Arab Authority For Agricultural
Investment And Development
(AAAID)

Adopting a New Model of Farming System for the Development of Rain-Fed Sector in Sudan

Prepared by:

Dr. Naufal H. Rasheed

Advisor to the President of AAAID

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1. INTRODUCTION

1.1 AAAID is focusing at the present time on establishing large-scale strategic agricultural projects that have direct impact on addressing Food security issues in Sudan and the rest of Arab world.

1.2 Sudan has been recognized among the few countries in the world that can contribute to solving food security problems.

1.3 Sudan has a great agricultural potential in terms of vast areas of cultivable land, sufficient water (rivers, rain, and ground water), and diversified environmental conditions.

1.4Traditional farming methods have been the most common systems in the rain-fed sector which is characterized by low productivity.

1.5 Development of a highly productive farming system has, therefore, become a necessity to face the problems of low productivity and high cost of production.

2. OBJECTIVES

2.1 The aim of this study is to describe the stages of adopting zero-tillage as a new model to replace the old system.

2.2 Introducing the zero-tillage system has been based on implementing a full Technological package for all agricultural operations supported by an efficient management system.

3. AAAID IN BRIEF

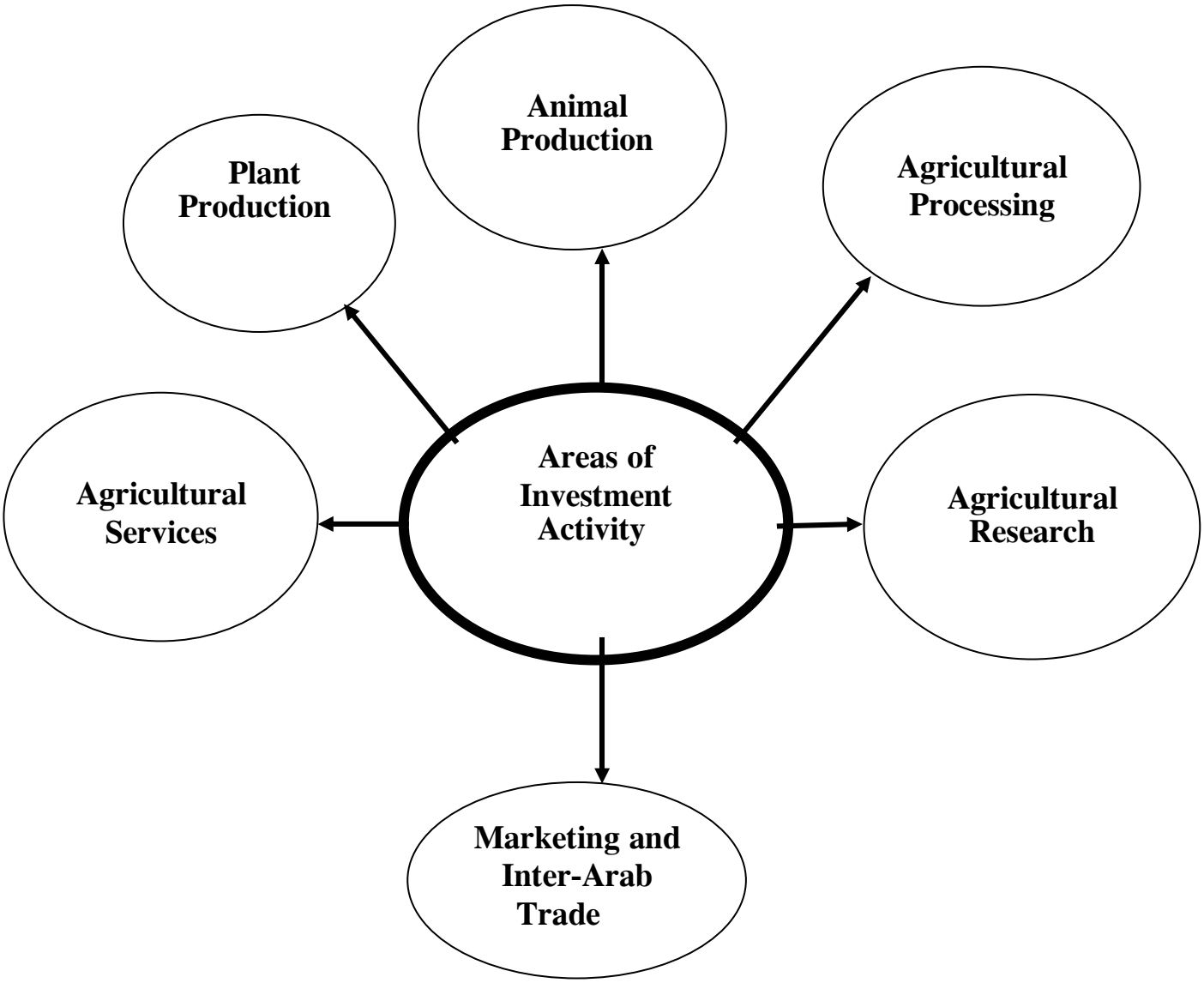
3.1. Establishment

The Arab Authority for Agricultural Investment and Development (AAAID) was effectively established on 1977.

3.2. Objectives:

- Development of agricultural resources and food production.
- Exchange of agricultural products.
- Promotion, financing and implementation of agricultural projects.
- Conducting research and studies.
- Cooperate with the relevant organizations.

3.3 Areas of Investment Activity



3.4. Capital:

The paid-up capital was about US$ 325 million.

3.5. Location:

Main Office: Khartoum, Republic of the Sudan,

Regional Office: Dubai, United Arab Emirates.

3.6. Member States:

Sixteen shareholder states in AAAID.

3.7. Existing Companies:

AAAID holds equity shares in 20 companies.

3.8 Companies Under Establishment:

AAAID is a shareholder in 8 companies, at different implementation phases.

3.9 Financial Position:

At the end of the year 2001, total assets amounted to US$715 million.

3.10 Dividends Distributed to Member States:

- AAAID distributed dividends to shareholders in the amount of US$ 215 million,
- shareholders' equity has amounted to 210% of paid-up capital.

4. RAINFED SECTOR IN SUDAN

4.1. Lands

Total Agricultural Land	84	Million Hectar
Land Presently Utilized	17	Million Hectar
Land Under Rain-fed Agriculture .	9-12	Million Hectar

4.2. Average Rainfall

450-800 mm/annum (in the central clay plains)

Seasonality : Between July and October

4.3 Current Farming Systems

4.3.1 Rain Fed partially mechanized system:

- Use of wide level Disc, Post-harvest and for soil preparation before sowing
- combine Harvesting primarily for sorghum
- Limited application of certain fertilizers (Urea), Herbicides and pest control

4.3.1 Rain-Fed Traditional System:

- No use of machinery, fertilizers or herbicides. Planting, cultivation and harvesting by hand.

4.4 Productivity of Essential Crops :

Crop	Prod (Ton/Hector)
Sorghum	0.70
Sunflower	0.50
Cotton	0.33
Peanut	0.60
Millet	0.50
Sesame (Partially Mech.sys.)	0.15
Sesame (Traditional System)	0.24

4.5 Conclusion

- **There are promising apprentices for foreign investment in agricultural in Sudan**

- **There an urgent need for changing the existing farming systems to achieve high productivity and good quality**

- **The challenges of globalization on us, the of efficient farming systems**

5. Nature of the project under development:

5.1. Background:

Name	Arab Sudanese Blue Nile for Agric. Co. (ASBANACO)
Establishment	1982
Shareholders	AAAID (51%) Sudan Government (49%)
Location	AGADI village Damazin City, Blue Nile State 700k South of Khartoum
Area	133000 Hectar
Average	1450000 Hectar
Average Rain fall	450-800 mm/annum
Duration of Rainy Season	From July to October
Type of soil	Heavy clay soil (Vertisols) Contains 60-80% of clay

5.2 Features of the old farming system

- Limited use of agricultural machinery.
- Lack of Herbicide and Fertilizer applications.
- Crop rotation not practiced.
- Diffidence of infrastructure (road, electricity, water).
- Improper management system
- High harvest losses.
- Weak of R&D program.

5.3 Conclusions:

- Low productivity.
- High cost of production
- Low quality of produce
- Financial losses.

6. Adoption of new farming system

6.1 Objectives:

- **Select the most modern technological farming system in order to increase production and reduce the cost.**
- **Implement full technological package for each crop.**
- **Suitability to the local environmental conditions**
- **Provide efficient management**
- **Initiated a new concept of applied research program oriented for the benefit of the new farming system.**

6.2 Preparations:

- **Studied and evaluated worldwide rain-fed farming systems part in USA, Canada, Australia, South Africa…etc**

Arrange seminars and workshops to examine and review international experience on rain-fed farming systems

- **Contact relevant international companies specialized in manufacturing of agricultural machineries for rain-fed agriculture**

- **More attentions have been taking care on the suitability of the new system to Sudan environment**

6.3. Selection of the new Farming System:

Zero-Tillage system and Min-Tillage system have been selected to replace the old system.

7. Concept of Zero Tillage

7.1 Definition:

Direct sowing without plowing or harrowing, using chemical treatment for weed control before and during the growing season

7.2 Advantages:

- **Conservation of soil moisture.**
- **Control of soil erosion.**
- **Improve chemical and physical properties of the soil.**
- **Increase organic matter in the soil.**
- **Effective control of weeds.**
- **Reduction in operational costs (labor and machinery).**
- **Substantial increases in productivity.**
- **Adoption of sustainable agricultural system.**

7.2 Application of Zero Tillage System

Season 2000

Large-scale field experiments in order to compare the following cultivation systems

- **ZEROTILLAGE**
- **HARROWING**
- **PLOWING**

(Cultivated area 200 feddans)

Findings

Zero Tillage significantly out yield the other systems

Sorghum	**1200 kg/fed**
Sunflower	**609 kg/fed**

Sorghum grown under Zero-tillage system

7.3 Application of Zero Tillage System

Season 2001

Pilot farm for applying Zero Tillage and Minimum Tillage

Cultivated area 5000 feddan

Productivity (kg/fed)

Crop	Zero-tillage	Minimum tillage
Cotton	470	329
Sorghum	1080	522
Sunflower	509	261

Conclusion

Selection of Zero Tillage system as a suitable system and rejecting the Minimum Tillage system

7.4 Application of Zero Tillage system

Season 2002

Pilot farm for applying Zero Tillage system

(Cultivated area 10,000 feddan)

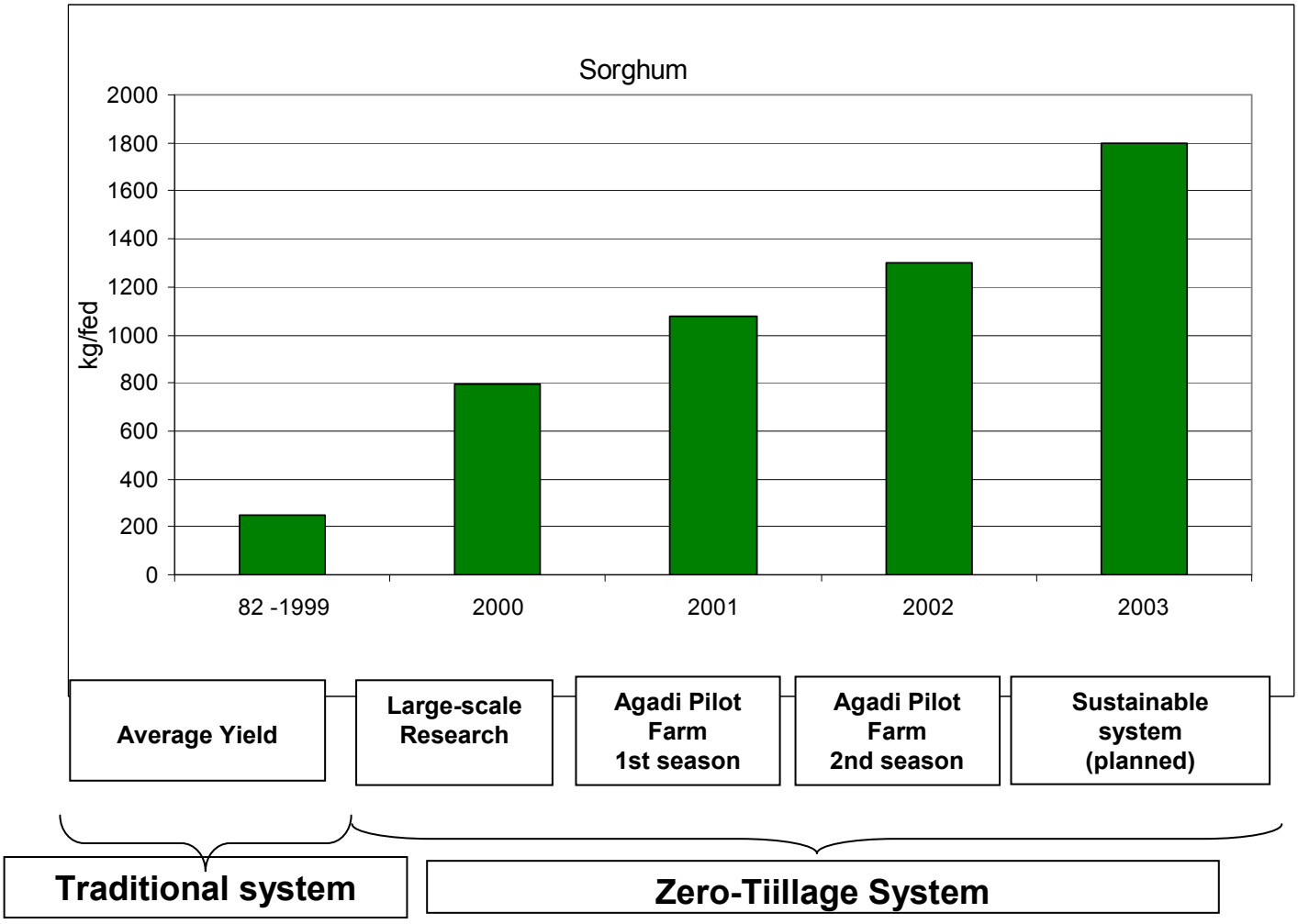
Crop	Area (fed)	Targeted Prod. (kg/fed)
Cotton	5000	830
Sorghum	3500	1500
Sunflower	1000	600
Sesame	250	399
Maize	250	1261

Indications

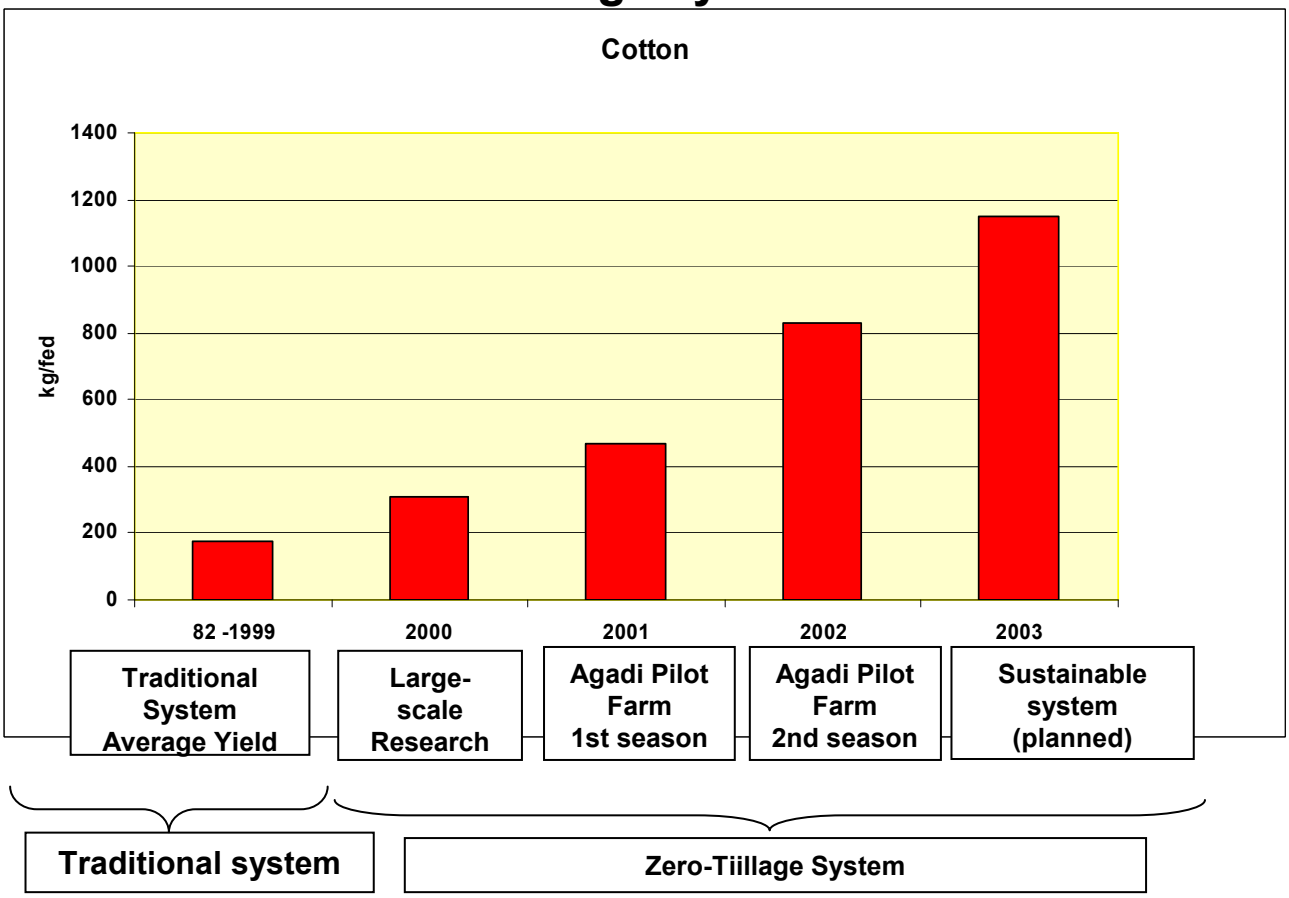
- Application of agricultural practices at the optimum time
- Good establishment of Crops, specially germination and plant density
- Full Control of pests and weeds during the growing season

DEVELOPMENT OF FIELD CROPS PRODUCTIVITY

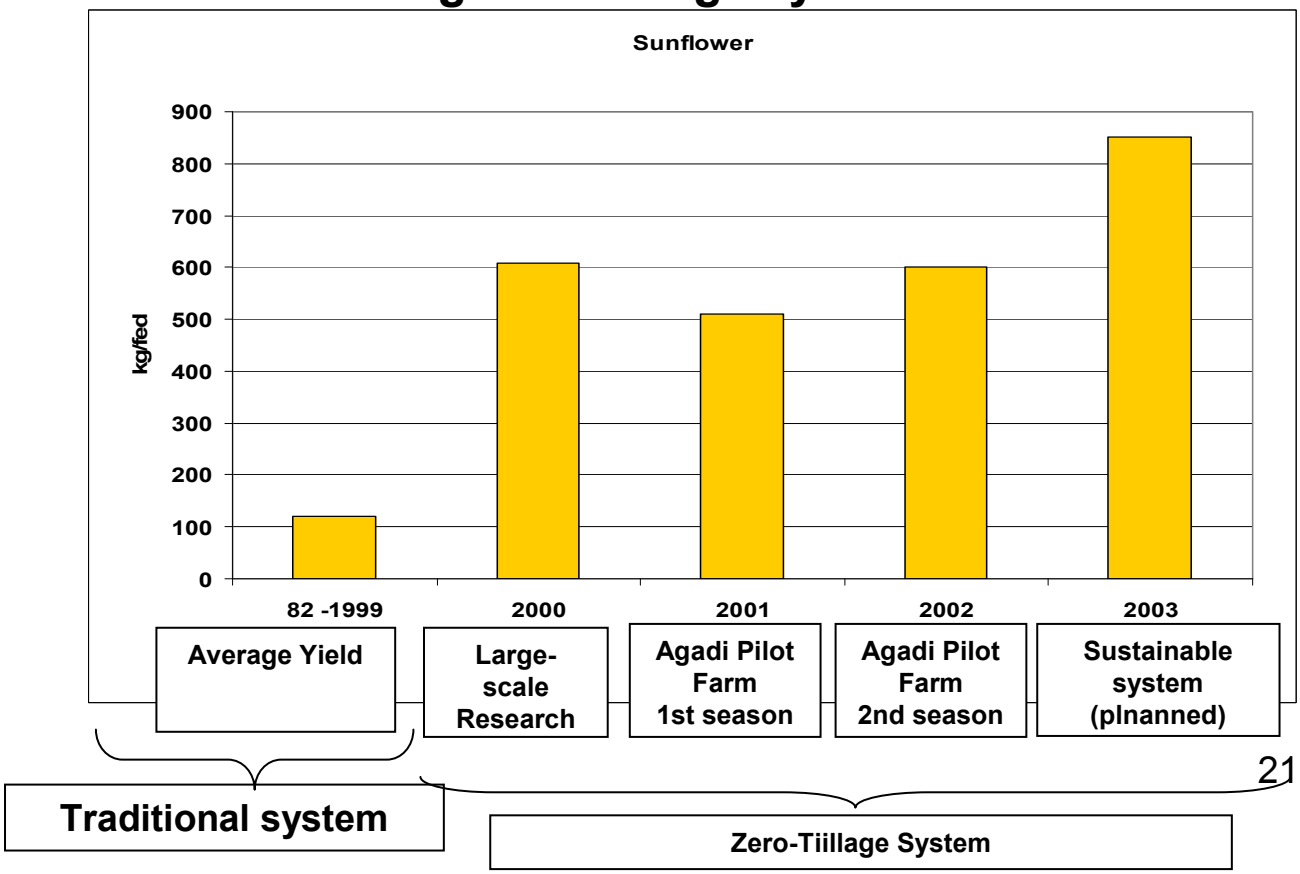
Development of Sorghum productivity using Zero Tillage system



Development of Cotton productivity using Zero Tillage system



Development of Sunflower productivity using Zero Tillage system



8. Integrated Package for Cotton using Zero Tillage System

Seq.	Agricultural Operation	Type of Machine
1	Pre-sowing weed control (Pre-emergence)	Boom Sprayer
2	Sowing in straight rows with fertilizer and herbicide application in one operation	Rowgrow Planter MF Yetter Planter
3	Post sowing weed control	Shield Sprayer
4	Application of growth regulator (PIX)	Aircraft
5	Defoliation of leaves before picking for harvesting using defoliat (Drop Ultra)	Aircraft
6	Mechanical harvesting	Picker
7	Chopping of Cotton stalks (left as mulch).	Mulcher
8	Cutting of roots 2 inches below soil surface	Root Cutter
9	Application of herbicide on fallow land.	Boom Sprayer or Aircraft

9. Integrated Package for Sorghum using Zero Tillage System

Seq.	Agricultural Operation	Type of Machine
1	Pre-sowing weed control (Pre-emergence)	Boom Sprayer
2	Sowing in straight rows with fertilizer and herbicide application in one operation	Rowgrow Planter MF Yetter Planter
3	Post sowing weed control	Shield Sprayer
4	Application of Herbicide before harvesting to control vegetation (plant and weed)	Aircraft
5	Mechanical harvesting	Combine Harvester
6	Application of herbicide on Fallow land	Aircraft

10. Integrated Package of Sunflower using Zero Tillage System

Seq.	Agricultural Operation	Type of Machine
1	Pre-sowing weed control (Pre-emergence)	Boom sprayer
2	Sowing in straight rows with fertilizer and herbicide application in one operation	Rowgrow planter MF Yetter planter
3	Post sowing weed control	Shield Sprayer
4	Mechanical harvesting	Combine Harvester
5	Application of Herbicide on Fallow land	Aircraft

Research Station for the development of Rainfed Crop Production (Agadi)

Applied Agricutlural Research Dept.
AAAID

11. Large-scale Field Trials, Season 2000

A wide-scale field research experiment for Zero Tillage, Plowing , Harrowing systems on an area of 200 feddan for growing different crops (cotton, Sorghum, and Sunflower)

Results

Crop	Yield (kg/fed)
Sorghum	1200
Sunflower	609

Zero Tillage significantly out yielded the other systems

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AAAID

12. Large-scale Field Experiments for Season 2001

Variety Trials

1. Sorghum Variety Trial (Wad Ahmed, Hageen Dura, Tabat, PANAR 606). Area 24 Fed.
2. Sunflower Variety Trial (Hysun 33, Damazin 1/3, PANAR 7353, PANAR, 7393). Area 24 Fed

Trials on the Effects of Different Tillage Systems

1. Effect of different tillage systems (Zero Tillage, Minimum Tillage, Conventional Tillage) on growth and yield of sorghum . 24 fed.
2. Effect of different tillage systems (Zero Tillage, Minimum Tillage, Conventional Tillage) on growth and yield of sunflower. 24 fed.

Contin.

Fertilizers Trials

1. Effect of Zinc and Boron on grain filling of sunflower. 12 fed.
2. Effect of Zinc and Phosphorous on grain filling of sunflower . 12 fed.
3. Effect of Phosphorous on the growth and yield of cotton. 24 fed
4. Effect of phosphorous on growth and yield of sorghum. 12 fed.
5. Effect of different sources of nitrogen (Urea, ammonium Nitrate) on growth and yield of sorghum. 12 fed.
6. Effect of different sources of nitrogen (Urea, ammonium Nitrate) on growth and yield of cotton . 12 fed.
7. Effect of different sources of nitrogen (Urea, ammonium Nitrate) on growth and yield of sunflower . 12 fed.

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Large-scale Field Trials for Season 2001

Summary of Main Findings

- **Confirmation of the superiority of Zero tillage in the Pilot Farm**
- **The local variety Wad Ahmed out yielded the local and imported sorghum varieties: Hageen Dura, Tabat, PANAR 606).**
- **The sunflower variety Hysun 33 out yielded Damazin 1/3, PANAR 7353, PANAR, 7393.**
- **Application of Boron to sunflower resulted in an increase in grain filling.**
- **Application of phosphorus resulted in an increase on the yield of sunflower**

Research Station
for the development of Rainfed Crop Production (Agadi)

Applied Agricutlural Research Dept. (AAAID)

13. Large-scale Field Trials for Season 2002

Variety Trials

1. Sunflower variety trial (Hysun 33 , PANAR 7351, PANAR 7392, Hysun 38. Hysun 47). 20 Feddans
2. Sorghum variety Trials (Wad Ahmed, Hageen Dura 1, PANAR 202, PANAR 602, Tabat). 20 Feddans
3. Cotton variety trial (BARAC 67B, ACALA 93, ALBAR). 12 Feddans

Fertilizer Trials.

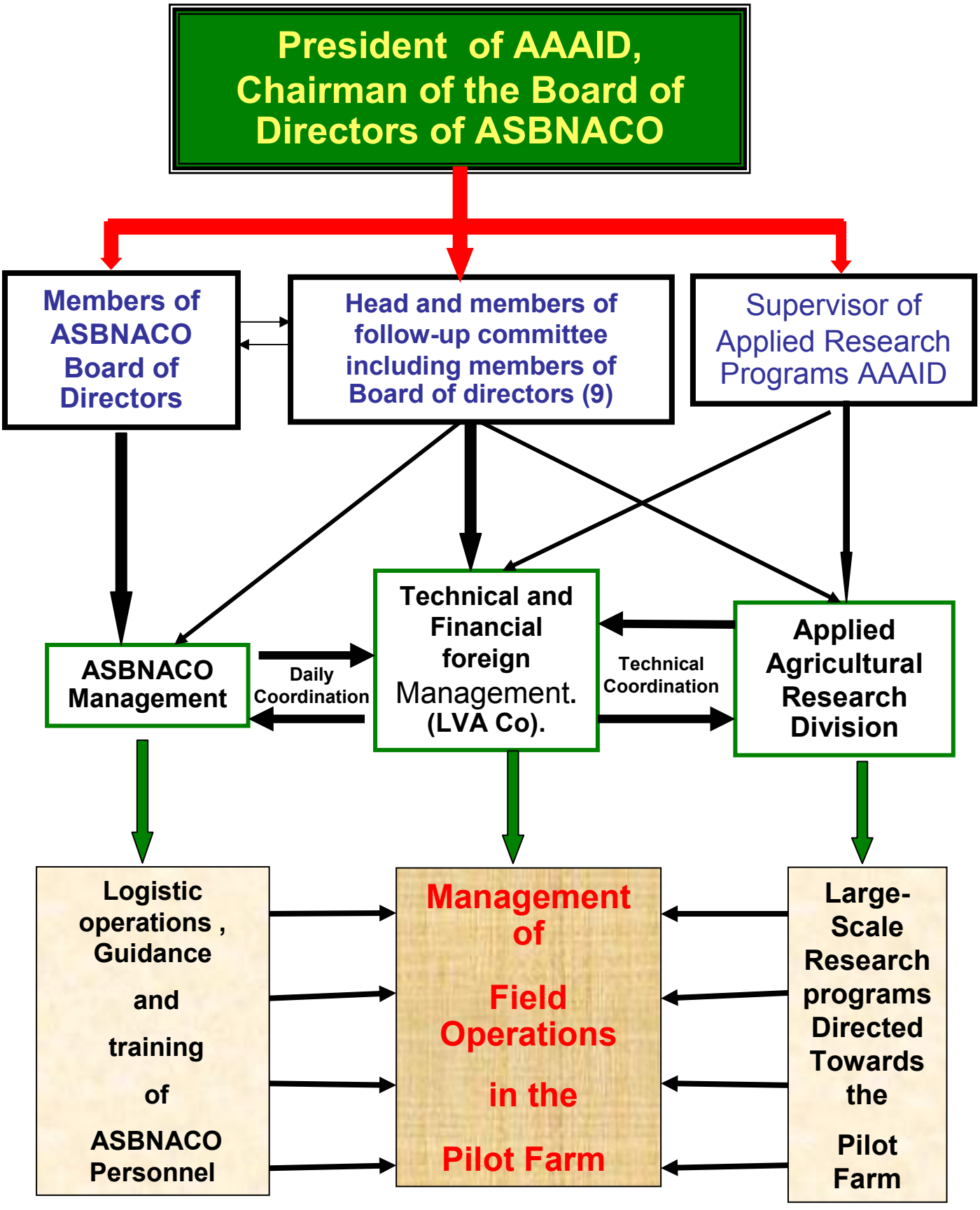
4. Effect of different sources of Nitrogen on sorghum and cotton. 16 Feddans
5. Effect of Zinc and Boron on grain filling of sunflower. 16 Feddans
6. Effect of the growth regulator (PIX) on cotton . 12 Feddans.
7. Effect of the macro-nutrient (NPK) on yield of cotton and sorghum. 40 Feddans
8. Observation trial of promising legume crops (Green gram peas, cow pea, soybean). 1 Feddan.
9. Effect of different levels of Nitrogen on cotton and sorghum. 12 Feddans
10. Effect of different time of application of nitrogen (at sowing , 4 weeks after sowing) on yield of cotton and sorghum.
11. Effect of Plant Density on growth and yield of cotton (spacing between and with rows). 12 Feddans

Result Under Study

A program for Transfer of Technology on Zero Tillage System to Small Farmers in Agadi Area

Responsibility	Applied Agricultural Research Dept. AAAID
Technology	Provision of small Planters and sprayers designed specially for this Purpose
Beneficiaries	**6 to 10 good farmers in Agadi area to be selected in Coordination with Local Authority**
Inputs	**Zero tillage planters, improved seeds, pesticides and fertilizers**
Expectations	• Increased yield • Adoption of new farming system by small farmers. •Social and economic development

Management System



New technology to be introduced in the season 2003

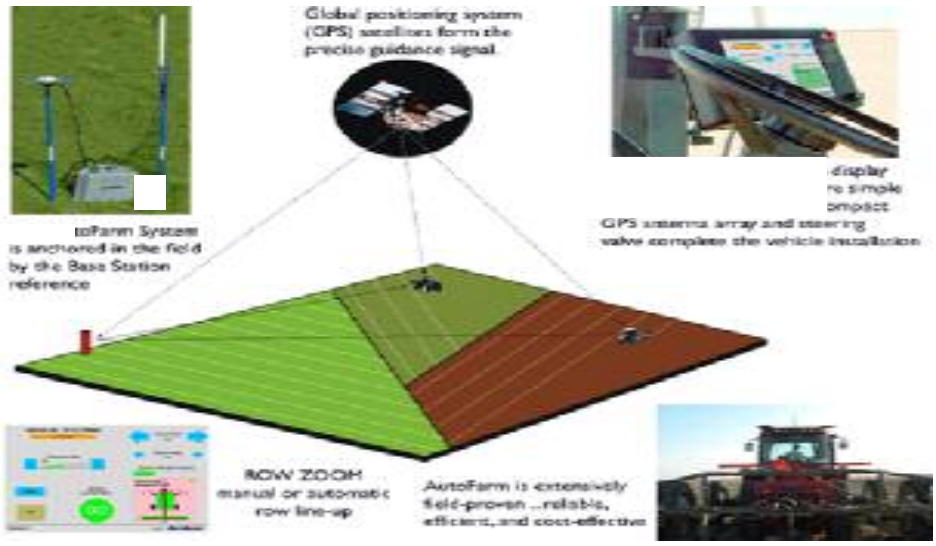
Precision Farming System

Advantages

- **Monitoring of crop growth at different stages to overcome problems**
- **Calibration of periodical reports**
- **Assessment of crop yield**
- **Contribution to controlled Traffic Farming System for agricultural operation**
- **Contribution to Fixed Traffic System**

Increase in Productivity and Securing Sustainable Agricultural System

New technology to be introduced in the season 2003



Controlled Traffic Farming System

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Advantages

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- **Solve compact soil problem**
- **Minimize agricultural input losses**
- **Reduce machinery operating costs.**
- **Reduce effort of equipment draging**
- **Handle water logging problems**
- **Minimize soil erosion**
- **Speed up of agricultural operations**

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Increase of Productivity and Securing Sustainable Agricultural System

Integrated Technical Package for Cotton Cultivation in Agadi

Boom sparyers

Weeds after sprayedchemical control

Field of cotton

Rowgrow Planter

Shielded -Sprayer

Integrated Technical Package for Cotton Cultivation in Agadi

Mechanical Cotton Picking

Collection of Cotton

Removal of Cotton Stalks (Root Cutter)

Remaining Cotton Stalks

Machineries used in Zero Tillage System

Rowgrow Planters

Sow in rows and places seeds, fertilizers and Pesticides at same time

Planter Cross

SlotSow in rows and places seeds and fertilizers at same time

Yetter Planter

Sow in rows and places seeds, and fertilizers at same time

Boom sprayer

For weed control before sowing

Shield Sprayer