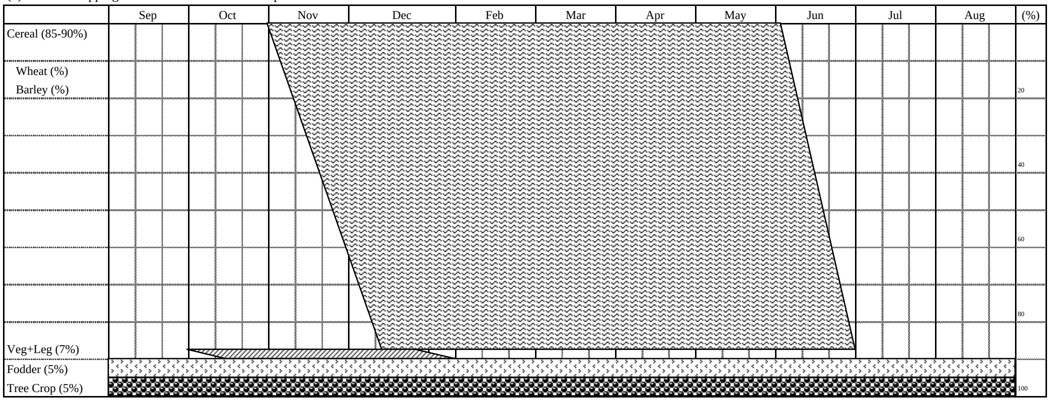
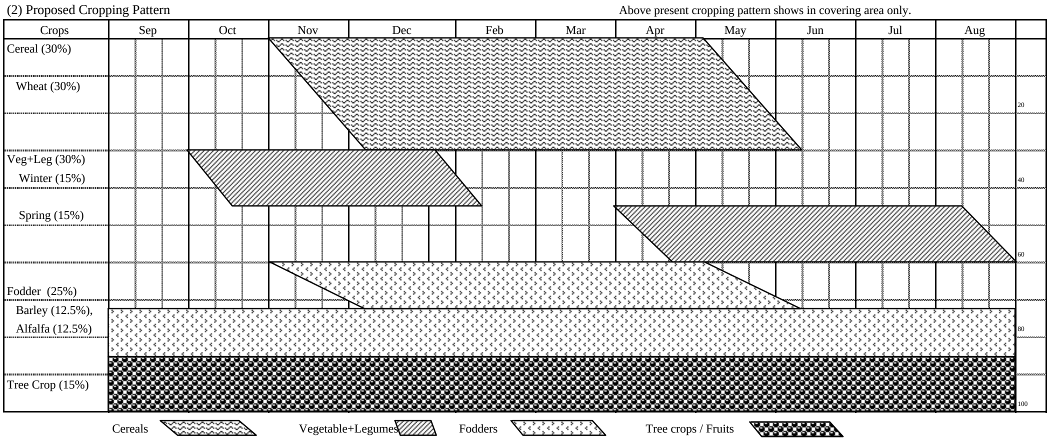
No. 5 N'Fifikh Upstream

(1) Present Cropping Pattern Occupation of Fallow land = 9%

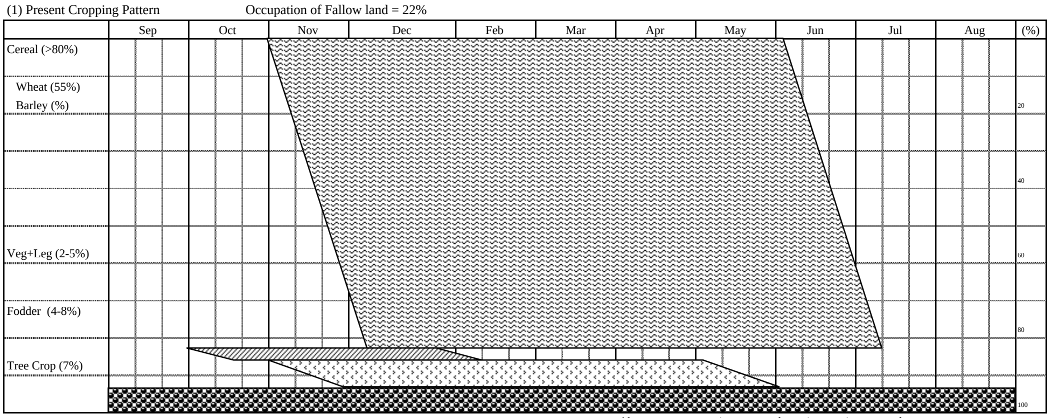


(2) Proposed Cropping Pattern Above present cropping pattern shows in covering area only.



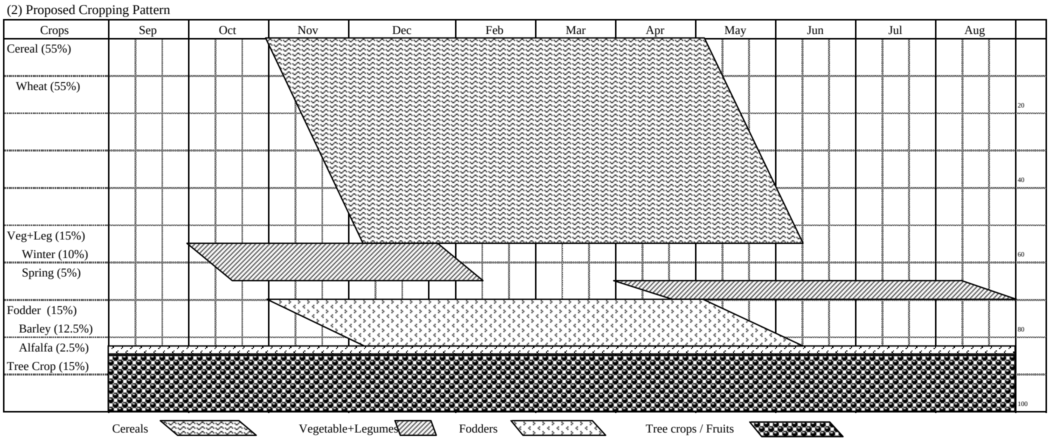
No. 5 N'Fifikh Downstream

(1) Present Cropping Pattern Occupation of Fallow land = 22%



Above present cropping pattern shows in covering area only.

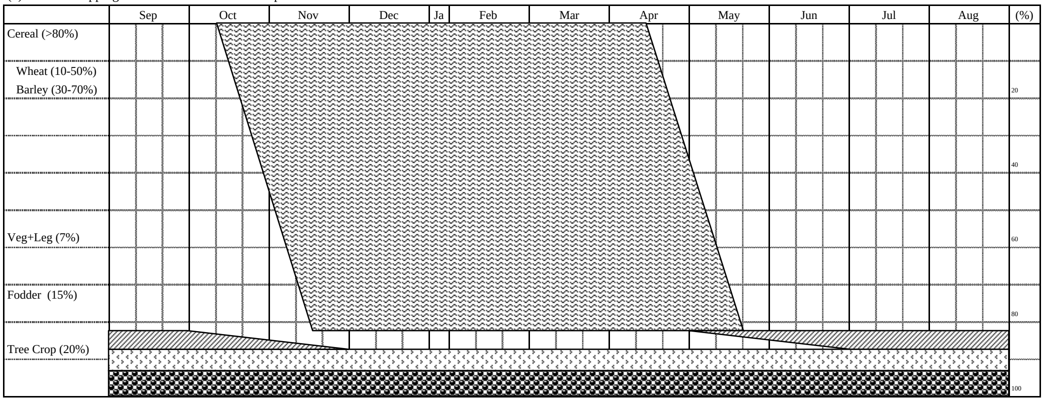
(2) Proposed Cropping Pattern



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XIII2.2.2 Etude Alternative dans les Différents assolements dans le Périmètre N'Fifikh amont et Aval**
JAPAN INTERNATIONAL COOPERATION AGENCY	

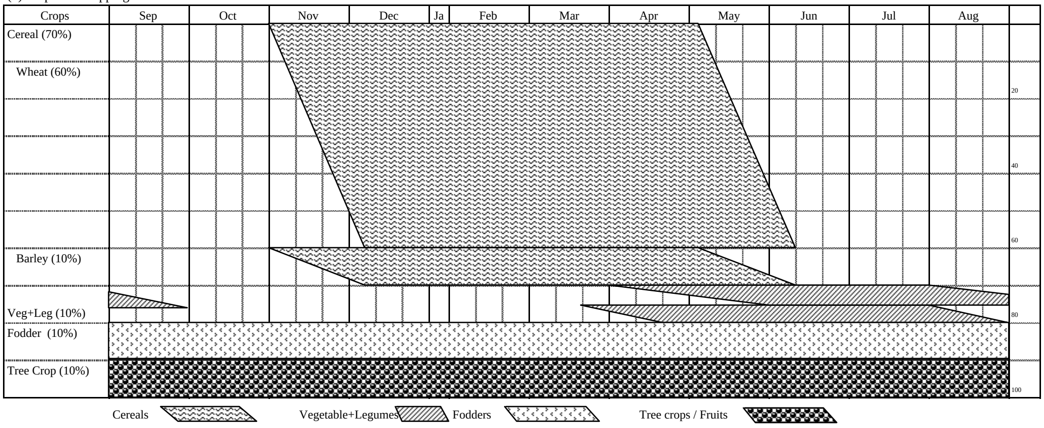
No. 9 Taskourt

(1) Present Cropping Pattern Occupation of Fallow land = 4%



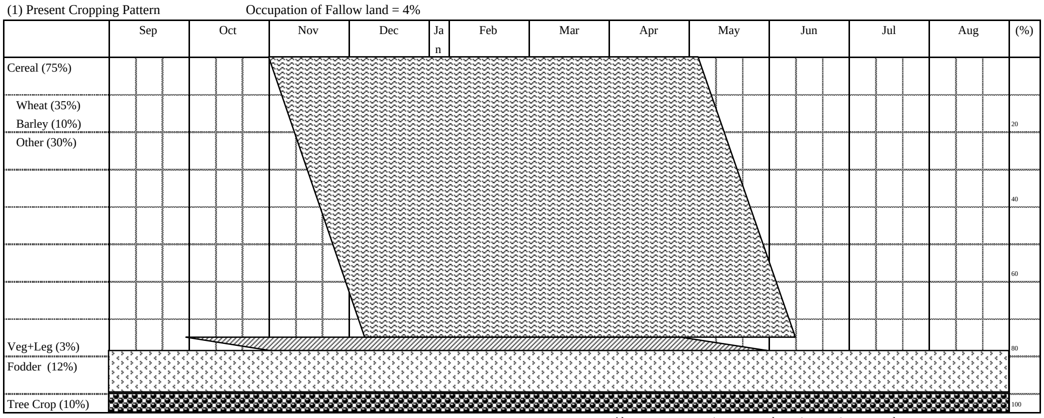
Above present cropping pattern shows in covering area only.

(2) Proposed Cropping Pattern



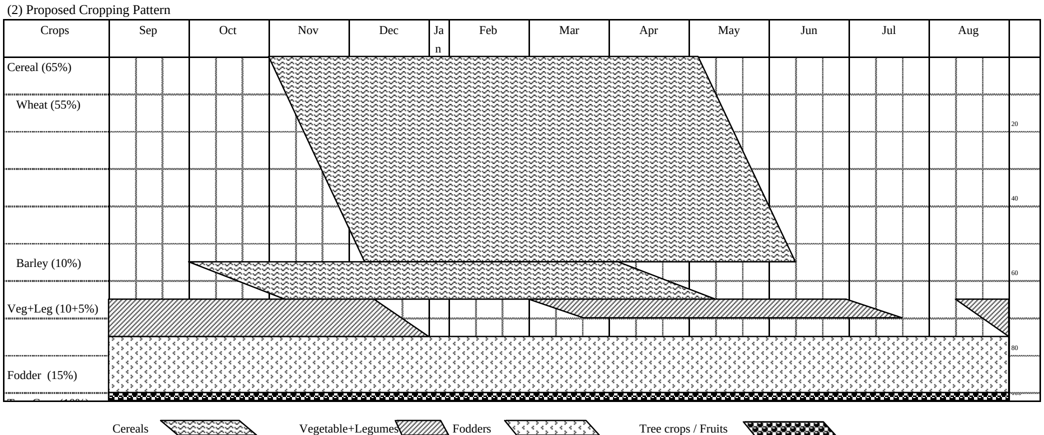
No.10 Timkit (Ifegh)

(1) Present Cropping Pattern Occupation of Fallow land = 4%



Above present cropping pattern shows in covering area only.

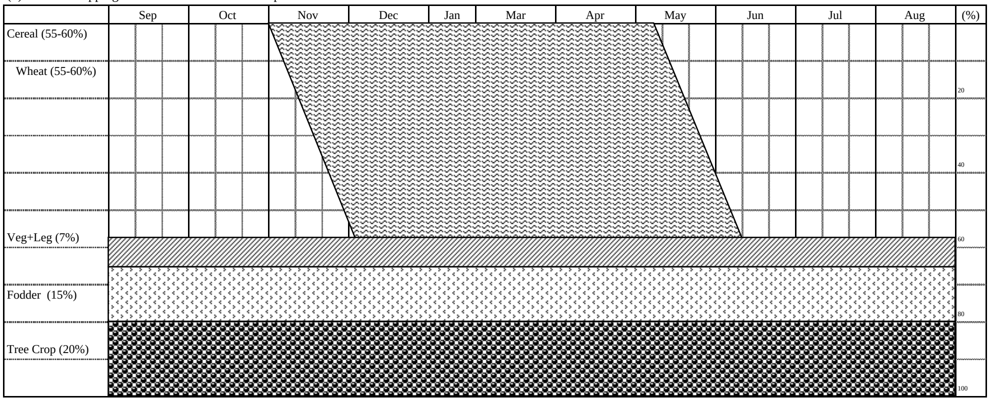
(2) Proposed Cropping Pattern



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XIII2.2.3** **Assolement Actuel Proposé dans les Projet de Priorité (Taskourt et Ifegh)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

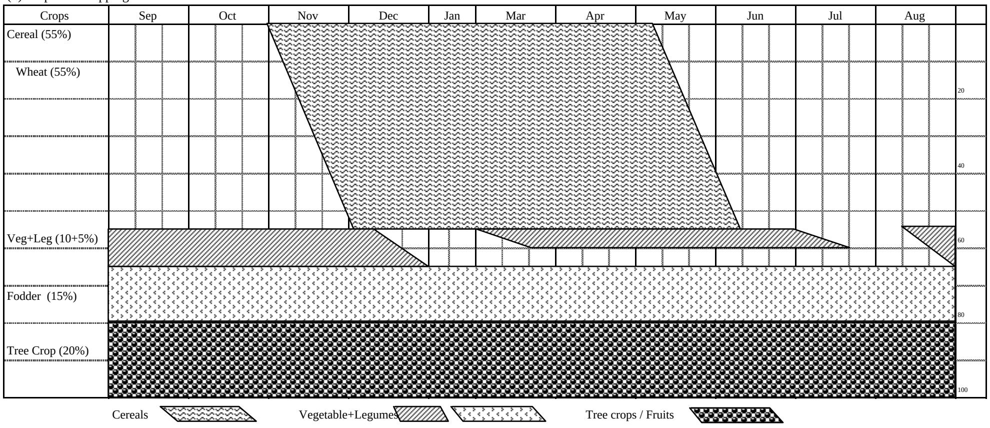
No. 10 Timkit (Tinejdad)

(1) Present Cropping Pattern Occupation of Fallow land = 16%



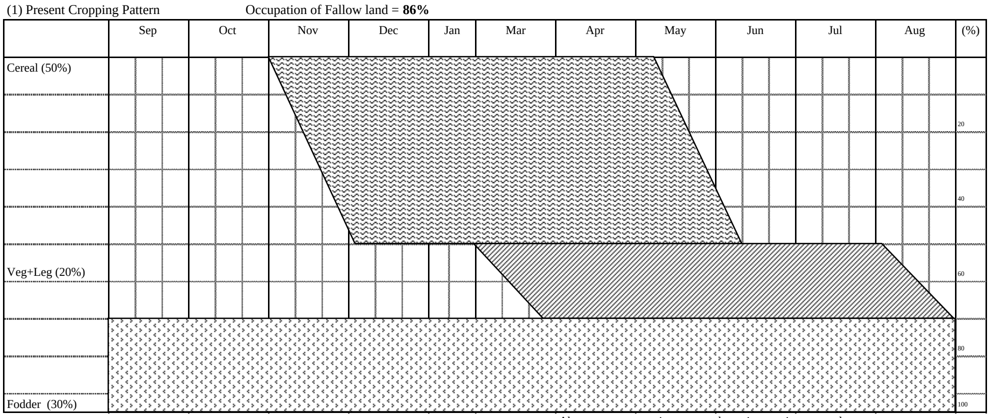
Above present cropping pattern shows in covering area only.

(2) Proposed Cropping Pattern



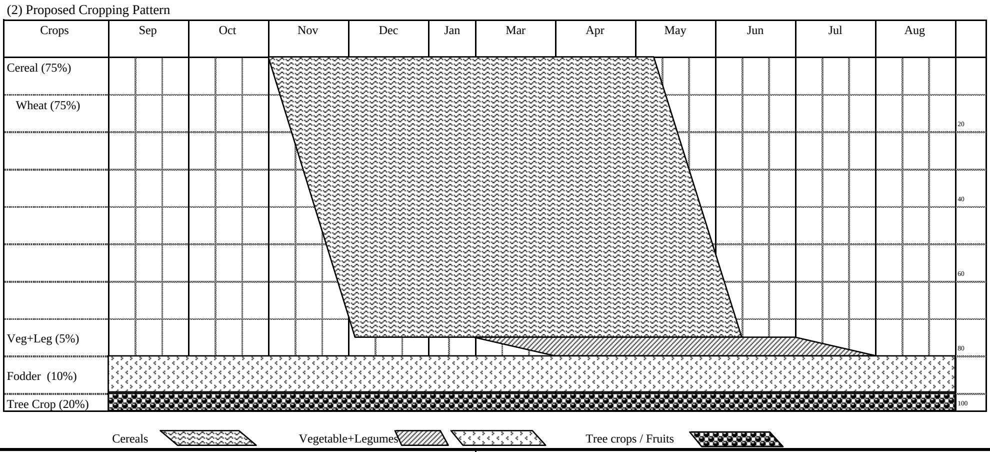
No. 10 Timkit (Chitam)

(1) Present Cropping Pattern Occupation of Fallow land = **86%**



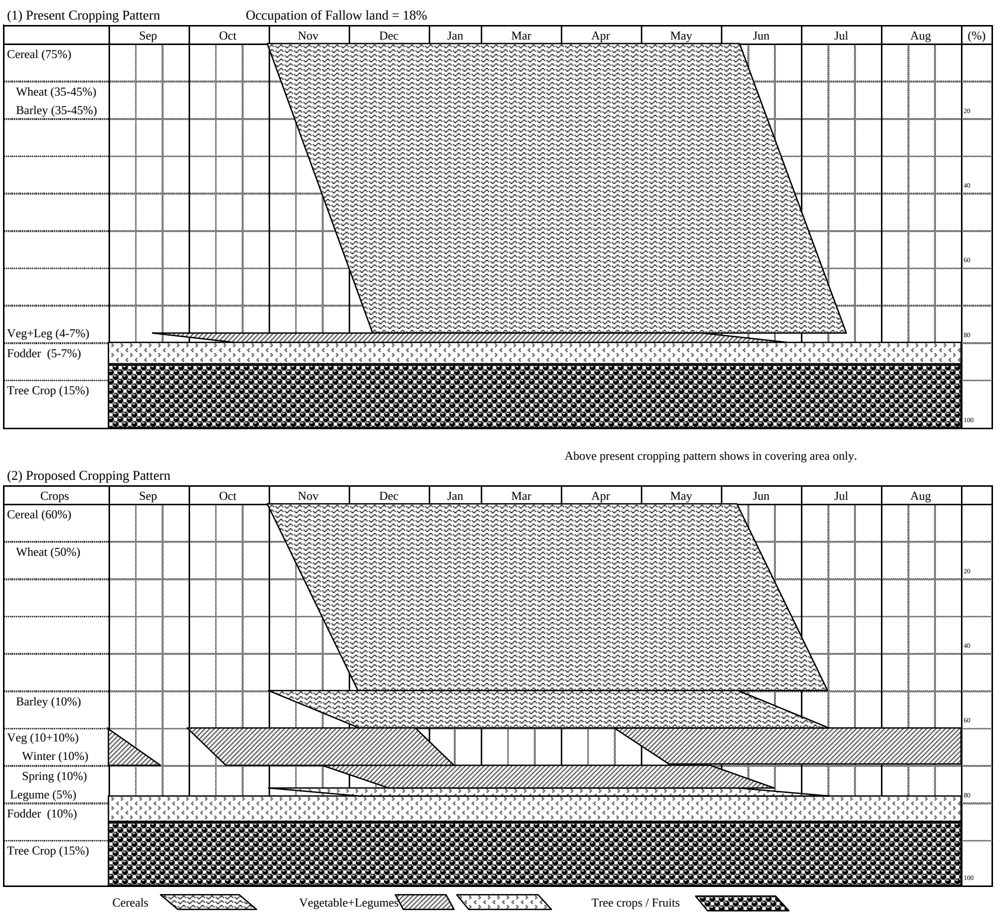
Above present cropping pattern shows in covering area only.

(2) Proposed Cropping Pattern

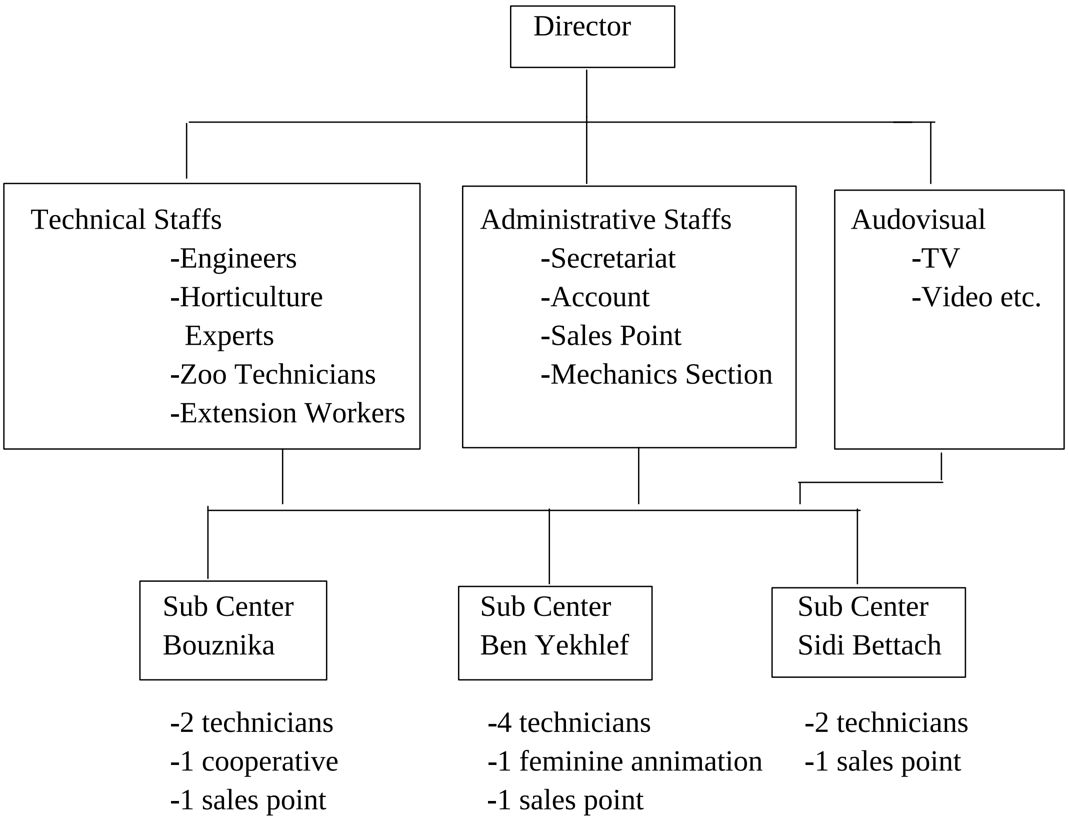


FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA JAPAN INTERNATIONAL COOPERATION AGENCY	**Figure XIII2.2.4** **Assolement Actuel Proposé dans les Projet de Priorité (Tinejdad et Chitam)**

No. 17 Azghar



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XIII2.2.5** **Assolement Actuel Proposé dans les Projet de Priorité (Azghar)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XIII4.2.1** **Structure Organisationnelle du Centre de Travail (CT) de Bouznika (No 5 N'Fifikh)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

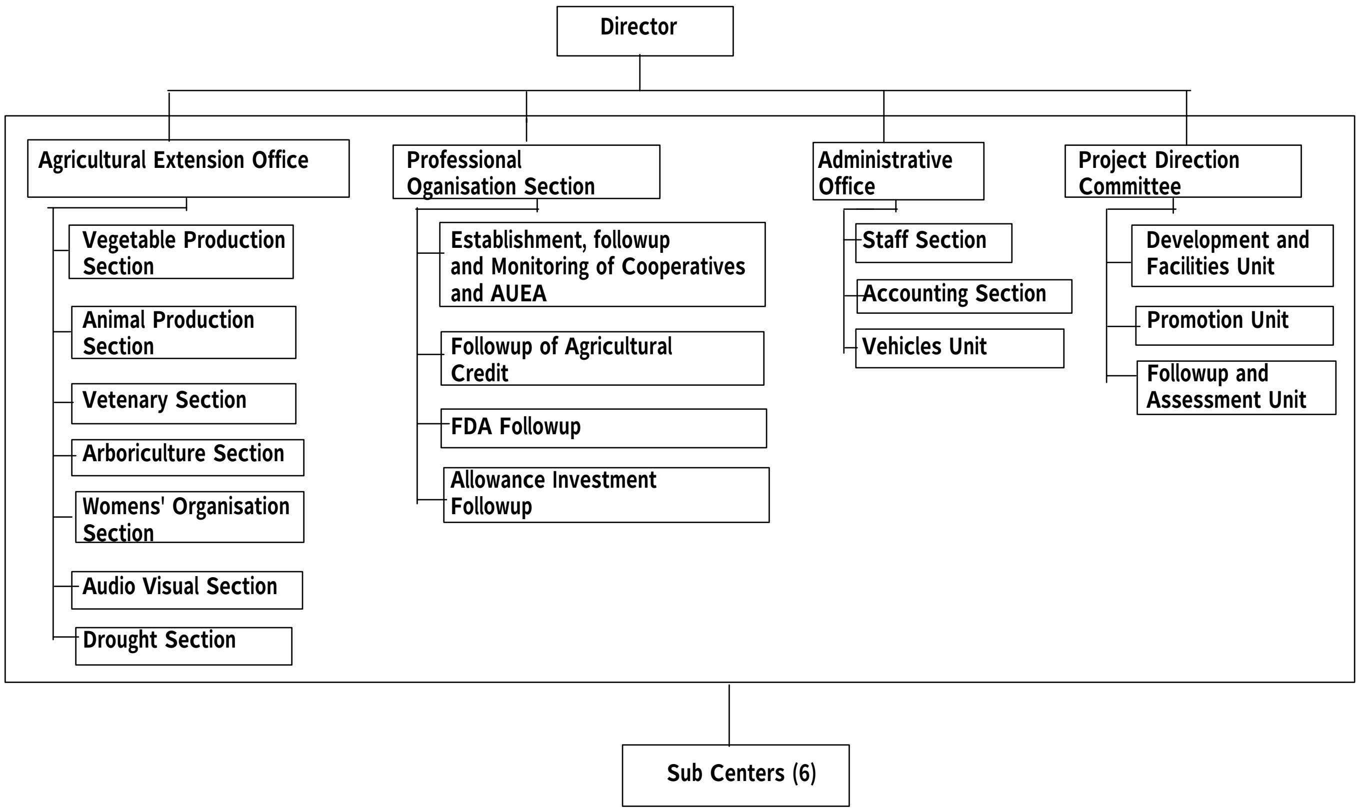


Figure XI4.2.2
Structure Organisationnelle du Centre de Travail (CT) de Chichaoua (No 9 Taskourt)

FEASIBILITY STUDY ON
WATER RESOURCES DEVELOPMENT
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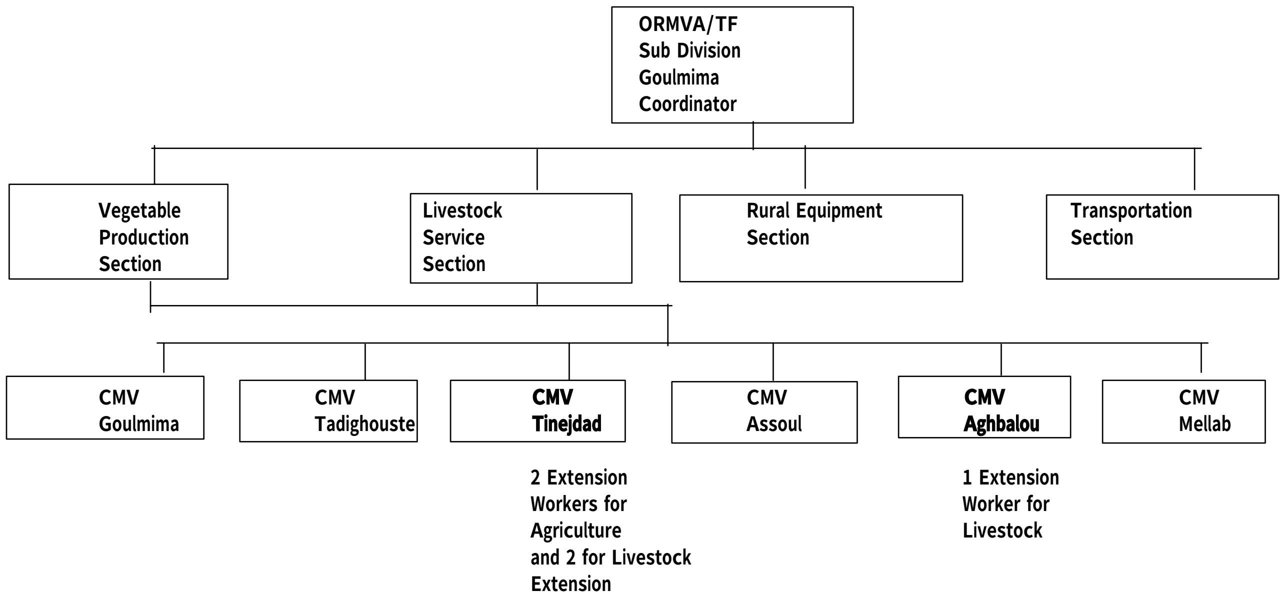
JAPAN INTERNATIONAL COOPERATION AGENCY



FEASIBILITY STUDY ON
WATER RESOURCES DEVELOPMENT
IN RURAL AREA

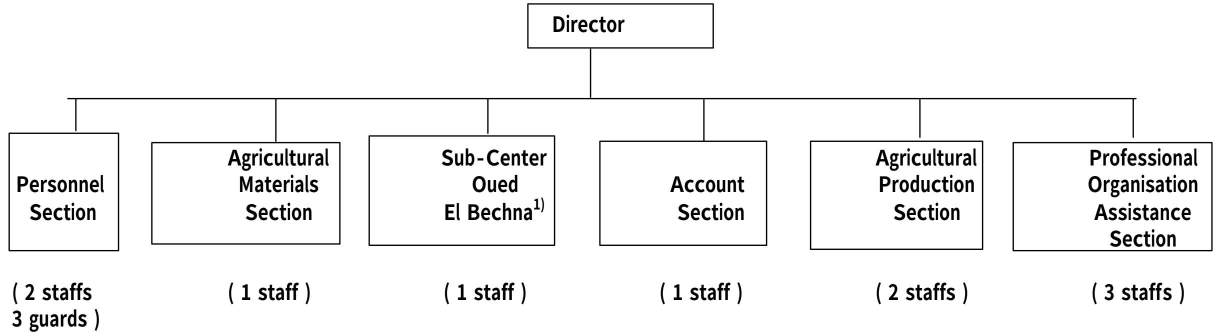
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure XIII4.2.3
Structure Organisationnelle du CMV (No 10 Tinkit)

FEASIBILITY STUDY ON
WATER RESOURCES DEVELOPMENT
IN RURAL AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure XIII4.2.4
Structure Organisationnelle du Centre de Travail (CT) de Ribat Al Kheir (No 17 Azghar)



Note: 1) However there is a provision for one sub center in Oued El Bechna but it does not exist presently

L'étude de Faisabilité Pour Le Développement des Ressources En Eau
Par Les Barrages Moyens Dans Le Milieu Rurale Au
Royaume Maroc
Rapport Final
Volume IV Rapport de Soutien (2.A) Étude de Faisabilité
Rapport de Soutien XIII
Sols, Agriculture et Irrigation

Attachment Spécifications Techniques pour l'enquête de Sol

ATTACHMENT

TECHNICAL SPECIFICATIONS FOR SOIL SURVEY

1. Objective

The objectives of soil survey, soil analyses are the identification and classification of soil groups as well as suitability of the land for irrigated farming.

2. Location of Soil Survey

Locations of the Projects and survey locations are shown in the following table. The total area to be surveyed by this CONTRACT is sixteen thousand and three hundred (16,300) hectares. Soil survey areas in each location are divided into one or more areas.

Details are shown attached Maps.

Project	Survey Location	Area	Total Area
(1)Azghar			**2,200ha**
	Left bank	300ha	
	Right Band (Upstream)	1,000ha	
	Right Band (Downstream)	900ha	
(2)N'fifikh			**2,500ha**
	Upstream area	1,100ha	
	Downstream area	1,400ha	
(3)Taskourt	Left bank	8,000ha	**8,000ha**
(4)Timkit			**3,600ha**
	Ifegh	300ha	
	Ait Labzen	1,900ha	
	Chitam	1,400ha	
Grand total			**16,300ha**

3. Soil Survey

Soil survey shall be carried out based on the Moroccan Standards justified by the Ministry of Agriculture, Rural Development and Fisheries.

Since the Ministry applied the French Soil Classification (C. P. C. S., 1967) as the Moroccan standard of soil classification, the soil survey shall be carried out in accordance with this system. The Ministry prepared its own classification system for land suitability for irrigation. Sampling condition and analysis shall be based on the system of land suitability classification. The criteria consist of various conditions for constraints of irrigation, which are shown in the table "Classification for Land Suitability" attached herewith.

The survey condition shall be as follows:

Survey Item	Sampling condition
(1) Photo Interpretation	Whole survey area
(2) Observation of soil profile	With Maximum of One (1) profile / 2.25ha 150 x 150 m mesh, depend on the topographical and soil conditions
(3) Topography Interpretation	Slope, Hydric erosion, Micro-relief
(4) Soil Feature	Soil depth, Texture, Stony, Salinity, Alkalinity
(5) Drainage Feature	Flood, Draining

In the maps of land suitability, following items should be symbolized and/or mentioned.

	Analysis criteria		
(1)	Slope	(7)	Hydraulic erosion
(2)	Flood condition	(8)	Micro topography
(3)	Drainage	(9)	Soil depth
(4)	Permeability	(10)	Stony
(5)	Salinity	(11)	Alkalinity
(6)	Texture	(12)	Lime stone

Class of each criteria to be mentioned in maps of land suitability shall be followed by table “Classification for Land Suitability”.

Maps of soils shall be prepared based on the Soil classification in Morocco.

Maps of soil and land suitability shall be prepared on the scale of 1/5,000.

Table: Classification for Land Suitability

1. Slope

Class		Level
Gravity	Sprinkler	(%)
V	IV	> 8
V	III	4-8
IV	I	2-4
III	I	1.5-2
II	I	1-1.5
I	I	< 1

2. Flood condition

Class	Risk of Flood
I	None
II	Light
III	Moderate
IV	Important
V	Very Important

3. Drainage

Class	Condition
I	Normal purification
II	Important purification
III	Very import. purification
IV	Normal drainage
V	Intensive drainage

4. Permeability

Class		Level
Gravity	Sprinkler	cm/h
V	IV	<0.5
IV	II	0.5-1
III	I	1-2
I	I	2-10
II	II	10-20
IV	IV	20<

5. Salinity

Class	Level (mmho/cm in extraction)
V	>32
IV	16-32
III	8-16
II	4-8
I	<4

6. Texture

Class		Texture
Gravity	Sprinkler	
IV	III	S
III	II	SL
II	II	SiL,
I	I	SC, SCL, L, LS, SiLS
II	I	C, CL, LC, SiCL
III	II	HC
II	II	Gravel (10-25%)
III	III	Gravel (25-50%)
IV	IV	Gravel (50-75%)

Gravel : 2mm – 9cm

7. Hydraulic Erosion

Class	Condition
V	No use
IV	Strong erosion
III	Moderate erosion
II	Low erosion
I	No erosion

8. Micro topography

Class		Relief Level (cm)
Gravity	Sprinkler	
I	I	0-15
II	I	15-30
III	II	30-60
IV	III	60-120
V	IV	>120

9. Soil depth

Condition in soil profile	Soil depth (cm) and Class				
	0-20	20-40	40-60	60-80	>80
S	IV	III	II	I	I
H	V	IV	III	II	I

S: The area where limestone

H: The area where found hard limestone

10. Stony

Level of stone (%)	Class (S/SS*)			
0-10	I	II	III	IV
10-25	II	II	III	IV
25-50	III	III	III	IV
50-75	IV	IV	IV	IV
>75	-	-	-	-

S/SS: Surface (0-20)/Sub-surface (20-40)

11. Alkalinity

Level (Na/CEC)	Class
>30%	V
20-30	IV
15-20	III
11-15	II
<10%	I

12. Lime stone

Level (%)	Class
< 7	Ca1
7-15	Ca2
15-25	Ca3
>25	Ca4

4. Soil Samples and Form of Delivery

Soil samples shall be taken from representative soil profiles in the study area. The fresh soil samples shall be directly delivered to the Laboratory of the CONTRACTOR for the chemical and physical analysis.

5. Sampling and Analysis of Chemical and Physical Properties

Collected samples shall be subjected (but not limited to) the following chemical and physical properties based on the Moroccan Standard for Chemical and Physical Analysis:

- Sample preparation
- Particle size
- Total Limestone
- Active limestone
- Organic matter
- Total Nitrogen
- PH of 1/5 water extract
- Equivalent water contents
- Available Phosphate
- Available Potassium
- EC of 1/5 water extract
- CEC & Exchangeable Bases
- EC & pH in saturation water extract
- Bases in saturation water extract
- Total Phosphate
- Total Potassium
- Measurements of Permeability
- Measurements of Hydraulic Conductivity

Proposed quantities for each item are listed as shown in Annex – A hereinabove of this Contract Document.

6. Methods of Analysis

The chemical and physical analysis shall be performed in accordance with the following methods or equivalents:

(1)	Sample preparation	Breaking up of aggregates carefully after perfectly air-dried by use of porcelain mortar; and then, sieving by the specific mesh of 2 mm size. Weighing gravels and stones over 2 mm in size. This sieved fraction (<2 mm) is used for further analyses.
(2)	Particle size	Fine particles, i.e. clay and silt portion be determined by mean of the Hydrometer method, namely shaking with sodium hexametaphosphate / sodium carbonate until the soil is perfectly suspended, and then, measuring silt+clay (0-50 micron) and clay (0-2 micron) after 40 seconds and 2 hours respectively. Sand fraction (50-2,000 micron) is obtainable by subtracting the sum of silt and clay from a total volume of the sample.
(3)	Total Limestone	Measurement by 25% HCl
(4)	Active limestone	Measurement by Oxalic ammonium, (Drouineau Method)
(5)	Organic matter	Analysis Total carbon by Walkley and Black method. Organic matter is calculated from the amount of total carbon
(6)	Total Nitrogen	Kjeldal digestion method
(7)	PH of 1/5 water extract	Measurement of pH (H2O) be made using suspension as soil and water ratio at 1:5
(8)	Equivalent water contents	Air-dried soil sample and distilled water is mixed and let the soil keep maximum water. Excess water will be drained and find the water amount to be kept in soil.
(9)	Available Phosphate	Olsen or Trony method
(10)	Available Potassium	Ammonium acetate extraction and measured by Flame Photometer
(11)	EC of 1/5 water extract	Measurement of EC be made using suspension as soil and water ratio at 1:5
(12)	CEC & Exchangeable Bases	CEC be determined by mean of successive leaching method using the 1N ammonium acetate (NH_4OAc), which shall be surely adjusted at pH 7.0. Extraction of Exchangeable Base by Ammonium acetate, Na & K; by Flame-Photometer method, Ca & Mg; by Atomic-Absorption spectro-photometer method
(13)	EC & pH in saturation water extract	Extract the soil solution from saturated paste. Measurement by EC meter and pH meter
(14)	Bases in saturation water extract	Na & K; Flame-Photometer method, Ca & Mg; Atomic-Absorption spectrophotometer method, method, CO3 & HCO3 ; H2SO4 titration, Cl : titration by KCl with AgNO3, SO4; Weight method
(15)	Total Phosphate	Extract Phosphate by three acid mixture (HNO3 + HCl + H2SO4) and analysis by Spectrophotometer
(16)	Total Potassium	Extract Potassium by three acid mixture (HNO3 + HCl + H2SO4) and analysis by Flame-photometer

(17)	Measurements of Permeability	Measure in auger hole or inverse auger hole
(18)	Measurements of Hydraulic Conductivity	Measure in auger hole or inverse auger hole

7. Reporting

The CONTRACTOR shall submit the following documents and statements to JICA TEAM.

Draft Final Report (After 3 months from Date of Contract)

(1) Performance Progress Report with maps,.................................... 3 copies

(2) Performance Finalized Report, including Method of Analyses
(copy of test manual) .... 3 copies

(3) Results of the Laboratory Test... 3 copies

(4) Draft Maps of Soil and Land Suitability on scale 1/5,000 .... 3 copies

Final Report (After 4 months from Date of Contract)

(1) Performance Final Report with maps, ... 3 copies

(2) Performance Finalized Report, including Method of Analyses
(copy of test manual) .... 3 copies

(3) Results of the Laboratory Test.. 3 copies

(4) Finalized Maps of Soil and Land Suitability on scale 1/5,000 .... 3 copies

(5) Data analyzed by Computer (Floppy diskette, CD)........................ 1 copy

(6) Performance Statement (Invoice), include the following terms:

- (a) Cost on a series of analysis for each soil sample
- (b) Total cost and its breakdown