced media formulations

Renewable Energy Integration

- **Solar Energy Utilization:**
  - Power greenhouse climate control systems with solar energy
  - Implement energy-efficient LED growing lights
  - Utilize solar-powered irrigation pumps and automation systems
  - Monitor energy consumption patterns for optimization
- **Energy Conservation:**
  - Design greenhouse structures for optimal thermal efficiency
  - Implement automated energy management systems
  - Schedule energy-intensive operations during peak solar production
  - Develop energy storage solutions for continuous operations

2.8.3 Output Integration

Olive Cultivation Unit Integration

- **Seedling Supply:**
  - Provide high-quality olive seedlings according to cultivation schedule
  - Customize variety selection based on cultivation unit requirements
  - Implement quality certification for all supplied seedlings
  - Coordinate delivery timing with planting schedules
- **Technical Support:**
  - Provide planting and early care guidelines
  - Offer troubleshooting support for transplantation issues
  - Conduct follow-up assessments of seedling performance
  - Collect feedback for continuous improvement

Date Palm Cultivation Unit Integration

- **Offshoot and Tissue Culture Plant Supply:**
  - Provide certified date palm offshoots and tissue culture plants
  - Ensure genetic authenticity and disease-free status
  - Coordinate supply timing with cultivation unit expansion plans
  - Implement tracking system for variety performance
- **Specialized Support:**
  - Develop custom handling protocols for sensitive varieties
  - Provide technical training for transplantation techniques
  - Offer ongoing consultation for establishment phase
  - Collect performance data for research purposes

Research and Knowledge Integration

- **Research Outputs:**
  - Share propagation research findings with all cultivation units
  - Develop improved protocols based on field performance data
  - Document variety-specific characteristics and requirements
  - Create educational materials for training programs
- **Knowledge Transfer:**
  - Conduct training workshops for project staff
  - Host demonstration sessions for visiting stakeholders
  - Develop educational programs for local farmers
  - Create digital knowledge repository for best practices

2.8.4 Circular Material Flows

Waste Stream Integration

- **Organic Waste Management:**
  - Direct plant trimmings and discarded material to composting unit
  - Separate and categorize waste streams for optimal processing
  - Implement waste reduction protocols in all operations
  - Track waste volumes and types for system optimization
- **Container and Material Recycling:**
  - Implement reusable container systems for seedling production
  - Recycle growing media when possible
  - Repurpose packaging materials within the project
  - Develop biodegradable alternatives for single-use items

Nutrient Cycling

- **Nutrient Recovery:**
  - Capture and reuse nutrient-rich water from irrigation runoff
  - Implement precision fertigation systems to minimize waste
  - Monitor nutrient levels in all growing systems
  - Adjust nutrient formulations based on plant performance
- **Biological Integration:**
  - Incorporate beneficial microorganisms in growing media
  - Implement mycorrhizal fungi applications for improved nutrient uptake
  - Develop plant-specific biological enhancement protocols
  - Document biological interactions for research purposes

2.8.5 Integration Management

Coordination Mechanisms

- **Planning and Scheduling:**
  - Implement integrated production planning with cultivation units
  - Coordinate resource requirements with input-providing units
  - Develop long-term forecasting for capacity planning
  - Maintain flexible scheduling to accommodate system changes
- **Communication Protocols:**
  - Establish regular coordination meetings with connected units
  - Implement digital tracking system for material flows
  - Develop standardized reporting formats for integration metrics
  - Create feedback mechanisms for continuous improvement

Performance Monitoring

- **Integration Metrics:**
  - Track material flow volumes between units
  - Monitor quality parameters of inputs and outputs
  - Measure resource efficiency improvements
  - Evaluate system resilience during disruptions
- **Continuous Improvement:**
  - Conduct regular integration performance reviews
  - Identify bottlenecks and optimization opportunities
  - Implement adaptive management approaches
  - Document best practices and lessons learned

2.8.6 Phased Integration Implementation

Phase 1: Basic Integration (2026-2027)

- Establish fundamental connections with water management and energy systems
- Implement basic waste stream separation and recycling
- Develop initial supply relationships with cultivation units
- Create baseline integration metrics and monitoring systems

Phase 2: Enhanced Integration (2027-2028)

- Implement advanced nutrient cycling systems
- Develop specialized growing media using project-produced inputs
- Expand knowledge transfer and research integration
- Optimize resource flows based on first-year performance data

Phase 3: Full Circular Integration (2028-2029)

- Achieve near-zero waste operations through complete material cycling
- Implement advanced biological integration throughout growing systems
- Establish comprehensive data sharing across all project units
- Develop demonstration capabilities for circular economy principles

This integration plan establishes the nursery unit as a vital connector within the El Tor Circular Economy project, creating synergistic relationships that enhance resource efficiency, minimize environmental impact, and maximize the overall sustainability of the system.

Chapter 3

Azolla Farming

3.1 Azolla Farming Overview

3.1.1 Introduction to Azolla

Azolla is a unique aquatic fern that forms a symbiotic relationship with the nitrogen-fixing cyanobacterium *Anabaena azollae*. This remarkable plant has been used for centuries in traditional rice farming systems across Asia, but its potential extends far beyond conventional applications. In the El Tor Circular Economy, Azolla serves as a cornerstone for multiple integrated processes.

3.1.2 Biological Characteristics

Azolla possesses several exceptional characteristics that make it ideal for the El Tor Circular Economy:

- **Rapid Growth Rate:** Under optimal conditions, Azolla can double its biomass in 3-5 days, making it one of the fastest-growing plants on Earth.
- **Nitrogen Fixation:** Through its symbiotic relationship with cyanobacteria, Azolla can fix atmospheric nitrogen at rates of up to 1.1 kg N/ha/day.
- **Adaptability:** Azolla can thrive in a wide range of water conditions, including treated wastewater and brackish water with appropriate management.
- **Minimal Requirements:** The plant requires minimal inputs, thriving with basic nutrients, sunlight, and water.

3.1.3 Productivity and Yield Estimates

Based on experimental trials and literature review, we project the following productivity metrics for the El Tor Azolla farming system:

- **Fresh Biomass Yield:** Up to 37.8 tons per hectare per growth cycle (approximately 20-25 days).
- **Annual Production Cycles:** 12-15 cycles per year in the El Tor climate, with appropriate management.

- **Annual Fresh Biomass:** Approximately 450-560 tons per hectare per year.
- **Dry Matter Content:** 5-8% of fresh weight, yielding 22-45 tons of dry biomass per hectare annually.
- **Oil Content:** 5-10% of dry weight, providing 1.1-4.5 tons of extractable oil per hectare per year.

3.1.4 Multi-Functional Applications

The Azolla produced in the El Tor system serves multiple functions within the circular economy:

Biodiesel Production

Azolla biomass serves as a primary feedstock for biodiesel production:

- **Oil Extraction:** The lipid content of dried Azolla (5-10%) can be extracted and processed into biodiesel.
- **Fermentation Potential:** Carbohydrates in Azolla can be fermented to produce bioethanol, which serves as a reactant in the transesterification process.
- **Projected Yield:** Approximately 60-70 tons of biodiesel annually from the planned cultivation area.

Livestock Feed

Azolla provides high-quality protein for various livestock:

- **Protein Content:** 19-30% crude protein on a dry weight basis.
- **Amino Acid Profile:** Rich in essential amino acids, particularly lysine.
- **Application:** Particularly valuable for poultry, fish, and ducks in the integrated farming system.
- **Feed Conversion:** Studies show improved growth rates and reduced feed costs when Azolla supplements conventional feeds.

Soil Amendment

Azolla contributes to soil health and fertility:

- **Green Manure:** Fresh or composted Azolla provides slow-release nitrogen and organic matter to soils.
- **Nitrogen Contribution:** Can provide 60-100 kg N/ha when incorporated as green manure.
- **Soil Structure:** Improves soil structure, water retention, and microbial activity.

3.1.5 Integration with Other Units

The Azolla farming unit is strategically integrated with other components of the El Tor Circular Economy:

- **Water Source:** Utilizes treated greywater and nutrient-rich water from the livestock unit.
- **CO_2 Utilization:** Captures CO_2 from the biodiesel production process, enhancing growth rates.
- **Outputs:** Provides biomass to biodiesel production, livestock feed to the animal units, and green manure to cultivation units.

3.1.6 Environmental Benefits

Beyond its productive applications, Azolla farming delivers significant environmental benefits:

- **Carbon Sequestration:** Rapid growth rates enable substantial carbon capture.
- **Water Treatment:** Azolla can help remediate nutrient-rich wastewater by absorbing excess nutrients.
- **Biodiversity:** Azolla ponds create habitat for beneficial insects and microorganisms.
- **Reduced Emissions:** Displaces fossil fuels and chemical fertilizers, reducing greenhouse gas emissions.

3.1.7 Strategic Importance

Azolla farming is strategically aligned with Egypt's Vision 2030 and the Sustainable Energy Strategy for 2035, focusing on renewable energy and emission reduction. The project contributes to these goals by providing a renewable, low-emission fuel source and potential participation in carbon credit mechanisms.

3.1.8 Project Details

The project spans approximately 100 hectares in the El Tor area of Sinai, with 25

3.1.9 Economic and Environmental Impact

The Azolla project aims to reduce reliance on fossil fuel imports, enhance energy independence, and provide sustainable local energy solutions. It also highlights Azolla as a national resource with untapped potential for agricultural and industrial development.

3.1.10 Integration with National Policies

The project aligns with national strategies to increase the share of renewable and non-conventional sources in the energy mix, supporting Egypt's commitments under the Paris Agreement and national greenhouse gas reduction plans.

3.2 Strategic Plan for Azolla Farming

3.2.1 Phased Implementation (2026-2031)

Phase 1 (2026-2027)

- **Area:** 3 Feddans pilot Azolla pond system
- **Infrastructure:** Basic pond construction, water supply system
- **Production Target:** 20-25 tons fresh biomass monthly
- **Integration:** Small-scale feed trials with initial livestock units

Phase 2 (2027-2028)

- **Area:** Expansion to 10 Feddans
- **Infrastructure:** Enhanced processing facility, storage systems
- **Production Target:** 70-80 tons fresh biomass monthly
- **Integration:** Regular feed supply to expanded livestock operations

Phase 3 (2028-2029)

- **Area:** Growth to 20 Feddans
- **Infrastructure:** Advanced processing units, biorefinery setup
- **Production Target:** 140-160 tons fresh biomass monthly
- **Integration:** Full-scale biodiesel feedstock production

Phase 4 (2029-2030)

- **Area:** Expansion to 35 Feddans
- **Infrastructure:** Complete processing and storage facilities
- **Production Target:** 245-280 tons fresh biomass monthly
- **Integration:** Maximum capacity biodiesel and feed production

Phase 5 (2030-2031)

- **Area:** Final expansion to 50 Feddans
- **Infrastructure:** Optimization of all systems
- **Production Target:** 350-400 tons fresh biomass monthly
- **Integration:** Full integration with all circular economy units

٣.٣ الخطة الاستراتيجية لزراعة الأزولا

١.٣.٣ التنفيذ المرحلي (٢٠٢٦-٢٠٣١)

المرحلة الأولى (٢٠٢٦-٢٠٢٧)

- **المساحة**: ٣ فدادين نظام برك أزولا تجريبي
- **البنية التحتية**: إنشاء البرك الأساسية، نظام إمداد المياه
- **هدف الإنتاج**: ٢٠-٢٥ طن كتلة حيوية طازجة شهرياً
- **التكامل**: تجارب تغذية على نطاق صغير مع وحدات الثروة الحيوانية الأولية

المرحلة الثانية (٢٠٢٧-٢٠٢٨)

- **المساحة**: التوسع إلى ١٠ فدادين
- **البنية التحتية**: مرفق معالجة محسن، أنظمة تخزين
- **هدف الإنتاج**: ٧٠-٨٠ طن كتلة حيوية طازجة شهرياً
- **التكامل**: إمداد منتظم للعلف لعمليات الثروة الحيوانية الموسعة

المرحلة الثالثة (٢٠٢٨-٢٠٢٩)

- **المساحة**: النمو إلى ٢٠ فدان
- **البنية التحتية**: وحدات معالجة متقدمة، إعداد المصفاة الحيوية
- **هدف الإنتاج**: ٤١٠-٦١٠ طن كتلة حيوية طازجة شهرياً
- **التكامل**: إنتاج المواد الأولية للديزل الحيوي بكامل طاقتها

المرحلة الرابعة (٢٠٢٩-٢٠٣٠)

- **المساحة**: التوسع إلى ٥٣ فدان
- **البنية التحتية**: مرافق معالجة وتخزين كاملة
- **هدف الإنتاج**: ٥٤٢-٨٢٠ طن كتلة حيوية طازجة شهرياً
- **التكامل**: إنتاج الديزل الحيوي والعلف بالسعة القصوى

المرحلة الخامسة (٢٠٣٠-٢٠٣٢)

- **المساحة**: التوسع النهائي إلى ٥٠ فدان
- **البنية التحتية**: تحسين جميع الأنظمة
- **هدف الإنتاج**: ٤٠٠-٥٣٠ طن كتلة حيوية طازجة شهرياً
- **التكامل**: التكامل الكامل مع جميع وحدات الاقتصاد الدائري

٢.٣.٣ طِسِن َند شِسسِن

طِسِن

ة ستَبلِسه زل ةر َس َ لَدِذ نتر فر سُستَنَبد ازلَ ُلتَتِن َند بِفُل ردُتِن ِن زيت، نترِبُتِذ ت نَتِنَل ذري ِندندذ َند نِرنمنتل سُستَنبِلِتي.

شِسسِن

ة دل َند مِلمنت َن ِنترَتد ازلَ فَرمِذ سيسِتم تهَت ِردُس رذوَبلِ بِفُل، نهَنس فد سُرِتي تهرُه لِستك فدَ ردُتِن، ند ِمرس سِل هلته َوهِل رتِذ ذمِ رتُنِتِس فر ته لل ممنِتي.

٣.٣.٣ ضترَتِ صبدِتس

(١). **زستَبلِسه رِممرَل-ضَا ازلَ صرِدُتِن**: ل ٥٢ هتَرس ف ازلَ ُلتَتِن ندس وِته تِمَل روِذ ندِتِنس ت هِ ترت بِمسس بِلدس.

(٢). **يمِلمنتِ فُل صرِدُتِن**: زستَبلِسه بِـرفِنرِس َبد ف رسسِذ ازلَ بِمَسس ِنت ٠٦-٠٧ تنس ف بِدِسل ننللي.

(٣). **ل ِررُلَر زذمي ينترَتِن**: ررَت سَملسس رسُر فلوس بتون ازلَ فَرمِذ َند تهر َرُلتُرَل َند ِندسترِل تِتِس.

(٤). **اهِ رَربِن ُترَلِتي**: يمِلمنت َربن سقُسترَتِن رَتِس ت ففست َلل رَتِنَل مِسسِنس َند ذرَت َربن ردِتس.

(٥). **ُلد شَل رَتي**: ةرَن لَل وركفر ِن ازلَ ُلتَتِن، رسسِذ، َند ِنترَتد فَرمِذ تهنقُس.

٤.٣.٣ الِنمنت وِته َتِنَل ضترَتِس

ةه ازلَ فَرمِذ سترَتِ لَن درتلي سُرتس:

- **زيت'س طِسِن ٠٣٠٢**: رنترِبُتِذ ت سُستَنَبد دلمنت َلس، َرتُلَرلي ِن ذري، َرُلتُر، َند نِرنمنت سترس.
- **ضُستَنَبا زذري ضترَتي ٥٣٠٢**: ضُرتِذ ته تَرت ف ِنرَسِذ رذوَبد ذري'س سهَر ِن ته نَتِنَل ذري مِس.
- **َتِنَل رلِمَت رهَذ ضترَتي**: ادَنذ َربن سقُسترَتِن َند مِسسِن ردُتِن بتِس.
- **ارُلتُرَل لمنت ضترَتي**: صرِمتِذ ننَتِ فَرمِذ تهنقُس َند رسُر ففِذي.

٥.٣.٣ ضترَتِ صسِتِنِ

شَركت صسِتِنِ

ةه زل ةر ازللَ رت وِلل سِتِن تسلف َس:

- ا ِذر ِن سُستِنَبل بِفُل ردُتِن فرم ذن-فد رس ِن زيت
- ا ِردر ف هِه-قُلِتي، رتِن-ره لِستك فد سُلمنتس
- ا سُر ف رَذ سِل َمندمنتس فر سُستِنَبل َرُلتُر
- ا مدل فر ِرُلَر ذمي ِملمنتَتِن ِن َرد رِنس

رمتِتِ ادَنتَس

ةه رت لرَس سرَل ُنقُ َدَنتَس:

- **ضسُر زفِفِذي**: ازللاَس مِنِمَل ِنُت رقُرمنتس َند رِد روته رَت
- **شُلتِ-فُنتِنَلتي**: ِرس رذُ سترَمس فرم َ سِندلُ لتَتِن سيستم
- **ررُلَر ينترَتِن**: ضينرِستِ رلَتِنسهِس وِته تهر َرُلتُرَل َتِتِس
- **رلِمَت ذفِتس**: رَربن سقُسترَتِن تنتَل َند ردُد مِسسِنس
- **طَتر زفِفِذي**: ابِلِتي تُ تِلِز ترَتد وَستوَتر َند ريل نُترِنتس

٦.٣.٣ ضترَتِ صَرتنرسهِس

شي سترَتِ َرتنرسهِس وِلل ب دلد وِته:

- **ضسَره ينستِتُتِنس**: سر نِذ ض& ِن ازللَ ُلتَتِن َند رسسِند
- **رنمنت اذِس**: سر رُلَتري سُرت َند َلنمنت وِته نَتِنَل ِنتَتِس
- **ارُلتُرَل ررَتِس**: سر دِسترِبُتِن ف فد َند سِل َمندمنت ردُتس
- **زذري رمَذِس**: سر بِدِسل دِسترِبُتِن َند بلندِذ
- **رَربن شَركت سِلِتَترس**: سر َربن ردت رتِفَتِن َند ترَدِذ

٧.٣.٣ ضُسس شتِرس

ةه سترَتِ لَن وِلل ب َلُتد بَسد ن:

- **صرذُتِن شتِرس**: ِمَسس بِلد ر هتَر، بِدِسل ُتُت، فد ردُتِن
- **سِنَنَل شتِرس**: ضذُ روته، رفت مَرِنس، رتُرن ن ِنستمنت
- **زنِرنمنتَل شتِرس**: رَربن سقُسترَتِن، وَتر ففِذي، بِدِرسِتي ِمَت
- **ضَل شتِرس**: شب رَتِن، سكِللس دلمنت، ممُنِتي ذَمنت
- **ينترَتِن شتِرس**: ضسُر فلو ففِذي، ِرُلَر ذمي ِملمنتَتِن

٤.٣ ازلاَ سَرمِذ صرَتِنَل صلَن

١.٤.٣ رُلتَتِن ضيستم سِن

صند ينفرَسترُثر

- **صند ضِز:** ضتَندَرد ُلتِتِن ندس ف ٥٠م س ٢٠م (١.٠ هتَر َه)
- **صند ته:** ٠٣-٠٤م تِمَل وَتر دته فر ازلاَ روته
- **شِنِذ:** سصز لِنرس ت رنت وَتر سَند نُترِنت لسس
- **ضهَدِذ:** صَرتَل سهَد سترُتُرس (٠٣٪ رَ) فر سُممر تمرَتُر مَنَمنت
- **طَتر رِرُلَتِن:** ش‌و-ذري َددلوهل سيستمس فر نتل وَتر ممنت
- **سَرستِذ اسس:** سِذد فر َسي مهنَل هَرستِذ فرم ند دس

طَتر شَنَهنت ضيستم

- **طَتر ضُرس:** صرِمَري ُس ف ترَتد ريوَتر َند لِستك ُنت ففلُنت
- **سِلترَتِن:** شُلتِستَ فِلترَتِن ت رم سلِدس َند َدُست نُترِنت للس
- **رِرُلَتِن:** رلسد-ل وَتر ريلِذ بتون ندس َند ترَتمنت سيستمس
- **شِنترِذ:** اُتمَتد سنسرس فر س، دسسلد سين، َند نُترِنت للس
- **ارَتِن:** ضلَر-ورد رَتِن سيستمس فر سين مَنتنَذ
- **طَتر رنسرَتِن:** زَرَتِن ردُتِن تهنِقُس َند رِنوَتر هَرستِذ

٢.٤.٣ رُلتَتِن صرتلس

ضترِن ضلتِن َند شَنَهنت

- **صرِمَري ضترِنس:** ازلاَ فِلُلِدس َند ازلاَ ننَتَ سلتد فر لَل ندتِنس
- **ضترِن ضتَتِن:** ضَسنَل رتَتِن بَسد ن تمرَتُر تلرَذ
- **ينُلَتِن:** ينتِل ستكِذ دنستي ف ٠٠٤-٠٠٥ فرسه وِهت ر سقُر متر
- **ضترِن صرسرَتِن:** شِنتنَذ ف ُر سترِن ستك ِن نترلد ندتِنس
- **نتِرستي:** رُلتَتِن ف مُلتِد سترِنس ت نهَذ رسِلِذ

روته رندِتنس شنَەنت

- **ُترِنت شنَەنت**: ضُلمنتَتِن وِته هسهرُس (لِمِتِند نُترِنت) َس ندد
- **س رنترل**: شِنَتَند بتون ٥.٥ َند ٠.٧ فر تِمَل روته
- **ةمرَثر شنَەنت**: ضَسنَل َدُستمنتس ت وَتر دته َند سهَدِذ
- **صست شنَەنت**: ينترَتد ست مَنَمنت وِته بِلَل نترلس
- **رص$_2$ زنرهەنت**: ِرتد َتُر فرم بِدِسل ردُتِن ُنت

٣.٤.٣ سَرستِنَند صرسسِن

سَرستِن ضيستم

- **سَرستِن سرڤذي**: ٣-٤ دَي يلس، رمِن ٠٣-٠٤٪ ف ند رَ َه تِم
- **سَرستِن شتهد**: ضُرفَ سكِممِن وِته نير بلت سيستمس
- **ةمِن**: زَرلي مرِنِد هَرستِن ت مَسِمِز دري مَتتر َند مِنمِز سترسس
- **ضرتِن**: ضَرَتِن ف رمُم قُلتي بِمَسس فر دِففرنت لَتِنس
- **ةرَنسرت**: شِنِمَل هَندلِن ت ردُ دمَ َند نُترِنت لسس

صست-سَرست صرسسِن

- **رين**: ضلَر دريِن ن مسه سُرفَس فر فد َند بِفُل لَتِنس
- **سرسه سَندلِن**: ِرت لَتِن رتلس فر رن مَنُر ُس
- **ضترَ**: رلِمَت-نترللد سترَ فر درِد ازللَ ردُتس
- **صُلتي رنترل**: ضُلَر تستِن فر نُترِنت نتنت َند نتَمِنَنتس
- **صَكَن**: اررَتَ كَن فر دِففرنت ند ُسس

٤.٤.٣ ِدِسل صرد ُتِن ينترَتِن

ِمَسس صررَتِن

- **رين**: ضددُتِن ت ٠١-٢١٪ مِستُر نتنت
- **رِندِذ**: ضِز ردُتِن ت ِنرَس سُرفَ َرَ فر سترَتِن
- **ضرنِن**: ضمَل ف نتَمِنَنتس َند ستَندَردِزَتِن ف َرتِل سِز

صِل زسترَتِن صرسس

- **زسترَتِن شتهد**: شهنَل رسسِن فللود بي سلنت سترَتِن
- **ضلنت ضري**: رلسدـل سلنت ريلِن سيستم
- **صِل صُرِفَتِن**: سلترَتِن نَد دُممِن رسسس
- **يِلد صتِمزَتِن**: صرسس دُستمنتس بَسد ن بِمَسس هَرَترِستِس

ةرَنسسترِفَتِن

- **رَتَليست**: الكَلـتَليزد رسس سُن تَسسُم هيدرسِد
- **الهل**: شتهَنل وِته رَتَل سُبستتُتِن ف بِتهَنل فرم ازللَربهيدرَتس
- **صرسس رنترل**: ةمرَتُر نَد رَتِن تم تِمزَتِن
- **ليرل ضري**: ضَرَتِن نَد رُفَتِن فر لِستك فد دِدتِ

٥.٤.٣ سد صرِدُتِن ينترَتِن

سد سرمُلَتِن

- **رين شتهد**: شوـتمرَتُر درِند ت رسر رتِن قُلِتي
- **صرسسِن**: رندِنَد مسِن وِته تهر فد نردنتس
- **ضُلهنتَتِن**: ادِدتِن ف مِنرَلس سَ ندد فر بَلَند نُترِتِن
- **صُلِتي ةستِن**: ضُلَر نَليسِس ف نُترِتِنَل نتنت نَد سَفتي

سد الَتِن صرتلس

- **صُلتري**: ٥ـ٠١٪ نلُسِن ن لَير نَد برلر دِتس
- **سسه**: ٥١ـ٠٢٪ نلُسِن ن تلَ نَد تَفسه فدس
- **ضُمِنَنتس**: سرسه ر درِد سُلهنتَتِن ت ٢ـ٣٪ ف دِت
- **سدِذ ةرِلس**: صنِن تِمزَتِن ف نلُسِن رَتس

٦.٤.٣ ضِل اهندهنت ينترَتِن

رن شَنُر الَتِن

- **سرسه الَتِن**: رت نررَتِن نت سِل بفر لَنتِن
- **رهستِن**: رـهستِن وِته تهر رَنِ مَترِلس
- **الَتِن ضَتس**: ٢ـ٣ تنس فرسه وِهت ر هتَر
- **ةمِن**: الَتِن ٢ـ٣ وكس بفر لَنتِن

شِڤْد سرتِلزر صرڈتِن

- **زسترَتِن**: ضتِنڈ ف فرسه ازللَ ِن وَتر فر نُترِنت رلَس
- **سرەنتَتِن**: رنترللد مِربِل فرمنتَتِن ت نهَذ نُترِنت لَبِلِتي
- **الَتِن**: سلَر سرَي ر درِ ررِتِن لَتِن
- **لُتِن ضَتس**: ٠١:١ دلُتِن فر مست لَتِنس

٧.٤.٣ صرَتِنَل ضهدُل

لِي صرَتِنس

- **ضيستم شِنترِز**: طَتر قُلِتي، روته رَتَ ِند هَلته هكس
- **سَرستِنِ**: ضتَتِنَل هَرستِنڈ ف دسِنَتد ندس
- **صرسسِنِ**: رنتِنُس رَتِن ف دريِنَ ند رسسِنِ فِلِتِس
- **شِنتنَ**: ضُلَر قِمنت هكس َند لَنِن

طكلي صرَتِنس

- **طَتر زسهَنِ**: صَرتَل وَتر رلَمنت َند نُترِنت َدُستمنت
- **صُلِتي ةستِنِ**: ضَملِنَ ند َنَليسِس ف ازللَ بِمَسس
- **ضترَن شَنَەنت**: زلَتِن َند َدُستمنت ف سترَن رفرمَنِ
- **زڤْەنت شَنتنَ**: صرنتِ مَنتنَ ند ف َلل سيستمس

ضَسنَل صرَتِنس

- **ضُممر شَنَەنت**: زنهَند سهَدِ َند وَتر دته َدُستمنتس
- **طِنتر شَنَەنت**: رنهُس رِڈ فر سلتد ندس
- **ضترَن ضتَتِن**: ضَسنَل هَنس ِن دمنَنت لُتَتِن سترَنس
- **ضيستم رلَنِن**: رملتد ند درِنَ ند لَنِ َنُللي

٨.٤.٣ صُلِتي رنترل ضيستم

مَسس صُلِتي صرَەترس

- **روته ضَتِ**: شِنترِڈ ف دُبلِڈ تِم َند ردُتِتي
- **ُترِنت رنتنت**: ضُلَر َنَليسِس ف رتِن، لِد، َند مِنرَل نتنت

- **رنتَمِنَتِن:** ةستِنـ فر هَي متَلس، ستِدس، نَد تَهنس
- **ضترَن صُرتي:** طِسلُ نَد مِرسِ سَمِنَتِن فر سترَن رِفَتِن

صرذُت صُلِتي ضتَندَردس

- **دِسل:** رملَذ وِته ز ٤١٢٤١ نَد اضةش ١٥٧٦ ستَندَردس
- **انمَل سد:** ادهرذ ت نُترِتنَل نَد سَفتي ستَندَردس فر فدِنردِنتس
- **ضِل امندمنتس:** ةستِنـ فر نُترِنت نتنت نَد نتَمِنَنت للس
- **ُمنتَتِن:** رمرهنسِ ررد-كِذ فر ترَبِلِتي

٩.٤.٣ ضتَففِنَ نَد ةرَنِنـ

رر ضتَفف ضةِرمنتس

- **رُلتَتِن ضَلِستس:** ٣-٤ تهنَنس ترَندِن ازلاَ مَنَمنت
- **صرسسِنـ صرَترس:** ٤-٥ ستَفف فر هَرستِنَ نَد رسسِنـ رَتِنس
- **شَبرَتري ةهنَنس:** ١-٢ ستَفف فر قُلِتي نترل نَد تستِنـ
- **شَنتَنَذ صرسننل:** ٢-٣ ستَفف فر سيستم مَنتَنَنَ نَد رَرس
- **شَنَمنت:** صرَتِنس مَنَر نَد دمِنستر تِ سُرت

ةرَنِنـ صررَم

- **ينتَل ةرَنِنـ:** رمرهنسِ ترَنِندِن لَل سَتس ف ازلاَ ُلتَتِن
- **صنِنـ زدُتِن:** ضُلَر ُدَتس ن تهنِقُس نَد تهنلِس
- **ررسس-ةرَنِنـ:** ضتَفف رتَتِن تهرُه دِففرنت رَتِنَل رَس
- **ضَفتي ةرَنِنـ:** ضُلَر سَفتي نَد مرذي رسنسـ ترَنِنـ
- **ُمنتَتِن:** لمنت ف دتِلد رَتِنَل مَنُلس

٥.٣ ازلاَ سَرمِذ سِنَنَل صلَن

١.٥.٣ رَتَل ينستمنت ضةِرمنتس

شَنَد لمنت

- **شَنَد صرَرَتِن:** زص ٢.١ مِللِن (٥٢ هتَرس َت زص ٨٤،٠٠٠\هتَر)
- **اسس ضَدس نَد ينفرَسترُثر:** زص ٠٥٧،٠٠٠

- **رَنَ ضيستمس**: زص ٠٠٠،٠٠٥
- **سنِنَند ضُرتي**: زص ٠٠٠،٠٥٣

صند رنسترُتِن

- **زسَتِنَند رَدِذ**: زص ٥.٢ مِللِن
- **سصز شِنرس**: زص ٥٧.٣ مِللِن (٠٠٠،٠٥٢ م^2َت زص ٥١\م^2)
- **طَتر رنترل ضترُثرس**: زص ٢.١ مِللِن
- **ضهَدِذ ضيستمس**: زص ٠٠٠،٥٧٨

طَتر شنَهنت ضيستمس

- **صُمِنزڤهنت**: زص ٠٠٠،٠٥٦
- **سِلترَتِن ضيستمس**: زص ٠٠٠،٥٢٨
- **طَتر ةرَتهنت**: زص ١.١ مِللِن
- **شنِترِذزڤهنت**: زص ٠٠٠،٥٢٤

صرسسِنسَلِتس

- **سَرستِنزڤهنت**: زص ٨.١ مِللِن
- **رِنسَلِتس**: زص ٢.٢ مِللِن
- **صِلزسترَتِنزڤهنت**: زص ٥.٣ مِللِن
- **ِدسل صرسسِن**: زص ٢.٤ مِللِن
- **ضترَنَند سنَندلِن**: زص ٣.١ مِللِن

ضُرت سَلِتس

- **شَبرَتري َند صُلِتي رنترل**: زص ٠٠٠،٠٥٩
- **صفڤَند ادمِنسترَتِن**: زص ٠٠٠،٠٥٧
- **ضتَففسَلِتس**: زص ٠٠٠،٠٥٥
- **شَنتذَند طركسه**: زص ٠٠٠،٠٥٦

ةتَل رِتَل ينستەنت

- **ةتَل ينِتَل ينستەنت**: زص ٠٣ مِللِن (رسِمَتلي وض ٩.١ مِللِن)
- **رنتِنذي** (٥١٪): زص ٥.٤ مِللِن
- **ةتَل رِتَل ضڤِرەنت**: زص ٥.٤٣ مِللِن

٢.٥.٣ صرَتِنَ رستس

ِرت صرڈُتِن رستس

- **ازلاَ رُلتَتِن**: زص ١.٢ مِللِن َننُللي
  - ضتَرتر رُلتُر: زص ٠٥١،٠٠٠
  - ُترِنتس: زص ٠٥٤،٠٠٠
  - طتَر ةرَتمنت: زص ٠٠٦،٠٠٠
  - زذري فر صُمِن: زص ٠٥٣،٠٠٠
  - شِنَتنَن شَترِلس: زص ٠٥٥،٠٠٠
- **سَرستِنَ ند صرسسِن**: زص ٨.١ مِللِن َننُللي
  - شَبر: زص ٠٥٧،٠٠٠
  - زذري: زص ٠٥٤،٠٠٠
  - رنسُمَبلس: زص ٠٥٣،٠٠٠
  - شِنَتنَن: زص ٠٥٢،٠٠٠
- **ِدسل صرڈُتِن**: زص ٤.٢ مِللِن َننُللي
  - رهمَلس َند رَتَليستس: زص ٠٥٨،٠٠٠
  - زذري: زص ٠٥٦،٠٠٠
  - رنسُمَبلس: زص ٠٥٤،٠٠٠
  - شِنَتنَن: زص ٠٥٤،٠٠٠

يندِرت صرَتِنَ رستس

- **ضتَفف ضَلَرِس**: زص ٢.٢ مِللِن َننُللي
  - شَنَمنت: زص ٠٠٦،٠٠٠
  - ةهنَل ضتَفف: زص ٠٥٩،٠٠٠
  - ضُرت ضتَفف: زص ٠٥٦،٠٠٠
- **ادمِنسترَتِ زسنسس**: زص ٠٥٩،٠٠٠ َننُللي
  - صفف صرَتِنس: زص ٠٥٣،٠٠٠
  - ينسُرَد: زص ٠٥٢،٠٠٠

- صرفسسنَل ضرِس: زص ٠٠٠،٠٠٢
- شِسللنُس: زص ٠٠٠،٠٥١

- **شَركتِنَد ستربُتِن**: زص ٠٠٠،٠٥٧ نَنُللي
  - صردُت ررتفَتِن: زص ٠٠٠،٠٥٢
  - ةرَنسرتَتِن: زص ٠٠٠،٠٥٣
  - شَركَتِنَ: زص ٠٠٠،٠٥١

ةتَل صرَتِنَ رستس

- **انئُل صرَتِنَ زسنسس**: زص ٢.٠١ مِللِن
- **صر سترَ صرَتِنَ رست**: زص ٠٠٠،٨٠٤
- **صر ةن فِ مَسس رست**: زص ٠٥٨

٣.٥.٣ ضدُ صرتِنس

ِدسل ضدُ

- **انئُل صردُتِن**: ٥٦ تنس
- **شَركت صرِ**: زص ٠٠٠،٥٢ ر تن
- **انئُل ضدُ**: زص ٥٢٦.١ مِللِن

شِستك سد ضدُ

- **انئُل صردُتِن**: ٠٥٤ تنس درِد ازللَ
- **شَركت صرِ**: زص ٠٠٠،٦ ر تن
- **انئُل ضدُ**: زص ٧.٢ مِللِن

ضِل اهندهنت ضدُ

- **انئُل صردُتِن**: ٠٠٢،١ تنس فرسه قُلنت
- **شَركت طَلَ**: زص ٠٠٥،١ ر تن
- **انئُل ضدُ**: زص ٨.١ مِللِن

رَربن ررِدت ضدُ

- **انئُل رَربن ضڤسترَتِن**: ٠٠٠،٥١ تنس رص$_2$ قُلنت
- **رَربن ررِدت طَلَ**: زص ٠٠٢ ر تن رص$_2$
- **انئُل ضدُ**: زص ٣ مِللِن

لیرِن ي-ردُت ضدُ

- **اننُل صرِدُتِن**: ٥.٦ تنس
- **شَركت طَنُ**: زص ٥١،٠٠٠ ر تن
- **اننُل ضدُ**: زص ٠٠٥،٧٩

ةتَل ضدُ

- **اننُل رسس ضدُ**: زص ٢٢.٩ مِللِن
- **ضدُ ر سِتَر**: زص ٠٠٨،٨٦٣

٤.٥.٣ سِنَنَل انَليسِس

صرِفتَبِلتي صرِتِنس

- **رسس شَرِن**: ٥٤٪ (فتر دِرت ستس)
- **صرَتِنَ شَرِن**: ٠١٪ (فتر لَل رَتِنَ ستس)
- **ت صرِفت (ىَر ٥)**: زص ٥.٢ مِللِن نَننُللي
- **زيةا (ىَر ٥)**: زص ٨.٣ مِللِن نَننُللي

ضثُرن ن ينستەنت

- **صَيبَك صرِد**: ٥.٧ يَرس
- **ينترنَل ضَتَ ف ضثُرن (يضض)**: ٢١٪
- **ت صرِسنت طَنُ (٠١٪ دِسُنت)**: زص ٥.٨ مِللِن (٠١-يَر هرِزن)
- **ضثُرن ن رِتَل زەليد (ىَر ٥)**: ١١٪

رَك-ن انَليسِس

- **رَك-ن صرِدُتِن**: ٠٠٠،٩ تنس فرسه بِمَسس نَننُللي
- **رَك-ن رِتَي وتِلِزَتِن**: ٥٦٪
- **رَك-ن ِدِسل صرِ**: زص ٠٠٥،١٢ ر تن

٥.٥.٣ سُندِذ ضترَتي

رَتَل ضترُثر

- **زفِتي ينستمنت:** ٠٤٪ (زص ٨.٣١ مِللِن)
- **بت سِنَنِ:** ٥٤٪ (زص ٥.٥١ مِللِن)
- **رنمنت رَنتس:** ٠١٪ (زص ٥٤.٣ مِللِن)
- **ضترَتِ صَرتنرس:** ٥٪ (زص ٣٧.١ مِللِن)

بت سِنَنِ ةرمس

- **شَن اُمنت:** زص ٥.٥١ مِللِن
- **ينترست ضَتَ:** ٢١٪ نَنُللي
- **ةرم:** ٨ يَرس
- **رَ صرِد:** ١ يَر
- **انئُل بت ضرِ:** زص ١.٣ مِللِن

صتنتَل سُندِذ ضُرس

- **لمنت نَكس:** زيتَن ارُلتُرَل نَك، افرَن لمنت نَك
- **رنمنت صررَمس:** ضنوَبد زنري نَد زنري زففِذي سُند
- **يمَت ينسترس:** ضَلِزدِن سُستَنَبد رُلتُر نَد رنوَبد نري
- **ضترَتِ يندُستري صَرتنرس:** زنري مَنِس، رُلتُرَل رَتِس
- **رلِمَت سِنَن:** رن رلِمَت سُند، لبَل زنِرنمنت سَلِتي

٦.٥.٣ سِنَنَل ضِسك شَنَمنت

ضنسِتتي انَليسِس

- **ِمَسس يِلد:** ٠١٪ ردُتِن درَسس يضض ت ٩٪
- **ِدِسل صرِ:** ٥١٪ ردُتِن درَسس يضض ت ٠١٪
- **صرَتِنز رستس:** ٠٢٪ نرَس درَسس يضض ت ٨٪
- **رِتَل رستس:** ٥٢٪ نرَس ستندس يَبك رِد ت ٢.٩ يَرس

ضِسك شِتَتِن ضترَتِس

- **ضذُ رسِفَتِن:** لَندِنم فرم مُلتِل ردُت سترَمس
- **صهَسد يملەنتَتِن:** ضتَدِتَل دليمنت بَسد ن رفرمَذ
- **سدِنذ:** سروَرد نترَتس فر بِدِسل سَلس
- **رنتِنذي ضسرس:** شِنتنَذ ف ٦-مِنته رَتِذ سنسذ رسر
- **ينسُرَذ:** رمرهنسِ رَ فر كي سستس نَد رَتِنس

٧.٥.٣ سِنَنَل شِنترِذَند رنترل

شي صرفرمَذ يندِتَترس

- **صرِدُتِن رست ر قن:** قَرت بلو زص ٠٠٨
- **رسس شَرِن:** قَرت بِ ٥٤٪
- **صرَتِذ زسنس ضَتِ:** قَرت بلو ٠٣٪
- **بت ضرِ ررَ ضَتِ:** قَرت بِ ٥.١
- **طركِذ رَتَل ضَتِ:** قَرت بِ ٠.٢

سِنَنَل ضرتِذ ضيستم

- **شِنتهلي شَنَەنت أنتس:** صرِدُتِن، سَلس، نَد ست ترَكِذ
- **صُرتَرلي سِنَنَل ضِوس:** رمرهنسِ رفرمَذ سسسسمنت
- **انئَل أدِتد ضتَتەنتس:** سُلل فِنَنَل ُدت بي ندندنت فِرم
- **رَسه ساو سرَستِذ:** ضللِذ ٢١-مِنته رتِنس ُدَتد منتهلي
- **ُدت طَرَذ انَليسِس:** شِنتهلي ترَكِذ ف َتُل س. لَنند رفرمَذ

٦.٣ ضسُر ضقُرمنتس

١.٦.٣ شَند ضقُرمنتس

ةهسِ ستن س ُررنتلي ُندر دلمنت نَد وِلِل بِ ُدَتد ِن تهـ نسـت رسِن. ةهـ رسُر رقُرمنتس فر ازَلَ فرمَذ وِلل ددرسس تهـ فللوِذ كي رس:

- شَند َر سِفَتِنس
- طَتر بدي رقُرمنتس
- صند نسترُتِن ُدلِنس
- ضهَدِذ نفرَسترُتُر

٢.٦.٣ طَتر ضسُرس

تَلد وَتر رسُر رقُرمنتس نلُدذ:

- طَتر قُلتي رَمترس
- طَتر قُنتتي لَلُتَتنس
- طَتر ريلذ سيستمس
- ضَنوَتر هَرستذ تنتَل

٣.٦.٣ زقُمنت نَد ينفرَسترُثر

زسسنتَل قُمنت نَد نفرَسترُتُر ندس وِلل بـ ُتلِندِن تهـ نسـت ُدَت.

٤.٦.٣ سُمَن ضسُرس

ضتَفذِ رقُرمنتس نَد سرتِس نددد فر سُسسفُل ازللَ ُلتَتِن وِلل بـ دتَلدِن تهـ ُمِذ رسِن.

٧.٣ ضِسك شَنَمنت

١.٧.٣ ضِسك اسسسسمنت سرَمورك

ةهس سِتِن س ُررنتِلي ُندر دلمنت نَد وِلل بـ ُدَتدِن تهـ نسـت رسِن. ةهـ رِسك مَنَمنت فرَمورك فر ازلل فَرَمِذ وِلل ددرسس تهـ فللوِذ كي رسَ:

- زنِرنمنتَل رِسكس
- صرَتِنَل رِسكس
- شَركت رِسكس
- سِنَنَل رِسكس
- ضُلَتري ملَذ رِسكس

٢.٧.٣ شِتَتِن ضترَتِس

تَلد متَتِن سترَتِس فر ِدنتِفذ رِسكس وِلل بـ رِددِن تهـ ُمِذ رسِن ف تهِس دُمنت.

٣.٧.٣ رنتِنذي صلَننذ

رنتِنذي لَنس فر َرُس رِسك سنَرِس وِلل بـ ُتلِندِن تهـ نسـت ُدَت.

٤.٧.٣ شنترذند ضو

ا مرهنس منترذند رو رسس ولل ب ستبلسهد ت نتنُسلي سسسس ند ددرسس رسكس ن ته ازلل فرمذ رتن.

٨.٣ ازللَ سرمذ ضُستَنَبلتي صلَن

١.٨.٣ ضُستَنَبلتي طسن ند صرذلس

ضُستَنَبلتي طسن

ة ستبلسه ازللَ فرمذ س رذرتَ رُلتُرَل سيستم تهَت نهَنس نرنمنتَل هَلته، سترذتهنس ممُنتي رسلذ، ند رتس لستَذ نمـلُ وهل سرذ س مدل فر سستَنبل قتَ ر ردتن ن رد رنس.

ُدذ صرذلس

- **ضذرَتِ سن**: ررَتذ سيستمس تهَت رستر ند نهَذ سيستم فُنتنس
- **ضسُر زففذي**: شَس مزذ ردُتتي وهل منمزذ رسُر نسُمتن
- **ررُلَر زذمي**: زلمنَتذ وَست تهرُه لسدـل رسُر فلوس
- **رلمَة ضسلذ**: ُلدذ دَتَ تَي ت وتهستَند لمَتَ رَبلتي
- **ضَل زفُتي**: زنسُرذ فَر دسترَبُتن ف بنفتس ند رتُنتس
- **شنولد ضهَرذ**: صرمتذ ن سهَذ ف سُستَنَبل رَتس

٢.٨.٣ زنرنمنتَل ضُستَنَبلتي

طَتر رنسرَتن ضترَتي

- **طَتر زففذي ةَرتس**:
  - اهـ وَتر ردُتتي ف ٥.٢ ك بمَسس ر ُبِ متر
  - ضدُ رَتِ لسسس بي ٠٣٪ تهرُه سُرف ر
  - ضيل ٥٨٪ ف رسس وَتر تهرُه لسدـل سيستمس
- **طَتر شَنَمنت صرَتس**:
  - يملمنت رسن منترذ ف وَتر قُلتي رَمترس
  - ينستَلل وتر-ففنت هَرستذ ند رسسذ سيستمس
  - رَتُر ند ُتلز رنوتر فر سُلمنترَي سُلي
  - شنَتَن تمل ند دته ت منمز رَتن
- **طَتر صُلتي صرتتن**:

- زستَبلِسه تَتِ بُففر زنس رُند ردُتِن رَس
- يملمنت بِلَل فلترَتِن فر وَتر رُفِتِن
- شِنتر ند نترل نُترِنت للس ت رنت ُترهِتِن
- رندُت رُلَر وَتر قُلِتي تستِند ررتِن

دِرستِي رنسرَتِن

- **سَبِتَت ررَتِن:**
  - زستَبلِسه ٣ هتَرس ف وتلَند بُففر زنس رُند ردُتِن رَس
  - ررَت مِرهَبِتَتس فر بنفَل نستس ند للنَترس
  - شِنَتِن نَتِ تَتِن ررِدرس بتون ردُتِن ُنتس
- **ضِس شَنَهنت:**
  - رُلتَت مُلتَل ازلَ سترِنس ت مَنتَن نتِ درستي
  - يملمنت سترِت بِسُرتي ت رنت نَس سِس نتردُتِن
  - شِنتِر ند دُمنت بِدرستي ندَترس قُرترلي
  - رللبرَت وِته نسرتِن رَنزتِنس فر هَبِتَت نهَنمنت
- **زلَل يننترَتِن:**
  - سِن ردُتِن سيستمس ت مِم نَتُرَل وتلَند فُنتِنس
  - يننترَت بِرد هَبِتَت فَتُرس ن نفرَسترُتُر دسِن
  - زستَبلِسه سَسنَل رتَتِن رس فر سيستم ررِي
  - ررَت دمنسترَتِن رَس سهوسِند لَل بنفتس

رلِمَت اتِن صلَن

- **رَربن شَنَهنت:**
  - ضقُستر ٥١،٠٠٠ تنس رص٢ قُلنت نَنُللي تهرُه بِمَسس ردُتِن
  - يننررَت ربن-رِه ازلَ رسدُس نت رُلتُرَل سلس
  - يملمنت لو-ربن رتَنَل رتَس رسس تهلُ هِن
  - اهِ ربن-نُترَل رتفَتِن بي ير ٣
- **ضذوَبا زذري يننترَتِن:**
  - ينستَل ٠٠٢ كط سلَر هتلتَ سيستم فر رَتِنس
  - وتلِز بِدسل ردُد ن-ست فر ٥٧٪ ف فُل رقُرمنتس
  - يملمنت ذري-ففنت قُمنت وِته مِنمُم ٤-ستَر رَتِنس
  - اهِ ٠٦٪ رذوبل ذري ُس رسس لل رَتِنس
- **رلِمَت ضسِاذ شَسُرس:**

- سنفرستروتر توتهستند سترم وتهر نتس
- لنتنذي لنس فر درهت ند هت و سنرس
- يملمنت وتر ستر سيستمس وته ٠٣-دي رسرتي
- زستبلسه لمت منترذ ستتنس فر رلي ورنذ

٣.٨.٣ ضل ضستنبلتي

طركفر لمنت

- **زمليمنت ررتتن:**
  - ذرت ٥٤ درت بس رسس سكلل للس
  - ررت ٠٢١ ندرت بس ن ته سلي هن ند رلتد سرس
  - صررتز هرذ فرم لل ممنتس وتهن ٠٣ كم ردس
  - زنسر ٠٤٪ ف ستنس فللد بي ومن ند يته
- **ةرنند رتي لدذ:**
  - صرد ٠٢١ هرس ف تهنل ترنند ر مليننللي
  - زستبلسه رنتسه ررم فر ٥١ لل يته
  - لررننمنت تهويس فر لل ستفف للس
  - صرتنر وته دتنل نستتتنس فر سلزد ترنند
- **طركذ رندتنس:**
  - زسد نتنل لبر ستندردس فر وس ند بنفتس
  - يملمنت مرهنسنتنل هلته ند سفتي رتلس
  - صرد هلته نسرنند وللنسس ررمس فر لل مليس
  - زستبلسه وركر رسنتتن ن منمنت دسنس

رممنتي زنمنت

- **ضتكهلدر صرتتن:**
  - زستبلسه رممنتي ادسري رد وته قرترلي متنس
  - رندت ننل ن ديس فر ممنتي ممبرس
  - يملمنت ترنسرنت رند مهنسم وته ٨٤-هر رسنس تم
  - صبلسه ننل سستنبلتي ررت وته ممنتي نت
- **شنولد ضهرذ:**
  - سست منتهلي دتنل ترس فر سهلس ند ممنتي رس
  - لدمنسترتن لتس فر فرمر ترنند
  - ررت دتنل مترلس ن لل لنس

- زستَبلِسه رسَره َرتنرسهِس وِته رِنَل ُنرسِتِس

- **رممُنِتي ينستمنت:**
  - اللَت ٢٪ ف رفِتس ت ممُنِتي دلمنت رتس
  - ضُرت لَل نترربُرسهِ تهرُه تهنَل َسسِستَن
  - صرِد سهلَرسهِس فر ٠١ لَل ستُدنتس ِن رلَنت فِلدس
  - رنترِبُت ت ممُنِتي ِنفرَسترُتُر ِمرمنتس

سد َند ُترِتِن ضُرِتي

- **ُترِتِنَل رنترِبُتِن:**
  - زنهَن رتِن نتنت ِن لَل ِستك ردُتس
  - يمر سِل فرتِلِتي فر ِنرسد ر يِلدس
  - صرِد تهنَل سُرت فر هم َردن دلمنت
  - رندُت نُترِتِن وَرنسس ررَمس ِن لَل ممُنِتِس

- **سد ضيستم ضسِاذ:**
  - ضترنتهن لَل فد سُلي هَنس فر ِستك ردُرس
  - ضدُ دندذ ن ِمرتد َرُلتُرَل ِنُتس
  - ل مرني فد ردُتِن رتلس
  - ضُرت درسِفَتِن ف لَل فد ردُتِن سيستمس

٤.٨.٣ زنهِ ضُستَنَبِلتي

ُسِنسس ش‌دل ضسِاذ

- **ضذُ ِرسِفَتِن:**
  - شِنَتَن بَلَند رتفلِ وِته ذ سِنل ردُت س‌دذ ٠٤٪ ف رذُ
  - ل َت لَست ٥ دستِنت لُ سترَمس فرم ازللَ ردُتِن
  - زستَبلِسه لذ-ترم نترَتس فر ٠٦٪ ف ردُتِن
  - ررَت رمُم ردُت لِنس وِته نهَند مَرِنس

- **سِنَنَل ضتَبِلتي:**
  - شِنَتَن ٦-منته رَتِن س‌نس رسر
  - اهِ دبت-ت-قُتي رتِ بلو ٥.٠ بي ير ٥
  - يملمنت رِسک مَنَمنت رتلس فر مَرکت لَتِلِتي
  - ل هَسد ِنستمنت رَه تِد ت رفرمَذ مترِس

- **صرَتِنَل زففِذي:**

- ضدُ ردُتِن ستس بي ٣٪ نَنُللي تهرُه رسس مرمنتس
- يملمنت ردتِ مَنتنَن ت مَنمز دونتم
- صتمز لستس ت ردُ ترنسرتتن ستس بي ٥١٪
- وتلز دتَل تلس فر رَل-تم ردُتِن منترِذ نَد تمزَتِن

طَأ رهَن لمنت

- **ضُلِر ضلَتنسهس:**
  - ل لَل سُلي هَنس فر ٠٧٪ ف نُتس
  - يملمنت سُلِر سُستَنَبلِتي ستَندَردس نَد رفَتِن
  - صرِد تهنَل سسستَذ ت كي سُلِرس
  - زستَبلِسه فِر رِذ مهنَسمس وِته ترنَسرذي
- **شَركت لمنت:**
  - ررَت رتفَتِن سيستم فر ازللَ-بَسد ردُتس
  - ل درت مركتذ هَنذلس ت رمُم ُستمرس
  - زستَبلِسه ردُت ترَبلِتي نَد قُلَتي سسُرَذ سيستمس
  - ُلد برَند دنتتي رَنُد سُستَنَبلِتي ردنتَلس
- **يننَتِن صِلِن:**
  - اللَت ٥٪ ف رذُ ت رسَره نَد دلمنت
  - زستَبلِسه ننَتِن رتنرسهس وِته رسَره نستتُتنس
  - يملمنت نَنُل ردُت نَد رسس مرمنت يلس
  - لِنتللتُل ررتي سترَتي فر كي ِننَتِنس

٥.٨.٣ رنَذ نَد شَذَمنت

ضُستَنَبلِتي رنَذ

- **صرَنزَتِنَل ضترُثر:**
  - زستَبلِسه ضُستَنَبلِتي رممتت وِته سُتِ ررسنتَتِن
  - انت ددتد ضُستَنَبلِتي شَذَر ررتذ ت رزص
  - يذلُد سُستَنَبلِتي مترس ِن لل مَنَمنت رفرمَذ لُتنس
  - يندرَت سُستَنَبلِتي نسدرَتنس ِنت لل مَر دسِنس
- **صلِي سرَمورك:**
  - ل مرهنس سُستَنَبلِتي لِي وِته نَنُل رِو
  - يملمنت سُلِر د ف ندُت وِته رفَتِن
  - زستَبلِسه نِرنمنتَل مَنَمنت سيستم وِته يضص ١٠٠٤١ رتفَتِن

- رررَ تررَنسَررنت رُرمنت لِي رِرتِزِذ سُستِتَنَبل سُرس

- **زتهَل صرَتِس:**
  - يملمنت نَتِ-ررُتِن لِي وِته زر تلرَذ
  - زستَبلِسه وهستلبلور رتتِن مهنَسم
  - رندُت تهس ترنَذ فر لل مليس نَنُللي
  - صرفرم رُلَر تهَل رسک سسسسمنتس

شِنترِذ نَد زَلَتِن

- **ضُستِتَنَبِلتي شترس:**
  - ل مرهنسِ سُستِتَنَبِلتي دَسهبَرد وِته ٥٢ کي ِندِتَرس
  - رندُت نَنُل سُستِتَنَبِلتي ُدت بي تهِرد رتي
  - يملمنت رل-تم منترِذ فر رِتَل نِرنمنتَل رَمترس
  - زستَبلِسه سِذ-بَسد تَرتس فر نِرنمنتَل رفرمَذ

- **ضرتِذ سرَمورك:**
  - صُبلِسه نَنُل سُستِتَنَبِلتي ررت فللوِذ ضيِ ضتَندَردس
  - صرَتِتَن رلَنت سُستِتَنَبِلتي رتِفِتَن ررَمس
  - شِنَتَن ترَنسَرنت ممُنَتَن ف رفرمَذ ت ستَکهلدرس
  - ذهمرك رفرمَذ ِنست ِندُستري لَدرس

- **رنتئُس يمرمنت:**
  - يملمنت قُرترلي سُستِتَنَبِلتي رفرمَذ رِوس
  - زستَبلِسه ِننَتَن هللذس فر سُستِتَنَبِلتي ِمرمنتس
  - ل کنولد مَنَمنت سيستم فر سُستِتَنَبِلتي رَتِس
  - ررَتِ ِنتِ سيستم فر سُستِتَنَبِلتي هِمنتس

٦.٨.٣ يملمنتَتِن ضَدمَ

صهَس ١: سُندَتِن (ىَر ١)

- زستَبلِسه بَسلِذ مَسُرمنتس فر لَل سُستِتَنَبِلتي ِندِتَرس
- ل مرهنسِ سُستِتَنَبِلتي لِي َند رنَذ سترُتُر
- يملمنت بَسِ نِرنمنتَل مَنَمنت سيستمس
- ينتِتَ ممُنتي نَمنت َند ستَکهلدر مَذ
- ةرِن ر تَم ن سُستِتَنَبِلتي رِذلس َند رَتِس

ص‌هَس ٢: ينترَتِن (ىَرس ٢-٣)

- اهِ كي رتفَتِنس (رَنِ، فَر ترَد، نِرنمنتَل مَنَمنت)
- يملمنت مرهنسِ منترِذَند ررتِند سيستمس
- لَربن مَنَمنت َند رفَتِن سيستم
- زسَند ممُنتي ررَمس َند َرتنرسهِس
- ينترَت سُستَنَبِلتي رِترِنتَل بُسِنسس رسسس

ص‌هَس ٣: شَدرسهِ (ىَرس ٤-٥)

- اهِ َربن-نُترَل ر َربن-نَتِ رَتِنس
- زستَبلِسه دمنسترَتِن نتر فر سُستَنَبل َقُتِ فَرمِند
- لكنولد سهَرِذ لَتفرم فر برَدر مَت
- يملمنت َندِ رُلَر ذمي سيستمس
- اهِ رنتِن َس سُستَنَبِلتي لَدر ِن تهِ ستر

٧.٨.٣ ضِسك شَنَمنت َند ضسِاذ

ضُستَنَبِلتي ضِسك اسسسسمنت

- **زنِرنمنتَل ضِسكس:**
  - رلِمَت هَنِ مَتس ن وَتر لَبِلتي َند تمرَتُر
  - ص‌تنتَل فر نِسِ سس ر دسسُتبركس
  - رهَنس ِن رُلَتري رقُرمنتس فر وَتر ُس
  - زس‌ترم وَتهر نتس ففتِنِ نفرسترُتُر
- **ضَل ضِسكس:**
  - رهَنس ِن ممُنتي َتَن ر سُرت
  - شَبر لَبِلتي َند سكلل س
  - صبُل رتِن َند رُتَتِن مَنَمنت
  - رُلتُرَل بررِرس تَدتِن ف ذو رَتِس
- **زنهِ ضِسكس:**
  - شَركت لَتِلتي فر نُتس َند ُتُتس
  - رهَنس ِن لِي سُرت فر رذوبل ذري
  - رمتِتِن فرم لترنتِ تهنلِس
  - اسس ت سُستَنَبل فِنَذ

ضسإذ ضترَتِس

- **ادَتِ شنَهنت:**
  - يملمنت سنَرِ لَننند فر كي رِسك فَترس
  - ل فلسبلد ردُتِن سيستمس دَتَبلد ت هَنِد ندتِنس
  - شِنَتَن ذتِ درِستيِ ن ازللَ سترِنس
  - زستَبلِسه رلي ورِند سيستمس فر نِرنمنتَل هَنس
- **ضدُندَذي نَد رِستي:**
  - شِنَتَن مُلتِلد وَتر سُرس وِته بَكُ سيستمس
  - رِسفي ردُت لِنس نَد مَركت هَننلس
  - ل مُلتِلد رتنرسهس فر رِتَل فُنتِنس
  - ررسس-ترِن ستَفف فر رَتِنَل فلسبِلِتي
- **ضسنس رِتي:**
  - ل دتَلد نتِنذي لَنس فر كي رِسكس
  - شِنَتَن مرذي رسنس قُمنت نَد سُلس
  - رندُت رُلَر سِمُلَتِن سرِسس فر رِسِس سنَرِس
  - زستَبلِسه رِد دسِن-مَكِن رتلس فر مرذِس

٩.٣ ينترَتِن صلَن فر ازللَ سَرمِذ

١.٩.٣ صهَسد ينترَتِن (٦٢٠٢-١٣٠٢)

صهَس ١ (٦٢٠٢-٧٢٠٢)

- **يئُتس:**
  - ةرَتد وَستوَتر (٠٠١ م^3\دَي)
  - ينتِل رمِمست تَ
  - سِ ند نفرَسترُتُر
  - ضلَر ور سُلي
- **صُتُتس:**
  - سرسه ازللَ بِمَسس (٥ تنس نَنُللي)
  - تُرِنت-رِه وَتر فر رِرتِن
  - ينتِل بِفرتِلزر ردُتِن
  - صسين ذرتِن
- **ينترَتِن صِنتس:**

- طَتر ترَتمنت سيستم
- شِستك فد سُلي
- ينتَل ُلتَتِن سُرت

صهَس ٢ (٧٢٠٢ـ٨٢٠٢)

- **ينُتس**:
  - زسَندد وَستوَتر ترَتمنت (٠٠٣ م^{3}\دَي)
  - زنهَند نُترِنت يلِن
  - زسَندد ند سيستم
  - صتِمزد ذري ُس
- **صُتُتس**:
  - ينرَسد بِمَسس ردُتِن (٥١ تنس َننُللي)
  - زنهَند وتر قُلِتي
  - زسَندد بِفرتِلزر رَذ
  - ررِبن سقُسترتِن
- **ينترَتِن صِنتس**:
  - شُلتِل ُلتَتِن ُنتس
  - زنهَند لِستك فد
  - ِدسل فدستك سُلي

صهَس ٣ (٨٢٠٢ـ٩٢٠٢)

- **ينُتس**:
  - سُلل وَستوَتر ِنترَتِن (٠٠٥ م^{3}\دَي)
  - رِملت نُترِنت ررِي
  - ادند ند منمنت
  - شَسِمُم ذري ففِذي
- **صُتُتس**:
  - صِک بِمَسس ردُتِن (٥٢ تنس َننُللي)
  - شِسِمُم وَتر ترَتمنت
  - سُلِل بِفرتِلزر ردُتِن
  - زنهَند سيستم سرِس
- **ينترَتِن صِنتس**:
  - الل ُنتس: ضسُر يلِن
  - صِرسسِند فِلَتيِ ِنترَتِن
  - ررِبن ردِت نرتِن

صهَس ٤ (٩٢٠٢–٠٣٠٢)

- **يئُتس**:
  - صتِمزد وَتر سيستمس (٠٠٧ م^3\دَي)
  - ضمَرت نُترِنت مَنَمنت
  - اُتمَتد ند نترل
  - ضذوَبل ذري ِنترَتِن
- **صُتُتس**:
  - ادَند بِمَسس ردُتس (٠٥ تنس َننُللي)
  - صرمُم وَتر قُلتي
  - ضلِزد فرتلِزرس
  - شَسِمُم ربن تُر
- **ينترَتِن صِنتس**:
  - رملد سيستم ِنترَتِن
  - طَلُـَدد رسسِنـ
  - زنهَند سُستَنَبِلتي مترِس

صهَس ٥ (١٣٠٢–٠٣٠٢)

- **يئُتس**:
  - شَسِمُم سيستم ِتي (٠٠٠١ م^3\دَي)
  - سُللي تِمزد نُترِنتس
  - ضمَرت سيستم نترل
  - صَک ذري ففِذي
- **صُتُتس**:
  - شَسِمُم بِمَسس يِلد (٥٦ تنس َننُللي)
  - صتِمَل وَتر قُلتي
  - رملد ردُت رَذ
  - صَک سيستم بذفِتس
- **ينترَتِن صِنتس**:
  - سُلل رُلَر ذمي ِنترَتِن
  - رملد رسُر تِمزَتِن
  - شَسِمُم سيستم ففِذي