Feasibility Study on Water Resources Development in the Kingdom of Morocco

Rural Area in

Final Report

Volume IV Supporting Report (2.A)

Feasibility Study

Supporting Report XIII Soils, Agriculture and Irrigation

FEASIBILITY STUDY
ON
WATER RESOURCES DEVELOPMENT
IN
RURAL AREA
IN
THE KINGDOM OF MOROCCO

FINAL REPORT

VOLUME IV
SUPPORTING REPORT (2.A)
FEASIBILITY STUDY

SUPPORTING REPORT XIII
SOILS, AGRICULTURE AND IRRIGATION

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SUPPORTING REPORT XIII

SOILS, AGRICULTURE AND IRRIGATION

XIII1 Soils

XIII1.1 Soils in Four Priority Areas

Soil survey was carried out at four priority project areas (7 location). Soil maps in each priority project areas are shown in Figures XIII1.1.1 to XIII1.1.7.

XIII1.1.1 Soils in N'Fifikh Area

(1) N'Fifikh Upstream Area

The soils of this area develop on the low and middle terraces in the large valley of the N'Fifikh River. Three types of soils mainly lie on the area:

i. Sols Peu Evolués d'Apport Alluvial (Alluvial Soils):

These soils developed from alluvial deposits are situated on the low terrace along the N'Fifikh River. The soils are very deep with silty texture. They are formulated by flooding of the N'Fifikh River. They are basically high land suitability for crops cultivations.

ii. Sols Isohumiques (Isohumic Soils) :

Sols Isohumiques extensively occupy on right bank of the river. The soils are very deep, reddish color and clayey texture. The soils do not have any constraint for irrigation.

iii. Vertisols:

These soils occupy large extent on the left bank of the river. The soils are very deep. They are characterized by clayey texture and low permeability, and have very high water holding capacities.

Locally, the soils present a stony load in middle surface. These soils have high potentialities for the crop production, but these soils located in flat to gentle inclined topography in this area.

Preliminary soil survey was carried out in the areas locating between dam site and N'Fifikh Upstream Area. The soils in the potential areas of irrigation were classified as Sols Peu Evolués d'Apport Alluvial.

These soils are suitable for any cultivation. The descriptions of soil profiles are shown in Data Book.

(2) N'Fifikh Downstream Area

The soils of this area develop on the low trays of the Meseta coastal. The area distinguishes itself by the dominance of Sols Hydromorphes and Sols Fersiallitiqueses.

i. Sols Hydromorphes (Hydromorphic Soils):

The soils are formed from old deposits of the Quaternary. They are characterized by a discontinuity of very clean profile texture. On the surface soils from 30 to 50 cm in depth, they are shaped by a horizon of coarse texture with strong content in ferruginous concretions (generally more than 50%). This horizon lies on accurate transition and subsurface soils are very clayey and compact horizon (argilite). This subsurface horizon constitutes an impervious layer that blocks infiltration of water and form water table in case of heavy rains. These soils present a major constraint of texture, discontinuity texture and internal drainage.

ii. Sols a Sesquioxydes der Fer (Fersiallitiqueses) (Red soils):

Sols a Sesquioxydes der Fer (Fersiallitiqueses) Rouge lie on the east borders of the potential area. The soils are deep (from 80 to 120 cm) and locally fairly deep (40 to 60 cm). Their textures are slightly sandy in surface and become clayey in depth. These soils are generally classified into high land suitability for crop production, but there is a constraint in their micro-topographical condition of undulating.

XIII1.1.2 Soils in Taskourt Area

There are following major four types of soils in the Taskourt area.

(1) Sols Alluviaux (Alluvial soils):

These soils, which are almost developed from alluvial soils, are situated on the low terraces of the Asif El Mal River and downstream of the project area. Main soils in these soils are Sols per Evolues D'apport allu-colluvial in the areas of upstream and Evolues D'apport alluvial in the areas of downstream. They are very deep soil. Their textures are generally silty.

These soils are apt to inundate in the low terraces locally. Most of these soils are put in high land suitability because of their silty texture. They are capable in all cultures.

Mineraux bruts sols occupy on the riverbed.

(2) Sols Bruns Calcaires: (Brown Calcareous Soils)

These soils as well occupy large extents in strand on left bank and of the river. Soil class of soil is in Calcimagnesiques. These soils are characterized by their shallow soil depth that are rarely 40 cm on thickness of surface soil and stony in surface. The areas located on these soils are also undulating on topographical condition. The major constraints of these soils are topographical condition.

(3) Sols Fersialitiques :(Fersialitic Soils)

These soils occupy large surface in the area and are concentrate completely on the terraces of upstream and downstream of left bank of the river in the project area. They are characterized by their red color and their fine texture. The soils have constraints of the slope. The shallow soil depth and stony on surface are recognized partly.

(4) Soils Isohumiques: (Isohumic Soils)

These soils occupy the areas of right bank of the river located in the downstream in the project area. The soils are very deep, reddish color and clayey texture. The soils do not have any constraint for irrigation. They are put in Class I in land suitability.

XIII1.1.3 Soils in Timkit Area

(1) Ifegh Area

This area is just located on downstream of proposed dam site situated on south of the High Atas Mountains. And proposed irrigable area is also divided into two locations, which are traditional farmland and newly extended area in rather downstream. Major soils in these areas are as follows:

i. Sols Peu Evolues

These soils are developed from the alluvial deposit. Sols Peu Evolues D’apport alluvial and Sols Peu Evolues D’erosion lie on the areas along the Timkit River. Soil groups of D’apport alluvial and D’apport anthropiques have deep soil and good soil texture. On the other hand, Sols Peu Evolues D’apport anthropiques occupy the south end of extension areas. Soil depths of these soils are relatively deep, but there are many stones and gravels, which are caused by the flooding.

ii. Sol Isohumiques

These soils are formulated by old alluvial deposit behind the Sols Peu Evolues along the river. These soils have brown color and fine soil texture.

Sol Isohumiques are devided into 3 series in terms of soil depth. Some of these soils contain much stones and gravels and soil depths are shallow, which are classified as Class V in land suitability. Terracing farmlands to be graded and leveled by farmers have been artificially developed in this area. In part of the area dominated by the seguia, soil becomes very shallow and farmers brought earth there to enable irrigated agriculture.

(2) Tinejdad Area

This area occupies a low alluvial terrace. Soils are homogeneous. It is the very deep alluvial soils and silty texture. Dominant soils in this area are Sol peu Evolues and Sols Isohumiques.

i. Sols peu Evolues

Sols peu Evolues occupy the areas between Toudorah and Ferkla Rivers and southern surroundings of the Toudorah River. These soils are very deep and silty texture. In some locations along the rivers, there are some areas, which are affecting by salt accumulation. Soil depths of these soils are relatively shallow.

ii. Sols Isohumiques

The areas near Tinejdad town are occupied by Sols Isohumiques. These soils are called as Sìerosèms, which have little organic matter and free calcium carbonate. These soils are brown color, sity texture and deep.

iii. Sols Mineraux Bruts

Sols Mineraux Bruts occupy the riverbed of the Toudorah River. Theses soils are formulated by recent alluvial deposit and eroded by flooding water at present condition. Soils are sand and depth of these soils is deep. Most of soils in this Tinejdad area don't present significant constraints for intensification of irrigation.

(3) Chitam Area

Main soils in this area are Sols Mineraux Bruts in north and Sol peu Evoluès in south.

i. Sols Mineraux Bruts

These soils mainly occupy the northern area of the study area. Surface soils are deposited deeply by strong wind. Soil texture of these soils is sand.

ii. Sols peu Evoluès

Southern part of the study area is occupied by Sols peu Evoluès. These soils are developed from alluvial deposits and have silty texture. There are three series in the difference of sand covering in the profile (no sand covering, 0 – 50cm and 50- 100cm).

XIII1.1.4 Soils in Azghar Area

This area is occupied a large floor-glaze of Zloul River shaped in the tender schistose marls of the Jurrassique in the north edges of the Middle Atlas.

Dominant soils in the area are deep Sols Isohumiqueses and Sols peu Evolues d'Erosions. Main constrains in this area is only topographical condition.

(1) Sols Isohumiqueses:

These soils occupy terraces where the gentle slope ranges between 2 and 4%. There are two types of soils. One is the brownish Isohumiqueses, which are mainly located at the upstream of the project areas, another is reddish Isohumiqueses located in the downstream of the project area. Their characteristics are similar, very deep, clayey texture, and locally stony. The soils have high fertility with various kinds of crop cultivations. The constraints of the area are in the slope and the micro-relief.

(2) Sols peu Evolues d'Erosions:

These soils situate in the areas where have relatively steep slope of 4 to 8%. The characteristics of soils are good but the depth of soils is little shallow (less than 40 cm). The main constraints of these areas are topographical condition.

XIII1.2 Land Suitability

XIII1.2.1 Adaptability of Moroccan Land Suitability Classification

The classification of land suitability in Morocco has mainly established and applied for the large-scale irrigation purpose. The classification is also categorized for the application of gravity and sprinkler irrigations.

Therefore, Moroccan classification of land suitability has severe definition of sloping. In this class, the area of 4 % of slope is classified in to Class V, which is not suitable for gravity irrigation. On the other hands, USBR (United States Department of the Interior, Bureau of Reclamation Manual) classifies this slope into "Class 2" which is arable area. And the areas, where have less than 8% of slope, are categorized as "Arable area". In due consideration of proposed irrigation scheme, proposed irrigation plan has been formulated and facilitated on the small-scale irrigation scheme. It is suggested that the areas sloped less than 8%, which is same classes with the sprinkler irrigation scheme can be adaptable for irrigation development plan on this study.

The areas of land suitability of each priority project areas in irrigable areas are summarized in Table XIII1.2.1. Survey areas are not matched with potential areas of irrigation in some areas. But most of the areas in each priority project areas are covering the area of irrigation development plan except in Tinejdad.

XIII1.2.2 Land Suitability in Four Priority Project Areas

(1) Land Suitability in N'Fifikh Area

- N'Fifikh Upstream Area

Detail land suitability classification in N'Fifikh upstream area is shown in Table XIII1.2.2 and map of land suitability is shown in Figure XIII1.2.1.

The main constraint in this area is topography (Initial letter "Pe"). Sloping areas (2 – 8%) cover the terraces in left bank of the river and soils mainly are Vertisols. But these slopes are not main constraints of the irrigation development.

- N'Fifikh Downstream Area

Land suitability map in N'Fifikh Downstream area are shown in Figure XIII1.2.2.

The main constraints in this are drainage, gravels and topography (Initial letters "D", "Tg" and "Pe").

Most of gravels are concretions formed by poor drainage condition. The areas where occur gravels are also located on the same areas of poor drainage condition. These areas are located on the areas of south and northern east in the project area.

The suitable areas (better than Class III) of irrigation occupy only the north part of railways and southeast part of the survey area. The areas having good soil texture are locating in the north part of railways, but undulating constraint on topography are also found at the same places.

In these areas, the distribution of irrigation facilities may be considered with this topography. The farmers who will able to joint to the cultivation live in north parts in the project area. The development potential in this area will be higher in the northern area of railways than southern part.

(2) Land Suitability in Taskourt Area

Detail land suitability classification in Taskourt area are shown in Table XIII1.2.2 and map of land suitability is shown in Figures XIII1.2.3 (1) and (2).

The major constraints in this area are stony and soil depth (Initial letters “C” and “P”).

The areas in Sols Calcimagnesisues have the constraint of soil depth and stony where classified as Class IV. These soils occupy the large extension of mid-stream of left and right bank in the project area. The shallow soils on the rock or/and stones of limestone cover these areas. In these areas, crop selection should be carefully considered. Presently, farmers are trying to remove these stones by them selves.

Large extend locating on the areas near the river covers suitable soil for the cultivation as Class II. But the soil depth in these areas is partially shallow.

Only the areas locating in right bank of the downstream of the river are classified into Class I but not much area in the potential area.

(3) Land Suitability in Timkit Area

- Ifegh Area

Detail land suitability classification of Ifegh in Timkit area are shown in Table XIII1.2.2 and map of land suitability is shown in Figure XIII1.2.4.

In the traditional cultivated areas along the river in the project, the soils are stony and shallow, which are classified into Classes IV or V. Also the areas classified to same Classes are scattered in extension areas.

On the other hand, the soils along the river in top of the upstream area and scattered areas in the extension areas are put in Classes I or II. The soils classified into Class III lies on the traditional farms and the southern areas in extension.

In Ifegh area, the major constrains are stony and shallow soil (Initial letters “P” and “C”). Farmers are grading and put dressing soil to be leveled and have been artificially developed in this area

- Tinejdad Area

Detail land suitability classification of Tinejdad in Timkit area are shown in Table XIII1.2.2 and map of land suitability is shown in Figure XIII1.2.5.

In the areas in Tinejdad, there are no major constraints. The areas located at the alluvial deposits in northern areas of Todrha River are classified into Class I. In

some spotted areas located along the river, the soils are classified into Classes III or IV and the constraint of these areas is sandy soil texture.

Most of the southern areas of Todrha River are also put in Class I or II which are suitable for cultivation except the areas near Tinejdad town. The areas classified into Class III are located on the southern edges of oasis, where are stony areas (Initial letter “C”).

- Chitam Area

Detail land suitability classification of Chitam in Timkit area are shown in Table XIII1.2.2 and map of land suitability is shown in Figure XIII1.2.6.

The main constraint of this area is sandy soil texture (Initial letter “C”). But most of the proposed development areas are can put in Class I to III and there is no serious constraints. And these soils are very suitable modernized cultivation such as drip and sprinkler irrigations.

The area located in eastern north area is put in Class IV, which is covered by sandy soil. This are should be considered the methods of water application when the cultivation will be carried out.

(4) Land Suitability in Azghar Area

Detail land suitability classification in Azghar area are shown in Table XIII1.2.2 and map of land suitability is shown in Figures XIII1.2.7 (1) and (2).

Major constraint of this area is only topographical condition (Initial letter “Pe”). Most of soils lied on this area have no serious constraints. They can put in Class II or III. The areas in left band of the Zloul River have the constraints of micro-topographical condition. The lands are undulating and shallow soils are covering.

In northern edges of the project areas where located on the inclined topography, shallow soils (20- 60 cm depth) lies on.

In this project area, however a large extends of the areas are locating on the area with major topographical constraint (Class V, 4 - 8% slope), these areas are definitely adaptable on the irrigation scheme which will be proposed on this project as mentioned in Section XIII 2.2.1.

XIII1.2.3 Soil Survey

(1) Survey Area

Survey areas in each priority project areas are shown in Figures XIII1.2.8 to XIII1.2.12.

(2) Field survey and analysis

Items of observations, analysis and map interpretations in the fields, and laboratory analysis are shown in the Attachment of this Supporting Report.

(3) Data lent to Soil Survey Company

- Aerial Photograph Observed

Following aerial photographs had been landed to the Soil Survey Company (Societe Centrale pour l'Equipment du Territorire, SCET-MAROC).

Sites	Photographing Data	Scale
N'Fifikh	4-Oct-2000	1:15,000
Taskourt	4-Oct-2000	1:15,000
Timkit	Sep-1993	1:17,500
Azghar	4-Oct-2000	1:15,000

- Topographical Map

Following topographical maps had been landed to the Soil Survey Company (Societe Centrale pour l'Equipment du Territorire, SCET-MAROC).

Sites	Scale	Type
N'Fifikh	1:5,000	By computer data
Taskourt	1:5,000	By computer data
Timkit	1:5,000	By maps
Azghar	1:5,000	By computer data

XIII2 Agriculture

XIII2.1 Present Agricultural Condition

XIII2.1.1 Present Land Use and Crop Production

Present land use in the 4 priority project areas are shown in the table on the next page:

The present conditions of agriculture have been analyzed by collecting 5-year's data from 1995/96 to 99/2000. The average production and yield of each crop were estimated by 3-year's data excluding maximum and minimum values.

Estimated Crop Occupancy in the 4 Priority Project Areas

Site	Crop Occupancy					Fallow Land	Irrigated Ocu.
	Cereals	Legumes	Vegetable	Fodder	Fruits		
N'Fifikh (Up)	85-90	5±	2±	5±	5±	9	3
N'Fifikh (Down)	80-85	1±	2-5	4-8	7±	22	5
Taskourt	>80	<2	5±	5±	7±	4	32
Ifegh	75±	3±		12±	10±	4	95
Tinejdad	55-60	2±	5±	15±	20±	16	75
Chitam	50	10	10	30	0	86	100
Azghar	75±	5±	<2	2-5	15±	18	6

Source: Estimation of the Study Team (Unit:%)

Main crops in these priority project areas are cereals. Fruits and fodders are commonly cultivated in each project areas. Irrigated occupancies in Timkit and Taskourt are higher than other 2 areas. The cultivations in N'Fifikh and Azghar are carried out under rain fed condition. The detail land use in the 4 priority project areas are summarized in below.

(1) N'Fifikh Area

- N'Fifikh Upstream

The area of N'Fifikh upstream is typical single cultivated area of cereals under rainfed condition. There are 2 commune rurals (Ziaida, Ouled Msdhya) located on this area. The crops productions in these 2 commune rurals are similar trends. Main cereals are soft wheat and hard wheat. Barley and maize are also cultivated in some area. The yields of these cereal crops are very low. The average yields of soft wheat and hard wheat in these 5 years are 1.4 and 1.2 ton/ha respectively. Vegetables are cultivated in the irrigated areas situated near the N'Fifikh River for self-consumption and cash income. Main vegetables are potato, tomato, pumpkin and onion. Legumes (broad bean and green bean), fodders (barley and oat) and tree crops (grape and olive) are cultivated in small areas (Tables XIII2.1.1 and XIII2.1.2). There are almost no productions of cereals, fodders and legumes in 1999/2000 because of the drought. Irrigation water is collected from ground water by traditional methods, but irrigated areas are very limited.

- N'Fifikh Downstream

Single cultivation of cereals under rain-fed condition is also predominant in the area of N'Fifikh downstream. There is only one Commune Rurals (Monsouria) located on this area. Main cereals are soft wheat and barley. Grapes are famous in this are, though their cultivated areas are not so large. Barley and oat are cultivated as fodder production. Vegetables (potato and tomato) and legumes are cultivated in very limited areas for self- consumption and cash income as

referred to Tables XIII2.1.3. Fallow land in the downstream area occupies larger area compared with the upstream area.

(2) Taskourt Area

The Taskourt area is located at the typical agricultural zone in the southeast Moroccan climate, which is relatively warm and low in precipitation. There are 4 Commune Rurals (Guemassa, Majjate, Assif El Mal and Mzouda) located on this are. Assif El Mal and Mzouda are occupied a large area of project area.

Main cereals consist of barley and soft wheat. The yields of these crops are very low. Fodder cultivation (alfalfa) is practiced in Assif El Mal along the river. Tree crops including olive and almond are widely cultivated. Olives are growing in flat lands and almonds, relatively sloppy areas. Main vegetables are melons in Guemassa, Majjate and Mzouda, and potatoes in Assif El Mal as referred to Tables XIII2.1.4 to XIII2.1.7.

The present land use in Taskourt is different in the areas of perennial irrigation area and seasonal/flood irrigation areas. Estimated present land use in Taskourt is shown as follows:

Estimated Present Land Use in Taskourt

Case	Crop Occupancy (%)				
	Cereals	**Legumes**	**Vegetable**	**Fodder**	**Fruits**
Total Area	>80	<2	5±	5±	7±
Perennial Irrigation Area	66±	2	12	5±	15±
Seasonal and Flood Irrigation Area	86±	0±	0±	0±	10±

Almost of legumes, vegetable and fodder crops are cultivated in the perennial irrigation area, while the cereal crops are mainly cultivated in seasonal and flood irrigation area.

(3) Timkit Area

There are three separate areas are in Timkit, Ifegh, Tinejdad and Chitam. These areas in Timkit are rather far away from big commercial areas.

i. Ifegh

Agriculture in this area is typical oasis one (high temperature and no precipitation) with traditional cultivation and small-scale farming. There is only one Commune Rurals (Agbalou-N"Kerdous) located on this area. The area consists by two lots, traditional farmland located near proposed dam site and newly extended area situated downstream of traditional farmland.

The cultivated areas of the commune rural in Ifegh area are shown in below: The farmers themselves consume the most of the present productions.

Main crops are cereals (hard and soft wheat, barley and maize), fodder (alfalfa) and tree crops (dates, olive and almond). Vegetables including potatoes, melons and onions are cultivated in limited area.

Cropped Area in the Ifegh Area

Crop	ha	Crop	ha	Crop	ha	Crop	Trees
Cereal	1,010	Legume	20	Vegetable	29	Tree Crop	(39,500)
Hard wheat	200	Broad B	14	Carrot	4	Dates	11,990
Soft Wheat	250	Green P.	6	Turnip	3	Almond	7,890
Barley	160			Onion	5	Olive	5,870
Maize	260	Fodder	170	Potato	7	Others	13,750
Millet	140	Alfalfa	170	Tomato	4		
				Others	6	Other	(103ha)

Source: Monographi de la Zone D'Action du CMV 720 D'Aghbalou N'Herdous

ii. Tinejdad

In this area, typical oasis agriculture (high temperature and no precipitation) is practiced by small landholders. There are 3 Commune Rurals (Ferkla el Oulia, Tinejdad and Ferkla es Soufla) located on Tinejdad and Chitam areas. The Tinejdad area has been faced with serious situation for agricultural activities because the ground water has been exhausted.

Main crops are cereals (hard wheat), fodder (alfalfa) and tree crops (dates and olive). The yields of cereal crops are high under irrigated cultivation (2.7 and 3.0 tons/ha in soft wheat and hard wheat respectively). Various vegetables such as tomato, potato, melons, carrot and onion are also commonly cultivated (Table XIII2.1.8).

iii. Chitam

In this area, the authority is trying to develop a farming area, which was ruined in 1970's due to exhausting of ground water. Small farms are scattered about the area. Cereals and fodder (alfalfa) are main crops in this area and most of the areas are still left as fallow lands (86% of potential land) as shown in below table.

Cropped Area and Occupancy in the Chitam Area

Crops	Cereals	Alfalfa	Vegetable	Legumes	Fallow	Total
Area (ha)	40	30	15	10	(595)	690
Occupation (%)	5.9	4.3	2.2	1.5	(86.2)	100

Source: ORMVA Tafilalet

Traditional cultivation has been practiced out in small lands under high temperature and no precipitation. Main crops are cereals (hard wheat) and fodder (alfalfa). Farmers come from surrounding areas such as Tinejdad and Goulmima. They have high-level cultivation technique.

(4) Azghar Area

The Azghar area is located in the typical agricultural zone in the northern Moroccan climate, which is relatively cool and high in precipitation.

There are 2 Commune Rurals (Igheznane and Ouled M'Koudou) located on this are. Irrigated area is very limited and most of the crops are cultivated under the rain-fed condition. Main crops in this area are cereals and olive. Main cereals are hard wheat and barley. The yields of hard wheat and barley are 0.6 and 0.7 tons/ha in the average of these 5 years, and these yields are very low. Legumes (broad bean and lentil) are also commonly cultivated. Olive cultivation is commonly practiced in the southeast part of potential area, where topography is undulating. Vegetables and other crops are cultivated for self-consumption. Barley and oat are produced for animal breeding (Table XIII2.1.9).

XIII2.1.2 Land Holding and Land Tenure System

The land holding sizes in N'Fifikh (Downstream), Taskourt, Tinejdad and Ifegh are shown in Figure XIII2.1.1 and Table XIII2.1.10. Averages farmland per farmer of N'Fifikh (Downstream) and Taskourt are 11.3 and 4.6 ha/farmer respectively in 1997. In these areas, the farmers have large areas. The farmers holding less than 5 ha of these areas are 45 % and 62% of total farmers respectively. On the other hand, the farmers of Ifegh and Tinejdad in Timkit area hold very small farmlands (0.65 and 1.91ha/farmer respectively). In N'Fifikh (Upstream) and Azghar, the data of land holding sizes are not found but the averages of farmlands per farmer are 8.5 and 4.4ha/farmer respectively in 1996.

In the areas of Azghar and Timkit, more than 94% of farmers are carried out agriculture on their land. On the other hand, 10 to 20% of farmers are working on the land of tenancy and/or sublease in Taskourt and N'Fifikh (Table XIII2.1.11).

XIII2.1.3 Present Cropping Pattern

Present cropping patterns of each priority project areas are shown in Figure XIII2.1.2. Cereal crops are cultivated in the winter season. The seasons of potato cultivation are in winter and spring. Tomato and melons are cultivated in spring.

XIII2.1.4 Present Farming Practice and Farm Inputs

Present cultivated cultivars of crops of commune rurals in the 4 priority project areas are shown in Table XIII2.1.12. Improved seeds of wheat are introduced, but their shares are only 5 to 20% of total consumed seeds. Main cultivars are Achtar and Merchouch. Barleys are almost local cultivars. Many cultivars of vegetables are widely introduced.

Utilization of agricultural inputs such as machineries, chemicals, fertilized and selected (improved) seeds are shown in Table XIII2.1.13 and summarized as follows:

Utilization of Agricultural Inputs by Farmers

	Mechanized Cultivation	Mechanized Harvest	Fertilizer	Selected Seeds	Agricultural Chemicals
N'Fifikh (UP)	◎	◎	◎	◎	◎
N'Fifikh (Down)	○	○	○	○	○
Taskourt	◎	○	△	△	△
Timkit	○	△	◎	△	△
Azghar	△	△	◎	△	○

◎:More than 60% ○: 60 – 30% △: Less than 30% (Rate of applied farmers)

N'Fifikh areas are commonly introduced these inputs. The utilizations of fertilizers by farmers are well extended, but the other inputs such as fertilizers, selected seeds and chemicals are utilized in some farmers.

Table XIII2.1.14 shows the numbers of agricultural machineries in the priority areas. Pumps are used in Timkit for irrigation from wells. Harvesters are only extended in N'Fifikh Upstream area.

The estimated present input values of agricultural machineries and labor forces of major crops in the priority areas are shown in Tables XIII2.1.15 to XIII2.1.19. Input values of wheat cultivation ranged from 1,600 to 2,700DH/ha. Input values of barley cultivations are lower than wheat cultivations. Inputs values of vegetables are more than 9,000Dh/ha.

XIII2.1.5 Livestock

The numbers of livestock in the priority areas are shown in Tables XIII2.1.20. The main table animals are cattle and sheep are in N'Fifikh, and cattle, sheep and goats in Taskourt and Timkit, mule in Azghar. Camels are breeding only Timkit area. Main draft animal is donkey in N'Fifikh, Taskourt and Timkit, mule in Azghar.

XIII2.1.6 Agricultural Products Processing

In the priority project areas, there are some facilities for agricultural products processing, but most of these facilities are organized by traditional systems. Major agriculture products processing are olive oil processing, milk collection and apiculture.

In the N'Fifikh Upstream area, since the cultivation of olives was introduced, only 10 years has passed. And there is no facility of oil processing so far. On the other hand, apiculture has been widely carried out in the mountainous area. Total 215 beehives are installed and approximately 650liters of honey was produced

annually. The productions are selling at the markets nearby. The milk production is also carried out. About 2,800 milk cows including local, crossbred and pedigree are breeding. The average amounts of milk productions are 8, 10-12 and 25 liters/ head /day, respectively.

In N'Fifikh Downstream area, there are no facilities of agricultural product processing. There was a cooperative of milk collection in 1990's, but this cooperative is not operated at the moment. The milk produced from 150 cows has been selling to the buyer from Mohamedia through the private routes.

In the Taskourt area, there are 35 traditional oil wringer machines of olive seeds in 11 Douars. The treatment amount of olive oil is 350ton/year in average and 1,050ton/year in maximum. About 35 % of olive seeds produced in this area have been treated in the factories in Marrakech. Apiculture has been seriously damaged by the drought in decade. About 6,000 beehives were installed in this area and 60 tons of honey was produced. There are some cooperatives of milk collection in Assif El Mar and Mejjat. The volume of milk collection is 714,000 liters/year.

There are no facilities of agricultural products processing in Ifegh and Chitam. Apiculture has carried out by using 800 beehives in Tinejdad.

In the Azghar area, olive cultivation has prosperously carried out. There are 26 traditional oil wringer machines in the project area. The treatment volume of these factories ranges from 120 to 140 ton/year in normal year. When the olive production is exceeding the treatment capacity in the site, the olive seeds have been treated by processing factory at the Mahzel. Other major processing facilities are not existing.

XIII2.1.7 Non-Agricultural Business and Educational Background

The non-agricultural businesses and educational background of farmers in the priority project areas are shown in Tables XIII2.1.21 and XIII2.1.22.

The fields of service, officer and private business are main non-agricultural businesses of farmers. There are many farmers in N'Fifikh and Timkit being engaged in non-agricultural businesses. Main businesses of these farmers are services and officers in N'Fifikh, construction and private business in Timkit. In the N'Fifikh and Timkit, There are many farmers who have the higher background of education (higher than high school education).

XIII2.2 Agricultural Development Plan

The proposed agricultural development plan has been formulated in consideration of the present land use, actual farming practices, intentions of local authorities and farmers, and the strategies of the Moroccan Government. The development plan has to contribute to the improvement of farmers' living

condition and be appropriate and sustainable. For the formulation of the agricultural development plan, the following basic strategies have been adopted as the general methodologies.

(1) Consideration of present land occupancy and farming practices

1) To introduce crops that farmers have sufficient experience and farming techniques

2) To formulate a plan based on the present cropping occupancy

3) To promote cereal cultivation that is most important for increasing stable income of farmers

4) To introduce crops in due consideration of marketing condition

5) To apply the most suitable crop rotation for annual cultivation

6) To formulate a land use plan with full assistance of the related authorities in view of technical support and marketing arrangement

(2) Consideration of agro-climatic condition and soil condition

1) To introduce crops that farmers have good experience in cultivation and formulation of a land use plan based on the agro-climatic condition

2) To formulate a land use plan to adopt soil conditions in sites

(3) Consideration of high value income under appropriate development

1) To introduce improved seeds of cereals

2) To introduce transplantation for some vegetable cultivation

3) To formulate a plan based on the most appropriate managements of irrigation, fertilization and chemical control

4) To introduce the crops those are considered sustainable for increasing farmers' income

5) To formulate a plan with fodders that are able to increase income from animal breeding

(4) Consideration of the national food security and the strategy of governmental policy

1) To formulate cropping pattern aiming at production of staple food, especially cereals for national food security, which is one of the most important strategies of the Moroccan Government

2) To target small and medium scale farmers as beneficiaries

3) To alleviate poverty, to mitigate rural differentials, and particularly to create job opportunities in the outskirts of main cities

4) To harmonize with other development sectors

5) To formulate land use plans from the economic and financial viewpoints of the project.

XIII2.2.1 The Project Area

Study areas of priority projects are selected from the area used as agricultural land. The total acreage of the Project Areas is 13,755ha of which 10,860ha is cultivable minimally. The acreages of each project area are shown below.

Total and Cultivable Area in the Priority Project Area

(Unit:ha)

Project Area		Study Area	Total Acreage	Cultivable Area
N'Fifikh	Upstream	1,250	1,250	1,170
	Downstream	1,700	330	280
Taskourt	Taskourt	8,000	6,000	5,330
Timkit	Ifegh	300	300	280
	Tinejdad	2,835	2,835	1,200+ α a/
	Chitam	690	690	690
Azghar	Azghar	2,350	2,350	1,910+ α a/
Total		17,125	13,755	10,860+ α

Note; a/ In Tinejdad and Azghar, there are the areas (1,333 and 131ha respectively) where are not included in soil mapping. However, there areas are nearly classified in cultivable area)

XIII2.2.2 Proposed Crops and Cropping Pattern

Proposed cropping patterns of each project area in due consideration of the basic strategies above mentioned have been proposed and formulated. Selection of crops, crop rotation, and the formulation of proposed cropping pattern and crop intensity have been carried out in consideration of the individual conditions of each project area. As shown in the tables of crop production in each area, the productions have been strongly affected by the meteorological condition. The increase of agricultural productions by the optimum irrigation through the installation of facilities has been suggested by previous projects. In Morocco, the irrigation projects have been developed, which achieved much higher productivity than without project.

(1) Selection of Crops

Selection of crops for adapting the proposed cropping patterns have been carried out in due consideration of the present cultivated crops, agro-meteorological condition, technical level of farmers and social conditions of each project area. As principals of selection of crops, cereals, fodders, legumes, vegetables and fruits (tree crops) have been considered. Basic principals for the selection of crops of each project are has been summarized as follows:

i. N'Fifikh Area

a) Upstream Area

- To promote present main cultivation (soft wheat)

- To extend fodder cultivation (alfalfa, barley)
- To extend vegetable cultivation
- To extend tree crop cultivations (grape, olive)

The alternative studies of different cropping patterns in N'Fifikh Upstream have been carried out to optimize the appropriate agricultural development plan. Three different cropping patterns have been studied as follows:

- Proposed Cropping Pattern
- Cropping pattern based on the present land use
- Cropping pattern to enhance vegetable cultivation

The alternative cropping patterns studied are shown in Figure XIII2.2.1.

b) Downstream Area

- To promote present main cultivation (soft wheat, barley)
- To extend fodder cultivation (alfalfa, barley)
- To extend vegetable cultivation and introduction of spring cultivation
- To extend high potential tree crop cultivations (grape)
- To attend soil drainage constraint

ii. Taskourt Area

- To promote present main cultivation (soft wheat, barley, alfalfa, tree crops)
- To extend wheat cultivation
- To extend vegetable cultivation
- To promote technical support of the related authorities
- To promote managing support of the related authorities for marketing
- To promote farmers' effort to remove gravels

iii. Timkit Area

a) Ifegh Area

- To promote present main cultivation (hard wheat, barley, alfalfa, tree crops)
- To introduce spring cultivation of vegetables
- To extend vegetable cultivation under oasis cultivation system
- To promote vegetables those are resistant against transportation and storage

b) Tinejdad Area

- Promote present main cultivation (hard wheat, alfalfa, tree crops)
- Introduction of spring cultivation of vegetables
- To extend vegetable cultivations under oasis cultivation system
- To promote vegetables, those are resistant against transportation and storage

c) Chitam Area

- To introduce crops suitable for sandy soils
- To introduce large-scale cereal (hard wheat) cultivation, possibly
- To extend vegetable cultivations under modernized system, possibly
- To promote vegetables those are resistant against transportation and storage
- To introduce tree crops (dates, olive) for production and windbreak purposes

iv. Azghar

- To promote present main cultivation (hard wheat, legumes, olive).
- To introduce alfalfa for livestock
- To extend vegetable cultivations
- To introduce spring cultivation of vegetables
- To introduce crops suitable for the prevailing agro-climatic condition (Fruits)

According to the field survey and statistical data in the each project area, these crops are widely grown, and the farmers in and/or around the project areas have long experience in cultivation.

Profitability and marketability for extended crops such as fruits and vegetables has been carefully considered, hence their introduction into the cropping pattern with a large area is decided in consideration with the present cultivated area.

Their production aiming at cash crops will require comprehensive development measures such as additional farming technologies, development of new markets including foreign countries, etc.

To achieve optimum development, the technical support of the related authorities and the managing support of the related authorities for marketing should be carried out.

(2) Proposed Cropping Pattern and Crop Intensity

Based on the above conditions, the proposed cropping patterns of each priority project areas have been formulated. The estimated present cropping patterns and proposed cropping patters are shown in Figures XIII2.2.2 to XIII2.2.5 in Main Report.

To minimize the water requirement and to maximize the beneficiaries are one of the most important essentials for the formulation of the proposed cropping pattern, hence the crop intensities of the cropping patterns are ranged from 100% to110% as shown in following table.

Proposed Crop Intensity in the Priority Areas

Site		Present (Estimated)	Proposed Crop Intensity					
			Cerelas	Fodder	Regumes	Vegetables	Fruits	Total
N'Fifikh	(Up)	91	30	25	30		15	100
	(Downm)	78	55	15	15		15	100
Taskourt		96	70	10	10		10	100
Timkit	Ifegh	96	65	15	15		10	105
	Tinejdad	84	55	15	15		20	105
	Chitam	14	75	5	10		10	100
Azghar		82	60	10	5	20	15	110

Source: Study Team

VIII2.2.3 Proposed Farming Practice and Farm Input

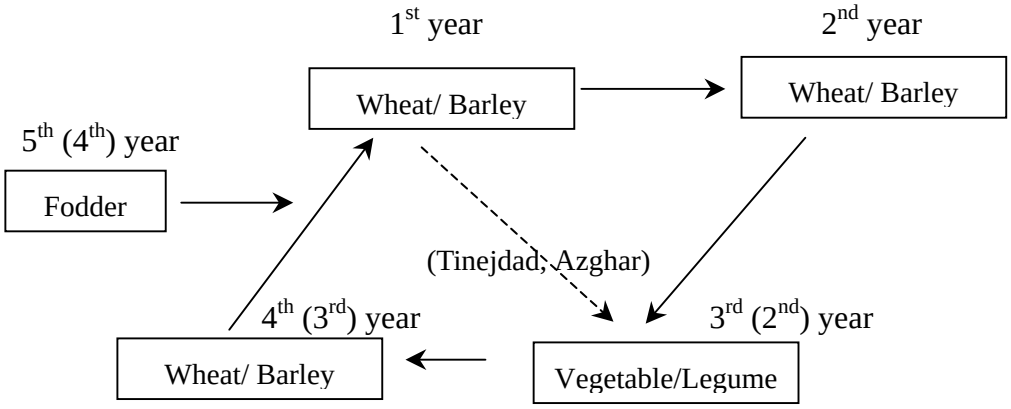
(1) Crop Rotation

Proper crop rotation is one of the most important farming practices due to the following reasons:

- To maintain the reasonable production by yearly cultivation
- To get maximum profit from the same piece of land
- To maintain soil in good physical and chemical conditions,
- Eradication of insects, disease and weeds,
- To increase productivity of the soil, and
- Proper utilization of irrigation water.

The following crop rotation will be recommended for the proper utilization of soils well as getting maximum profit. Based on the occupation of crops, 5 years rotation can be adaptable in the areas of N'Fifikh, Taskourt and Ifegh.

In the areas occupied by large areas of vegetables, legumes and fodder such as Azghar and Tinejdad are possible by 4 years rotation.



Alfalfa should cultivate for more than 3 years continuously. And the areas of vegetable cultivation should be change yearly.

(2) Appropriate Land Use

The land use plan is one of the most important plans to optimize the production from farmlands. The distributions of crops to the appropriate location should be carefully considered. Basic components of optimization of land use are topographical and soil conditions.

i. Topographical Condition

Flat areas can be adaptable for any kinds of crops. The distribution of irrigation can be easily applied to crops and the land preparation can also easily practiced. The mechanization is also adaptable.

Sloped and terrace areas should be considered for the selection of crops. Fruits crops such as olive and almond can be adaptable. The cultivations by sprinkler and drip irrigation systems should be considered on these areas.

ii. Soil Condition

Vertisols in N'Fifikh upstream area are not recommended for the cultivation of tree crops because of the deep cracking of soil following the cuts of roots. Stony and gravel soils in a part of Taskourt and Ifegh are not recommended for roots crops such as radish and carrot. Hydromorfic soils in N'Fifikh downstream and sandy soil in Chitam should be considered to minimize the application of water using drip irrigation.

(3) Land Preparation

For the proper seedbed preparation, land should be ploughed with machine and/or animal traction mounted plow once before starting cultivation of crops to pulverize the soil, control weeds and insect/pests and bury residue of the previous crops. After that the clod should break by a tractor mounted hallow, which should be followed by leveling. Before preparation of soil, irrigation should be applied once. In the areas where agriculture has not mechanized or where the machine cannot be adapted in small plots such as oasis farming area, ploughing the land 2 – 3 times should carry out for land preparation. It is recommended that deep ploughing should be used every third year to break the hardpan beneath the soil surface.

(4) Fertilizer Application

i. Chemical fertilizer

According to the present condition, the utilization of fertilizer including manure is rather insufficient due to the poor economic conditions of farmers. In these days, the numbers of farmers' applied chemical fertilizers has been increasing.

The chemical fertilizers are most important factor to get optimum yields and they should be applied to the fields. The most popular fertilizers are compound fertilizer (12-24-12) and TSP (Triple Super Phosphate) as base application and urea as additional dressing. Chemical fertilizer should be applied on the basis of the amount of recommendation.

ii. Manure and compost

Application of manure is also very rare even the most of farmers have livestock. Manure and compost have very important function to maintain the soils in good physical and chemical conditions, to eradicate insects, disease and weeds and to activate the biological condition of the soil. Compost can produce from bi-product material such as wheat straw, dead leaves and dung from livestock. The application of manure and compost is strongly recommended for sustainable crop production.

(5) Agro-chemical Application and Weed Control

A large number of agro-chemicals are recommended for use in various crops depending upon the insect species and other vertebrate pests such as rats and molls, etc. Liquid types of agro-chemicals are mixed with water and sprayed with hand or power sprayer. The dilution of chemicals should be followed the specification. Granule types are applied to the plant parts where insects/pests are hiding while powder forms be either mixed with water and sprayed with hand or power sprayer or broadcasted

Weed control is also very important to get maximum benefit from the crops. Weeds compete with the crops for water, nutrients and lights. Weed control can be done by a) crop rotation, b) mechanical control, c) manual control and d) chemical control. Presently a large number of herbicides are available in the market for weed control.

The present applied chemicals are shown in Table XIII2.2.1. These chemicals are necessary to get optimum yield and diseases and pests control. Therefore, the chemical control should be applied in the crops cultivation.

The present applied chemicals are shown in Table XIII2.2.1. These chemicals are necessary to get optimum yield and diseases and pests control. Therefore, the chemical control should be applied in the crops cultivation.

(6) Harvesting

In case of wheat and barley, well-ripened crops should be harvested. Threshing should be preferably carried out with a tractor-driven thresher. At the same time, straws should bale by tractor-driven baler into hay bales, and transported for

feeding of livestock. If the mechanized thresher is not available, the traditional thresher or treading the harvest materials with draft animal can be used.

(7) Storage and Processing

Post harvest loss should be minimized as less as possible. According to the survey in the priority project areas, the threshing of cereals are rather mechanized and post harvest losses are estimated to not much. However, losses of post harvest of vegetables, legumes and fruits are estimated high.

In case of cereal crops, the grain should be dried up to proper moisture contents before storage. The produce should be put in clean bags and stored into pest free and well ventilate rooms on wooded stacks 5 – 10cm above floor surface.

Vegetables, legumes and fruits should be sold as fresh product in the various markets. Transportation is also important. Some of vegetables, legumes and fruits should be stored into cold storage for selling at time when the fresh product is not available.

(8) Fruits (Tree crop) Cultivation

Income from fruits is one of the important sources for the farmers. However, the cultivation methods in Morocco are generally not unconvincing and extensive.

Olive trees (*Olea europaea* L) are most suitable on the climate in Morocco. Olives are grown on a wide variety of soils. Therefore there are no doubts to select soil in Morocco. They are tolerant of high pH, salinity, excess boron, and drought, but are sensitive to flooding. Pruning should be carried out. Olive trees need some stimulus each year to produce new fruiting wood for the following year's crop. For this purpose, the fertilization or by light thinning cuts designed to improve light penetration into the center of the crown should be carried out.

Almond trees (*Prunus dulcis*) are true Mediterranean fruit crop, requiring mild winters, and long, rain-less, hot summers with low humidity. Trees should be harvested when hulls of fruit in the interior of the canopy are open, since these split last. The seed coat turns brown during the drying-out process of maturation. Fruits are hulled and the hulls sold for livestock feed. Nuts should be dried in ovens (starting at 90C and increasing temp as moisture) in their shells to 10% moisture content (preferably 5-7%). Almond kernels can be stored for long periods if dry, or very long periods when frozen (years). Nuts for long-term storage should be fumigated for navel orange worm and kept at cold storage.

Grapes (*Vitis spp.*) are adapted to a wide variety of soil conditions. However, deep, well-drained, light textured soils are best for wine grapes. Highly fertile soils are unsuited to high quality wine production, since vigor and yield be controlled. Time of harvest should be determined mostly by appearance,

including color and size of berries for table grapes. The stems of the cluster turn a wood or straw color when berries are mature. Individual clusters should be clipped from vines with minimal handling. Clusters are picked into retail containers to minimize damage and handling. Shipping occurs immediately after harvest when possible, but some storage facilities should be necessary for marketing control. Grapes should be pre-cooled in forced-air rooms, where fumigation with SO_2 occurs.

Date palm trees (*Phoenix dactylifera*) are one of the main income sources in oasis agriculture in Timkit. Date palms should be fertilized once a year with manure. More importance is the supply of water; enough amount water should be necessary. Date pollen is abundant but is not airborne very far. Therefore, date palms need artificial pollination. The female inflorescences should be thinned out, or some removed entirely at pollinating time, or several weeks later when the stalk has drooped lower, in order to conserve the palm's energy for the following season. Without thinning, fruits would be borne only every other year. During the pollinating operation, a grower should tie the elongating flower stalk to a palm frond. A number of pickings have to be made over a period of several weeks. Soft dates may be picked early while they are still light colored. Semi dry dates may be picked as soon as they are soft and then ripened artificially. Dry dates should be left on the palm until they are fully ripe. Rain, high humidity during the maturing period may cause damages such as fruit drop, splitting of the skin, imperfect maturation, and excessive moisture content, or even rotting. Under such condition, dates must be harvested while still immature and ripened artificially.

XIII2.2.4 Farm Input

The Ministry of Agriculture, Rural Development and Fisheries have the recommended “Standard” to achieve the anticipated crops yields of crops as shown in Table V2.1.19 in Chapter V. And Estimated input values are shown in Table XIII2.2.2.

According to input requirement by the Moroccan Standard, the manure application is not mentioned. However, the manure applications are very important to get the annual maximum yields. Therefore, the Study Team will strongly recommend the application of manures in the cultivation of cereal crops.

XIII2.2.5 Anticipated Crop Yield and Crop Production

Ministry of Agriculture prepared the model for target yield and the period for target production for each crop with the introduction of the irrigation facilities by means of accumulation of the previous data. In the formulation of agricultural

development plan in the project, the team respects and follows these data. Ultimate crop yield are summarized in Table XIII2.2.3 and table below, some other anticipated crop yields have been estimated based on the data in Morocco.

Present yields of crops are very low in Morocco compared with any other countries, which have sufficient rain and irrigated areas. However, the data show that the yield of crops will be drastically improved by the proper management and operation. And particularly securing of irrigation water is most important factor to increase the production.

Table Ultimate yield of some selected crops

	Target yield by MAF a/	Range of anticipated yield b/)
Grain cereals (wheat)	4.0 tons / ha	3.0 –5.0 tons / ha
Straw of cereals	1,000 UF	
Grain corn	4.0 tons / ha	4.0 –5.0 tons/ha
Green vegetables	15.0 tons / ha	
Winter vegetables c/	28 tons / ha	16 – 29 tons / ha
Summer vegetables d/	35 tons / ha	20 – 40 tons / ha
Alfalfa e/	10,500/6,500 UF	80 – 100 tons / ha
Existing olive	10.0 tons / ha	12 – 16 tons / ha
Citrus f/	30.0 tons / ha	20 – 30 tons / ha
Potato f/	31.0 tons / ha	
Melon f/	31.0 tons / ha	
Tomato f/	50.0 tons / ha	
Dates f/	3.5 tons / ha	
Almond f/	3.5 tons / ha	
Grapes f/	10.0 tons / ha	
Broad bean f/	15.0 tons / ha	

a/ Target year at full production = 5 years
b/ Refer to Agricultural Compendium For Rural Development in the Tropical and Subtropics, Elservier
c/ Potato 50% & carrot 50%
d/ Tomato 50% & Water melon 50%
e/ Modified and estimated by the team
f/ Estimation from previous maximum yield in Morocco

XIII3 Irrigation Water Demand

XIII3.1 Basic Considerations

In this country, in order to compute the irrigation water demand in the existing condition, estimate of consumptive use has been based on the reference crop evapotranspiration worked out by the methods of Radiation, Blaney-Criddle, etc.

Recently, the Ministry of Agriculture, Rural Development and Fisheries (MOA) is re-estimating the water demand using the modified Penman method for the appropriate management of irrigation water.

According to the guidelines prepared by FAO (Irrigation and Drainage Paper No. 56 Crop Evapotranspiration, 1998), the modified Penman method is

recommended to be used as it offers the best results with minimum error of plus or minus 10% in summer, and up to 20% under low evaporative conditions. Whilst the Radiation method, in extreme conditions, involves a possible error up to 20% in summer, and the Blaney-Criddle method should only be applied for a period of one month or longer; in humid, windy, mid-latitude winter conditions.

Estimate of the water demand with project is based on the meteorological information of five stations of Fes (for Zone I), Marrakech and data on temperature recorded at the Sidi Jaber Station (for Zone II), Marrakech (for Zone III), Ouarzazate (for Zone IV) and Errachidia (for Zone V). Reference crop evapotranspiration (ET_0) worked out by the modified Penman method is shown in Table XIII3.1.1. It is understood that approximate reference crop evapotranspiration of the four stations is 2,000 mm/year, and that there are very little differences among the five.

The effect of the crop characteristics on crop water requirement is given by the crop coefficient (kc) which represents the relationship between reference crop evapotranspiration (ET_0) and crop evapotranspiration (ETcrop) or ETcrop = kc・ ET_0.

The effective rainfall (Pe) is calculated by analyzing rainfall records and preparing rainfall probabilities. In the Study, the effective rainfall is estimated by the evapotranspiration/precipitation ratio method (FAO Irrigation and Drainage Paper No. 25, Effective Rainfall, 1975) at dependable rainfall of 4 out of 5 years. The rainfall data observed at four stations of Ribat Al Kheir, Feddan Taba, Amizmiz, and Errachidia as shown in Tables XIII3.1.2, XIII3.1.3, XIII3.1.4 and XIII3.1.5 are used for estimating the effective rainfalls for the respective areas of Azghar, N'Fifikh, Taskourt and Timkit.

The net irrigation requirement (In) is calculated using the field water balance. The variables include crop evapotranspiration (ETcrop), rainfall (Pe), groundwater contribution (Ge) and stored soil water (Wb), or In = ETcrop – (Pe + Ge + Wb). In the Study, Ge and Wb are disregarded, and hence, In = ETcrop – Pe.

The project efficiency (Ep) in terms of meeting water at field level in quantity and time is determined by both water losses by canal seepage and the way the system is managed and operated. Additional water losses are incurred during field distribution and application. Farm layout, land leveling and irrigation practices greatly affect water use efficiency at field level. The calculation of the project water requirement (V) required for a given cropping pattern and intensity includes the net irrigation requirement (In) and other water needs including conveyance, distribution and application efficiencies of the system. These are

calculated on a monthly basis. Using average supply, the total project acreage can then be determined from the available water resources.

XIII3.2 Project Water Requirement of the N'Fifikh Upstream Area

XIII3.2.1 Gravity Irrigation of the Upstream Area (Alternative NU1)

The project water requirements for the proposed cropping pattern by means of gravity irrigation for the N'Fifikh upstream area are calculated to examine the irrigation extent as well as economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.2.1. In this calculation, data and information used and procedures are as follows:

(1) The reference crop evapotranspiration (ET_0) is estimated by the meteorological data observed at the Marrakech Station and modified by using temperature recorded at the Sidi Jaber Station;

(2) The crop coefficient (kc) is referred to the standard figures given in the Irrigation and Drainage Paper No. 56. The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the N'Fifikh upstream area which is shown in Figure XIII2.2.1 (No.1);

(3) The crop evapotranspiration (ETcrop) is the product of Items (1) and (2);

(4) The dependable rainfall 4 out of 5 years or 80% probability is estimated using the rainfall data observed at the Feddan Taba Station;

(5) The cropped area in each month is based on the proposed cropping pattern;

(6) The effective rainfall (Pe) in each month is the product of Items (4), (5) and the fraction obtained by the evapotranspiration/precipitation ratio method;

(7) The net irrigation requirement (In) is the difference between Items (3) and (6);

(8) The project water requirement (V) for the upstream area is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency, water released to the river – concrete lined canal – feeder canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%); and

(9) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 780 ha with 80% probability, whereas 1,000 ha with 20% probability.

XIII3.2.2 Gravity Irrigation of the Upstream Area (Alternative NU2)

The project water requirements for the existing cropping pattern by means of gravity irrigation for the N'Fifikh upstream area are calculated to examine the utmost irrigation extent as well as economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.2.2. In this calculation, data and information used and procedures are the same as above (1) except the followings:

(1) The monthly average kc was calculated based on the cropping pattern prevailing in the N'Fifikh upstream area, which is shown in Figure XIII2.2.1 (No.2);

(2) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 810 ha with 80% probability of rainfall, whereas 1,030 ha with 20% probability.

(3) Gravity Irrigation of the Upstream Area (Alternative NU3)

The project water requirements for the pattern by means of gravity irrigation in the N'Fifikh upstream area are calculated to examine the irrigation area and economic feasibility (to be discussed in Chapter XVIII) as shown in Tables XIII3.2.3. In this calculation, data and information used and procedures are the same as above (1) except the followings:

- The monthly average kc was calculated based on the cropping pattern proposed by the ADP Benslimane for the N'Fifikh upstream area, which is shown in Figure XIII2.2.1 (No.3);

- Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 590 ha with 80% probability of rainfall, whereas 740 ha with 20% probability.

XIII3.2.3 Mechanical/Gravity Irrigation of the Upstream Area (Alternative NU4)

The project water requirements for the proposed cropping pattern by means of mechanical (50%) and gravity (50%) irrigation for the N'Fifikh upstream area are calculated to examine the irrigation area and economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.2.1. In this calculation, data and information used and procedures are as follows:

- The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the N'Fifikh upstream area, which is shown in Figure XIII2.2.2 (No.5);

- The project water requirement (V) for the gravity irrigation area is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%);

- The project water requirement (V) for the mechanical irrigation area is estimated on the assumption that the overall irrigation efficiency is 68% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution (pipeline) + application efficiencies of sprinkler and drip irrigation: 85%); and

- Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 900 ha with 80% probability of rainfall, whereas 1,170 ha with 20% probability.

XIII3.2.4 Gravity Irrigation for the Highlands of the Left Bank by Lifting Water (Alternative NU5)

The project water requirements for the proposed cropping pattern by means of gravity irrigation for the highlands of the left bank of the N'Fifikh area by lifting water are calculated to examine the irrigation area and economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.2.1. In this calculation, data and information used and procedures are as follows:

- The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the N'Fifikh upstream area which is shown in Figure XIII2.2.1 (No.1); and

- Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 780 ha with 80% probability of rainfall, whereas 1,000 ha with 20% probability.

XIII3.3 Project Water Requirement for the N'Fifikh Downstream Area

XIII3.3.1 Mechanical Irrigation of the Downstream Area by Constructing a Weir for Pumping up Water (Alternative ND1)

The project water requirements for the proposed cropping pattern by means of mechanical irrigation (100%) for the N'Fifikh downstream area are calculated to

examine the irrigation area and economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.3.1.

(1) The reference crop evapotranspiration (ET_0) is estimated by the meteorological data observed at the Marrakech Station and modified by using temperature recorded at the Sidi Jaber Station;

(2) The crop coefficient (kc) is referred to the standard figures given in the Irrigation and Drainage Paper No. 56. The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the N'Fifikh upstream area, which is shown in Figure XIII2.2.2 (2);

(3) The crop evapotranspiration is the product of Items (1) and (2);

(4) The dependable rainfall 4 out of 5 years or 80% probability is estimated using the rainfall data observed at the Feddan Taba Station;

(5) The cropped area in each month is based on the proposed cropping pattern;

(6) The effective rainfall (Pe) in each month is the product of Items (4), (5) and the fraction obtained by the evapotranspiration/precipitation ratio method;

(7) The net irrigation requirement (In) is the difference between Items (3) and (6);

(8) The project water requirement (V) for the mechanical irrigation area is estimated on the assumption that the overall irrigation efficiency is 75% (conveyance efficiency of pipeline: 90%, and application efficiency of sprinkler and drip irrigation: 83%);

(9) Monthly mean discharge at the Rahal site for a period of 58 years are shown in Table XIII3.3.3;

(10) The base flow of the proposed weir sites (pump station) is estimated based on the dependable discharge of 80% probability as shown in Table XIII3.3.2; and

(11) Studies on water balance, which are made in Table XIII3.3.2 indicate that the net irrigation area is 210 ha with 80% probability rainfall, whereas 260 ha with 20% probability.

XIII3.3.2 Mechanical Irrigation of the Downstream Area by Constructing a Dam/Reservoir for Pumping up Water (Alternative ND2)

The project water requirements for the proposed cropping pattern by means of mechanical irrigation (100%) for the N'fifikh downstream area are calculated to examine the irrigation extent as well as economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.3.1. In this calculation, data and information used and procedures are the same as above (1) except the followings:

- The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the N'Fifikh downstream area, which is shown in Figure XIII2.2.2 (2);

- Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 470 ha with 80% probability rainfall, whereas 590 ha with 20% probability.

XIII3.4 Project Water Requirement for the Taskourt Area

XIII3.4.1 Gravity Irrigation through the Dam with a Capacity of 34 Mm^3 (Alternative TA1)

The project water requirements for the proposed cropping pattern by means of gravity irrigation for the Taskourt area are calculated to examine the irrigation extent as well as economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.4.1. In this calculation, data and information used and procedures are as follows:

(1) The reference crop evapotranspiration (ET_0) is estimated by the meteorological data observed at the Marrakech Station;

(2) The crop coefficient (kc) is referred to the standard figures given in the Irrigation and Drainage Paper No. 56. The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the Taskourt area that is shown in Figure XIII2.2.3 (2);

(3) The crop evapotranspiration is the product of Items (1) and (2);

(4) The dependable rainfall 4 out of 5 years or 80% probability is estimated using the rainfall data observed at the Amezmiz Station;

(5) The cropped area in each month is based on the proposed cropping pattern;

(6) The effective rainfall (Pe) in each month is the product of Items (4), (5) and the fraction obtained by the evapotranspiration/precipitation ratio method;

(7) The net irrigation requirement (In) is the difference between Items (3) and (6);

(8) The project water requirement (V) is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%); and

(9) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 3,530 ha with 80% probability, whereas 4,500 ha with 20% probability.

XIII3.4.2 Mechanical/gravity irrigation through the Dam with a Capacity of 34 Mm^3 (Alternative TA2)

The project water requirements for the proposed cropping pattern by means of mechanical (50%) and gravity (50%) irrigation for the Taskourt area are calculated to examine the irrigation area and economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.4.1. In this calculation, data and information used and procedures are the same as the above (1) except the followings:

- The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the Taskourt area that is shown in Figure XIII2.2.3 (2);

- The project water requirement (V) for the gravity irrigation area is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%);

- The project water requirement (V) for the mechanical irrigation area is estimated on the assumption that the overall irrigation efficiency is 68% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution (pipeline) + application efficiencies of sprinkler and drip irrigation: 85%); and

- Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 4,060 ha with 80% probability of rainfall, whereas 5,100 ha with 20% probability.

XIII3.4.3 Gravity Irrigation through the Dam with a Capacity of 24 Mm^3 (Alternative TA3)

The project water requirements for the proposed cropping pattern by means of gravity irrigation for the Taskourt area are calculated to examine the irrigation extent as well as economic feasibility (to be discussed in Chapter XVIII) as shown in Table XIII3.4.1. In this calculation, data and information used and procedures are the same as above (1) except the followings:

(1) The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the Taskourt area that is shown in Figure XIII2.2.3 (2);

(2) The project water requirement (V) is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%); and

(3) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 2,500 ha with 80% probability, whereas 3,150 ha with 20% probability.

XIII3.4.4 Mechanical/gravity irrigation through the Dam with a Capacity of 24 Mm^3 (Alternative TA4)

The project water requirements for the proposed cropping pattern by means of mechanical (50%) and gravity (50%) irrigation for the Taskourt area are calculated to examine the irrigation area and economic feasibility (to be discussed in Chapter XV) as shown in Table XIII3.4.1. In this calculation, data and information used and procedures are the same as the above (1) except the followings:

(1) The monthly average kc was calculated based on the cropping pattern proposed by the Study Team for the Taskourt area that is shown in Figure XIII2.2.3 (2);

(2) The project water requirement (V) for the gravity irrigation area is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency, water released to the river - main canal – feeder

canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%);

(3) The project water requirement (V) for the mechanical irrigation area is estimated on the assumption that the overall irrigation efficiency is 68% (conveyance efficiency, water released to the river - main canal – feeder canal: 80%, and distribution (pipeline) + application efficiencies of sprinkler and drip irrigation: 85%); and

(4) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 2,880 ha with 80% probability of rainfall, whereas 3,620 ha with 20% probability.

XIII3.5 Project Water Requirement for the Timkit Area

XIII3.5.1 Gravity Irrigation by means of Surface Water from the Timkit Dam and Subsurface Water Recharged with Floods (Alternative TI1)

The project water requirements for the proposed cropping pattern by means of gravity irrigation using surface water from Timkit Dam and subsurface water recharged with floods are calculated. This is to examine the irrigation extent as well as economic feasibility (to be discussed in Chapter XVIII) as shown in Tables XIII3.5.1, XIII3.5.2 and XIII3.5.3. In this calculation, data and information used and procedures are as follows:

(1) The reference crop evapotranspiration (ET_0) is estimated by the meteorological data observed at the Errachidia Station;

(2) The crop coefficient (kc) is referred to the standard figures given in the Irrigation and Drainage Paper No. 56. The monthly average kc was calculated based on the cropping pattern proposed for the Timkit area which is shown in Figure XIII2.2.3 (2), for the Ifegh area, Figure XIII2.2.4 (2) for the Tinejdad area, and Figure XIII2.2.4 (2) for the Chitam area;

(3) The crop evapotranspiration is the product of Items (1) and (2);

(4) The dependable rainfall 4 out of 5 years or 80% probability is estimated using the rainfall data observed at the Errachidia Station;

(5) The cropped area in each month is based on the proposed cropping pattern;

(6) The effective rainfall (Pe) in each month is the product of Items (4) and (5), and the fraction obtained by the evapotranspiration/ precipitation ratio method;

(7) The net irrigation requirement (In) is the difference between Items (3) and (6); and

(8) The project water requirement (V) for the Ifegh area is estimated on the assumption that the overall irrigation efficiency is 58% (conveyance efficiency of concrete lining canal: 90%, and distribution and application efficiencies of basin irrigation: 65%).

(9) The project water requirements (V) for the Tinejdad and Chitam areas by means of subsurface water are estimated on the assumption that the overall irrigation efficiency is 60% (conveyance efficiency: 90%, and application efficiency: 65%).

(10) The project water requirements (V) for the Tinejdad and Chitam areas by means of surface water from the Timkit Dam are estimated on the assumption that the overall irrigation efficiency is 46% (conveyance efficiency along the river and canal: 72%, and application efficiency: 65%).

(11) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 1,110 ha plus 240 ha for the Ifegh area.

XIII3.5.2 Gravity Irrigation by means of Subsurface Water Recharged with Timkit Dam and Floods (Alternative TI2)

The project water requirements for the proposed cropping pattern by means of gravity irrigation using subsurface water recharged with the Timkit dam and floods are calculated to examine the irrigation extent as well as economic feasibility as shown in Tables XIII3.5.1, XIII3.5.2 and XIII3.5.3. In this calculation, data and information used and procedures are the same as the above (1) except the followings:

(1) The monthly average kc was calculated based on the cropping pattern proposed for the Timkit area which is shown in Figure XIII2.2.3 (2), for the Ifegh area, Figure XIII2.2.4 (2) for the Tinejdad area, and FigureXIII 2.2.4 (2) for the Chitam area;

(2) The project water requirements (V) for the Tinejdad and Chitam areas by means of subsurface water are estimated on the assumption that the

overall irrigation efficiency is 60% (conveyance efficiency: 90%, and application efficiency: 65%).

(3) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 1,460 ha plus 240 ha for the Ifegh area.

XIII3.6 Project Water Requirement of the Azghar Area

XIII3.6.1 Gravity Irrigation of the Azghar Area (Alternative AZ1)

The project water requirements by means of gravity for the Azghar area are calculated as shown in Table XIII3.6.1. In this calculation, data and information used and procedures are as follows:

(1) The reference crop evapotranspiration, (ET_0) is estimated by the meteorological data observed at the Fes-Sais Station;

(2) The crop coefficient (kc) is referred to the standard figures given in the Irrigation and Drainage Paper No. 56. The monthly average kc was calculated based on the cropping pattern proposed for the Azghar area that is shown in Figure XIII2.2.5;

(3) The crop evapotranspiration is the product of Items (1) and (2);

(4) The dependable rainfall 4 out of 5 years or 80% probability is estimated using the rainfall data observed at the Ribat Al Kheir Station;

(5) The cropped area in each month is based on the proposed cropping pattern;

(6) The effective rainfall (Pe) in each month is the product of Items (4), (5) and the fraction obtained by the evapotranspiration/precipitation ratio method;

(7) The net irrigation requirement (In) is the difference between Items (3) and (6);

(8) The project water requirement (V) is estimated on the assumption that the overall irrigation efficiency is 52% (conveyance efficiency of concrete lining canal: 80%, and distribution and application efficiencies of furrow, border and basin irrigation: 65%); and

(9) Studies on water balance and/or optimization of dam scale indicate that the net irrigation area is 2,000 ha with 80% probability of rainfall.

XIII3.7 Net and Gross Irrigation Areas

The area that is determined by the water balance study made between the available water resources and the project water requirements estimated based on the dependable rainfall of 80% probability is defined as the net irrigation area which is commonly used for economic evaluation. However, it is preferable to increase the cultivation area as large as possible in the dry region such as this country where the available water resources are much less to meet the land resources, as the farmers intend to utilize the land to a maximum extent. To cope with this, another project water requirement is calculated on the basis of the dependable rainfall of 20% probability as shown in the lower part of Tables XIII3.2.1 to XIII3.6.1. It is proposed to determine the project area adopting the latter water requirements instead of the former. It is expected that incremental benefits may be gained when the rainfall exceeds that of the dependability of 80%.

It is understood from the tables that the water demand worked out on the basis of the dependable rainfall of 20% probability is lower than that calculated on the basis of the 80% dependability by 20% to 35%. In other words, the irrigation area estimated by the former will be larger than that estimated by the latter by 20% to 35% except Timkit area, where the rainfall is too little to be effective.

It is necessary to determine the area required for infrastructures i.e., canals, ditches, roads, etc, as well as buildings for storage, farming, accommodation, etc. It is a common practice to add 10 to 15% to the net irrigation area for such structures and buildings.

As a result of the discussions made above, the gross area should be as large as 1.5 to 1.6 times the net irrigation area with some allowance. It is noted that in future the irrigation area be increased by adopting water saving mechanical irrigation method such as sprinkler, drip, etc. The increased area, which is estimated at approximately 30%, can be accommodated in the gross area thus determined. In conclusion, the alignment of irrigation facilities and structures are proposed to cover the entire gross area.

XIII4 Agricultural Extension and Supporting Services in the Study Area

XIII4.1 Introduction

The grass level agricultural and livestock extension services are carried out by Work Centers (CTs) and CMVs. In N'Fifikh, Taskourt and Azghar, CTs under DPAs are responsible and in Timkit CMVs under ORMVA are responsible for the grass level extension activities. Sub Centers staffed by technicians provide

extension services. Extension activities aim mainly at utilization of inputs and machinery, loans, irrigation, cooperatives/farmers' associations, women's education etc. The extension workers are not only responsible for extension activities but are also responsible for preparing reports on contact, collecting statistics on the present agricultural situation etc.

XIII4.2 Extension Activities in the Study Area

XIII4.2.21 N'fifikh (No.5)

There are two Work Centers (CTs) responsible for the extension activities in the Study Area i.e., the CT of Ben Slimane for up stream and the CT of Bouznika for down stream respectively. The CT of Ben Slimane has four Sub Centers of which one is in Ben Slimane with 7 technicians and is responsible for the extension activities in the communes of Zaida and Malin Ghaba. The CT of Bouznika has 3 Sub-Centers of which one is in Ben Yakhlef with four technicians and one staff for feminine animation. The other Sub Center in Sidi Battach with two technicians specialized in livestock and big farming is responsible for the extension activities in the communes of Sidi Moussa Ben Ali and Sidi Moussa Majdoub). There are about 400 farm households per extension worker. Livestock extension is assisted by a multidisciplinary team of experts in the DPA that provides advice to technicians on livestock extension. The organizational structure of the Work Center (CT) in Bouznika is shown in Figure XIII 4.2.1.

XIII4.2.2 Taskourt (No. 9)

The extension activities in the Study Area are the responsibility of Work Center in Chichaoua. There are 6 Sub Centers under the CT of which 3 are in the Study Area, i.e., Guemassa, Assif El Mal and Mzouda respectively. The said Sub Centers are staffed by one extension workers each. The average farm households per extension workers exceed more than 2000 households. Concerning livestock extension, there are two livestock extension specialists under DPA and provide livestock extension services. For injection or treatment they have to relay on private veterinarians. The organizational structure of CT is shown in Figure XIII4.2.2. Insufficient extension workers, lack of transportation and communication means were observed in the Study Area.

XIII4.2.3 Timkit (No. 10)

Two CMVs one in Tinejdad and one in Aghbalou under ORMVA/TF are responsible for the extension activities in the Study Area. ORMVA/TF has one Sub Division in Goulmima that supervises the activities of the above CMVs.

There are altogether 5 Sub Divisions and 21 CMVs under ORMVA/TF. In the CMV of Tinejdad there are two extension workers for general agriculture and one for livestock production. In Aghbalou there is only one extension worker specialized in livestock (refer to Figure XIII4.2.3). The extension program consists of mass extension program, demonstration program, individual program etc. Lack of extension staff and lack of transportation means are the main obstacles of extension activities.

XIII4.2.4 Azghar (No. 17)

There are 4 Work Centers (CTs) in the province of Sefrou. The Work Center (CT) located at Ribot Al kheir is responsible for the extension activities in the Study Area. There are 6 technicians for extension activities and one is in charge of agricultural materials. Among 6 extension workers 2 are specialized in general agriculture, 2 in horticulture and 2 in livestock production respectively (refer to Figure XIII4.4.4). There are about 500 farm households per extension worker.

XIII4.3 Agricultural Marketing

XIII4.3.1 Marketing of Agricultural Products

The marketing system for most of the agricultural products have been fully liberalized. The marketing of food crops i.e., cereals, vegetables and fruits as well as livestock is dominated by private small traders. Agricultural marketing is characterized by large number of small traders who operate both from and outside the Study Areas and from nearest big cities i.e., in case of Timkit from Agadhir, Meknes for Azghar from Fees, for Taskourt from Marrakech and for N'fifikh from Casablanca, Mohammedia, Rabat etc.

The major destination of the agricultural products in the Study Area are local Souks. Souks are retail markets. The area of the Souks varies between 2 ha and 8 ha. Either farmers themselves bring the commodities to the market and sale it to the retailers or retailers/jobbers go to the farmers or big markets in town to procure and sale it in retail. Every retailers i.e. traders pay taxes to the local government, occupy the space and sale the commodities. The rules and regulations on transactions are formulated by the respective communes. The commune offices or municipalities are expected to provide services such as cleaning, setting disputes etc.

Cereal sellers sale their commodities at a retail price using a can called Abra or Moud as a standard measure. There are also butchers and slaughter houses in the market. It is difficult to estimate the total volume transacted in the market,

because no any record on transaction is available. Some Souks used by the farmers in and around the Study Area are shown in Table XIII4.3.1.

(1) N'Fifikh (No.5)

Farmers in the Study Area sale their products either to the wholesalers from the big markets from Casablanca, Mohammedia, Rabat etc. or sale in the local markets called Souks. There are five Souks used by the farmers namely, Tlet Zaida, Arba Ben Slimane, Jemaa Fedalette, Khemisse Bouznika and Ahade de Beni Yakhlef.

(2) Taskourt (No.9)

There are four Souks Had M'jjate, Arba Frougma (Guemassa), Sebt Mzouda (Mzouda) Arba Assif El Mal in the Study Area. Agricultural products, livestock, daily use commodities etc. are sold in those weekly markets. Traders from other areas or big markets from Marrakech, usually used those Souks for the procurement of agricultural and livestock products.

(3) Timkit (No.10)

Two Souks, Had Tinjedad and Tlet Gulmima were the main Souks used by the farmers of the Study Area.

(4) Azghar (No.17)

The major destination of the agricultural products in the Study Area is the Souk of Tinin Ribat Al Kheir.

XIII4.3.2 Marketing of Agricultural Inputs

(1) N'Fifikh (No.5)

Owing the good excess to the big cities as Casablanca, Mohammedia or Rabat, It is estimated that about 95% of the farmers buy agricultural inputs from private traders rather than from the sales points of CTs. It is estimated that the price of inputs in private shops are cheaper by 10% in average.

(2) Taskourt (No.9)

Farmers of the Study Area procure agricultural inputs from the sales point of CT in Chichaoua. Chemical fertilizers and traditional seeds are also available in weekly markets (Souks) or private shops, but certified seeds are only available in the sales point of CT. It is estimated that the use ratio of certified seeds is about 10%, so the consumption of chemical fertilizers and other agro chemicals is

estimated very low. Agricultural inputs are mainly procured by CT from Casablanca and are sold at the same prices.

(3) Timkit (No.10)

Farmers of the Study Area buy agricultural inputs from the sales point of CMV or from private shops. SONACOS has a sales point in Errachidia and FERTIMA has four sales points in Errachidia of which one is in Goulmima. Prices are rather low at private shops, so the share of agricultural input supply of private traders is in increasing trend.

(4) Azghar (No.17)

Agricultural inputs, such as seeds, fertilizers, pesticides etc. are available at the sales point of CT at Ribat Al Kheir which lies at a distance of about 4 km from the Study Area. Fertilizers and seeds of traditional varieties are also available in the weekly market at Al Kheir or in private shops. The use of certified seeds are estimated at 7% and the remaining is traditional. Prices of fertilizers and other inputs are rather low in the private shops than the sales point of CT.

XIII4.4 Agricultural Credit

The main sources of agricultural credit in the whole Study Area are CLCA and CRCA. Farmers must own land to be eligible for loan. The amount of loan is determined according to the value of land. The maximum amount of loan provided by the CLCA is 120,000 Dh and farmers or agro-industries who need loan more than this ceilings are referred to CRCA that provides maximum amount of 800,000 Dh. Loans are provided for short term (less than 12 months), at an interest rate of 8.5% to 11.0%, medium term (2 to 5 years) at an interest rate of 11.0% and long terms (5 years and above) at 12.0% respectively.

XIII4.5 Agricultural Subsidy

From Agriculture Development Fund (FDA) subsidies are provided for the purpose of hydro-agricultural facilities construction, land improvement, production of certified cereal seeds, utilization of certified cereal seeds, farming equipment, intensification of livestock production, air freight for exportation of agricultural commodities etc. The rate of subsidies is shown in Table XIII4.5.1.

XIII4.6 Cooperatives and Farmers' Organizations

The stable irrigation water supply will make it possible to expand the cultivation area and will intensify the use of land and in some places crops will be diversified. Proper management of irrigated water in all parts of the system is essential to obtain the full benefit of the project.

At present there are several cooperatives and farmers' associations, however those cooperatives or associations include only few farmers, and their activities are confined only on few activities such as water use, milk collection and marketing and sheep breeding etc.

XIII4.6.1 N'Fifikh (No.5)

There are several cooperatives in and around the Study Area and majority of them are milk collection and marketing cooperatives as shown in Table XIII 4.6.1. There are three farmers' associations, N'Fifikh River Water Users' Association (Association des Usagers d'eau d'Oued N'Fifikh), Red Meat Producers' Association (Association des Producteurs de Viande Rouge) and Young Farmers' Provincial Association (Association Provinciale des Jeunes Agriculteurs ; APJA).

XIII4.6.2 Taskourt (No.9)

There are 4 Water Users' Associations in the Study Area, two in Assif El Mal one in Guemassa and one in M'jjate respectively. Those associations were established after 1996 and have altogether 650 households as members and every household pays 100 Dh per annum as membership fees. Thee are 8 cooperatives in the Study Area 3 in the commune of M'jjet, 3 in Assif El Mal, one each in Guemassa and Mzouda respectively. All cooperatives but two are milk collection and marketing cooperatives (refer toTable XIII4.6.2).

XIII4.6.3 Timkit (No. 10)

In the Study Area there are 6 cooperatives of which 5 are in the Commune of Tinejdad and one in Aghbalou. 4 cooperatives are active in sheep breeding, one in apiculture and one in pumping as shown in Table XIII4.6.3.

XIII4.6.4 Azghar (No.17)

There are no cooperatives and farmers' organizations in the Study Area, however some farmers are the members of provincial comparatively large cooperative and association called ASSAS (Association ds Arboriculture de Sefrou) and Red Met producers' Association.

XIII4.7 Household Economy

In the rural areas of Morocco, agriculture is the main source of income and employment. The rural economically active population represents about 50% of the total economically active population and agriculture sector provides employment to nearly 80% of the rural employment.

In the whole Study Area agriculture and livestock production is the important source of income. However, due to the successive periods of draught and the degradation of the grazing land, more and more households are engaged in non-agricultural activities to generate income.

XIII4.7.1 N'Fifikh (No.5)

According to the household interview survey, 52% households were engaged only in agriculture and livestock keeping, whereas the other 48% were engaged in agriculture and other activities as labor, small business etc. Owing to the proximity to the big cities, like Casablanca, Mohammedia, Rabat etc., there were more opportunities for employment. The total average annual family income was estimated at 47,900 Dh. And the annual total family expenditure was 15,600 Dh (refer to Table XIII4.7.1).

XIII4.7.2 Taskourt (No.9)

The major economic activities were agriculture, livestock rearing, small business, seasonal labor etc. that generated annual average family income of 27,000 Dh. According to the household interview survey, 50% of the active men labor force found employment in big towns like Marrakech, Agadhir etc., for two to three months during a year which generated about 27% of the total family income. The total average family expenditure was estimated at 17,100 Dh per annum (refer to TableXIII4.7.1).

XIII4.7.3 Timkit (No.10)

In the Study Area of Timkit 47% of the respondent households were engaged in agriculture cum labor, whereas 19% were engaged only in agriculture and livestock rearing. Because of the draught during recent years, majority of the households were forced to get some source of alternative income. According to the household interview survey nearly two third of the young labor force goes to the cities for seasonal employment. The average annual family income was 32,400 Dh and the annual average family expenditure was 16,100 Dh (refer to TableXIII4.7.1).

XIII4.7.4 Azghar (No.17)

In the Study Area, the important source of income is agriculture and animal husbandry. According to the household interview survey 43% households were engaged only in agriculture and animal husbandry whereas another 57% were engaged in agriculture/animal husbandry cum other activities like small business, labor etc. The annual average family income in Azghar was estimated at 23,700 Dh and the average annual expenditure was 16,300 Dh (refer to TableXIII4.7.1).

XIII4.8 Recommendations for the Development of Extension and Supporting Services

XIII4.8.1 N'Fifikh (No.5)

(1) Extension Services Strengthening

The strengthening proposal of Work Centers (CTs) is directed to the enhancement of the capacity of CTs, Sub-Centers or field extension workers, that are expected to take core functions under the project.

- Logistic support strengthening : provision of motorcycles to the field staffs.
- Capacity building of field extension workers: in-service training. They should be provided in-service training at the province level.
- Strengthening of technical guidance of CTs: train farmers by demonstration of developed farm technology at demonstration plots in farmers' fields.
- Farmers' Training (Crop Production): recommended practices, pest control, chemical use etc.
- Demonstration trials: new crops, variety, fertilization rate, recommended package technology, irrigation methods and water management

(2) Formation/Strengthening of Farmers' Associations/Cooperatives

New associations should be established in the Study Area, and they are expected to support production activities, group purchage of farm inputs, joint collection and delivery of vegetables/fruits, agricultural credit etc.

XIII4.8.2 Taskourt (No.9)

(1) Extension Services Strengthening

In the Study Area, there are more than 2,000 farm households per extension worker and lack of transportation and communication means is also a serious problem. The following items are recommended to strengthen the extension services in Taskourt.

- Logistic Support Strengthening: provision of mottorcycles to the field level extension workers and 4 wheel vehicles to the CT. And posting of more extension workers to the sub-centers.
- Capacity building of field extension workers: inservice training at provincial level
- Strengthening of technical guidance of CT: establish an adoptive trial farm to train extension workers as well as farmers. Posting an experienced staff in irrigated agriculture in the project area.
- Production Demonstration: production demonstration will be conducted in the farmers' fields to transfer technology effictively. Proved techniques in a similar environment should be demonstrated.
- Farmers' Training (Production): farmers should get training on harvesting, packing and transport, use of fertilizer and other chemicals etc.

(2) Marketing Support

Consideration have been given to proposals that would enhance market efficiency by bringing together buyers and sellers for marketing cost effective transcations.

- Collection Center: presently farmers do not have collection centers after harvest. Establishment of collection centers of simple structure with roof and concrete floor can be used for group delivery to big markets like Marrakech, Casablanca etc. Local Souks with concrete floor and roof like Haad M'jjate, Arbaa Frouga, Sebt Mzouda may be used as collection center on non market days.
- Market Information: information on market situation should be provided through CT. With adequate market information farmers can plan, what to produce, when to produce and how to produce etc.

(3) Formation and Strengthening Farmers Assocations/Cooperatives

In the Study Area, there are six milk cooperatives, and four water users' associations. Water users' associations were created mainly for water distribution, facility management of the existing traditional canals. Farm households are used to cooperatives and associations. After the implementation of the project, new cooperatives for vegetable/fruit marketing will be needed. The purpose of strengthening of water users' associations in the irrigated area is to make them responsible for O & M and to make the irrigation scheme sustinable. Farmers' Associations/Cooperatives are expected to support production activities of the member farmers in group purchase of farm inputs, joint collection and delivery of vegetables/fruits, supply of agricultural inputs etc.

- Training: the discussion meetings will be held with the farmers for the establishment of new organisations in the collaboration with the present agencies in charge of the farmers' organisations i.e., CT and DPA. Training program on cooperatives, farmers' associations will be formulated according to the needs.

XIII4.8.3 Timkit (No.10)

(1) Improvement of Existing Extension System

Basic concept of extension service for crop production is as follows;

- To train farmers by demonstration of improved farming technology at demonatration plots in farmers' fields in Ifegh, Tinejdad and Chitam
- To experiment newly introduced vegetables, legumes, fodder trees
- To collect information of farming from research institutions and private sector and to provide them to the farmers
- Dissemination of information on institutional credit

(2) Marketing System Improvement

- Planning of cropping pattern: after the implementation of the project the cropping season will be adjusted with irrigation water supply, so as to insure the strategic production in the areas, since the price fluctuation of vegetables comes from unstable supply to the market.

- Establishment of Distribution Center: the products of the Study Area goes to Agadhir, Marrakech, Meknes etc. Group shipment through distribution center will strengthen the bargaining power of the farmers.

(3) Organizing and Activation of Farmers' Associations and Cooperatives

- Creation of self-reliant farmers' organisation focussing on the beneficiaries in the proposed irrigation development area. ORMVA will support to the WUA and farmers' cooperatives.
- WUAs are expected to be responsible for the operation and mentenance of the proposed facilities.
- Farmers' cooperatives are expected to support the production activities of the member farmers in joint purchase of farm inputs, joint collection of farm products and supply of agricultural credits.
- Training on expected roles and objective of the newly established organizations.

XIII4.8.4 Azghar (No.17)

(1) Extension Services Strengthening

The strengthening proposal of Work Centers (CTs) is directed to the enhancement of the capacity of CTs, Sub-Centers or field extension workers, that are expected to take core functions under the project. The proposal exists of

- Capacity building of field extension workers: provide in-service training at the province level.
- Strengthening of technical guidance of CTs: train farmers by demonstration of developed farm technology at demonstration plots in farmers' fields.
- Posting an experienced staff in irrigated agriculture and vegetable crops in the project area
- Demonstration trials : new crops, variety, fertilization rate, recommended package technology, irrigation methods and water management

(2) Improvement of Marketing System:

Collection Centers:

- Centers of simple structure but with roof and concrete floor for

collection and group delivery.

(3) Formation of Farmers' Associations/Cooperatives

- Target group: beneficiary farmers of irrigation development
- Program Component: Awareness program for irrigation beneficiaries, WUA formation and guidance to the beneficiaries, workshop for formation of WUA, "learning by doing" under the support of DPA, study tour of representatives of the WUA
- Farmers' Training: training should be provided based on the area specific needs of the area or individual farmers which will be identified through discussions with the farmers. Periodical training will be provided for the leaders of farmers' groups. The objective of the training is to identify the problems in their areas and the solution for such problems, through the discussion among the leaders.

Feasibility Study on Water Resources Development in the Rural Area in the Kingdom of Morocco

Final Report

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Soils, Agriculture and Irrigation

Tables

Table XIII1.2.1 The Area of Land Suitability in each Project Area

		No.5 N'Fifikh		No.9 Taskourt	No.10 Timkit			No.17 Azghar
		Upstream b/	Downstream		Ifegh c/	Tinejdad	Chitam	
Gravity Irrigation	I	384	0	276	17	910	435	18
	II	129	66	2,854	38	130	0	2
	III	47	34	630	90(79) d/	162	119	766
	IV	215	186	1,579	63	0	136	521
	V	73	12	231	13	0	0	621
	VI+Others	0	32	299	0	274	0	105
	(Sub-total) a/	848	330	5,869	131	1,476	690	2,033
Sprinkler Irrigation	I	518	0	281	17	910	508	690
	II	257	132	2,860	38	155	0	547
	III	73	46	706	90(79) d/	137	171	601
	IV	0	120	1,568	63	0	11	73
	V	0	0	156	13	0	0	17
	VI+Others	0	32	299	0	274	0	105
	(Sub-total)	848.0	330.0	5868.9	131.0	1476.4	690	2032.9
Irrigable Potencial Area	by Gravity (less than 8%)	848	286	5,339	287	1,202	690	1,911
	by Sprinkler	848	298	5,414	287	1,202	690	1,911
No Mapping		42	0	131.1	(79) d/	1333 e/	0	317.1
Gross Irrigation Development Area		890	330	6,000	300	2,835	690	2,350
Proposed Irrigation Area		800	260	4,500	200	2,130	552	2,000

Note: a/ Sub-tolal including no mapping area
b/ The areas of directly under dam site (360ha) are not included, but approximatedly 280ha is classified Class I. See data book
d/ Most of the no mapping areas will be included in the Class III by field investination.
e/ Most of these areas are located in the south area ot Todrha River.

Source: Land Suitability Map 2001

Table XIII1.2.2 The Classification of Land Suitability in Each Priority Project Area

N'Fifikh (Upstream)

	Area (ha)	For Gravity Irrogation	For Sprinkler
Class I	384		
	120	I	I
(M)	264	I	I
Class II	129		
Pe2,T'2	15	II	II
T'2	60	II	I
T'2,Pe2	54	II	I
Class III			
Pe3,T'2	47	III	II
Class IV	215		
Pe4,T'2C2(J)	53	IV	II
Pe4,T'2	142	IV	II
Pe	20	IV	I
Class V	73		
Pe	16	V	III
Pe5,T'2	57	V	III
No mapping	42	-	
	848		

N'Fifikh (Downstream)

	Area (ha)	Gravity	Sprinkler
Class II			
Pe2T'2	66	II	II
Class III	33		
Pe3T'2	3	III	II
Pe2Tg3/T'3	31	III	III
Class IV	186		
Pe1Tg4/T'3	2	IV	IV
Pe2Tg3/T'3	2	IV	III
Pe2Tg4/T'3	87	IV	IV
Pe4T'2	38	IV	II
Pe4Tg4/T'2	31	IV	IV
Pe4T'2,Tg2	26	IV	II
Class V	12		
Pe1D	8	V	III
Pe5P2/H.T'2	4	V	III
Class VI	33		
	4	VI	VI
W	26	VI	VI
Town	2	VI	VI
	330		

Taskourt

	Area (ha)	Gravity	Sprinkler
Class I			
(J)	276	I	I
Class II	2,854		
T2	742	II	II
T2(J)	229	II	II
T,2,C3,(J)	42	II	II
C2,(J)	41	II	II
C2-2,(J)	408	II	II
C3-3.(J)	117	II	II
VI-1Pe2,C	42	II	II
P1/H.T'2,C	839	II	II
T2(J)	133	II	II
P2/H.(J)			
P1/H,C			
T'2,C2/2,(J)	262	II	II
T1/H,C2-2			
T2			
Class III	630		
C(J)	59	III	III
C3(J)	28	III	III
C3-3(J)	46	III	III
P2/H	2	III	III
P2/H(J)	9	III	III
P2/H,C	34	III	III
P2/H,C2	38	III	III
P2/H,C3,(J)	9	III	III
P2/H,C3-3	19	III	III
P2/H,P'2	9	III	III
P2/H,T2,C3,(J)	142	III	III
P2/H.C2(J)	25	III	III
P2/Z,T'2,C	18	III	III
P3/H(J)	4	III	III
P3/Z.C3-2	12	III	III
Pe/H,C3-2,(J)	73	III	III
Pe/H,T'2,C3-2(J)	103	III	III
Class IV	1,579		
C4/4(J)	10	IV	IV
I-4	15	IV	IV
P3/H,C2-2	7	IV	IV
P3/H,C3	85	IV	IV
P3/H,C3-2	435	IV	IV
P3/H.C3-3	5	IV	IV
P3/HC3(J)	1,001	IV	IV
P4/H	9	IV	IV
Pe4	6	IV	I
Pe4,C2-3	6	IV	II
Class V	231		
IV	5	V	V
P4/H	149	V	V
Pe5	12	V	III
Pe5,C3,(J)	64	V	III
	1	V	V
Class VI	277	VI	VI
No Class	131		
Total	5,979		

Ifegh

	Area (ha)	Gravity	Sprinkler
Class I			
	17	I	I
Class II	38		
Pc	19	II	II
C	18	II	II
Class III			
Pc	90	III	III
Class IV			
	63	IV	IV
Class V			
	13	V	V
No Class			
	79		
	300		

Tinejdad

	Area (ha)	Gravity	Sprinkler
Class I			
	910	I	
Class II			
T2	130	II	
Class III	162		
T3	25	III	
C	137	III	
Class IV			
	42	IV	
No class			
	26		
Town			
	233		
	1,503		

Chitam

	Area (ha)	Gravity	Sprinkler
Class I	435		
	384	I	I
(R)	51	I	I
Class III	119		
	31	III	III
T3	15	III	III
T3/T1	73	III	I
Class IV	136		
Vt4	124	IV	III
	11	IV	IV
	690		

Azghar

	Area (ha)	Gravity	Sprinkler
ClassI			
	18	I	I
Class II			
M	2	II	II
Class III	765		
Pe3	253	III	I
Pe3M	16	III	I
Pe3M,P1	238	III	I
Pe3M,P2	249	III	II
Pe3P1	9	III	I
Class IV	521		
	10	IV	I
Pe4	79	IV	I
Pe4M	51	IV	I
Pe4M,P1	15	IV	I
Pe4M,P2	93	IV	II
Pe4M,P2,C	87	IV	II
Pe4M,P3	70	IV	III
Pe4P2	116	IV	II
Class V	620		
N	13	V	III
Pe5	16	V	III
Pe5,P3	24	V	III
Pe5M,P2	44	V	III
Pe5M,P2,(C)	16	V	III
Pe5M,P4,AR	70	V	IV
Pe5P2	130	V	III
Pe5P3	93	V	III
Pe5P4	3	V	IV
Pe6,P3.C	20	V	III
Pe6M,P3	17	V	III
Pe6P3	157	V	III
	17	V	V
Classs VI	108		
	5	VI	VI
W	103	VI	VI
No Class	317		
	2,032		

Table XIII2.1.1: Crop Production of the Commune Rural "Ziaida" in the N'Fifikh Upstream Area

Crops	95/96			96/97			97/98			98/99			99/2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Soft wheat	5,000	11,000	2.2	1,800	1,440	0.8	4,500	8,550	1.9	4,700	7,050	1.5	4,800	480	0.1
Hard wheat	3,000	6,000	2.0	3,350	2,345	0.7	3,000	5,400	1.8	2,800	2,800	1.0	2,900	435	0.2
Barley	400	960	2.4	400	400	1.0	400	960	2.4	400	480	1.2	400	60	0.2
Maize	300	1,500	5.0	200	220	1.1	200	240	1.2	300	150	0.5	400	0	0.0
Fodders															
Barley	300	1,350	4.5	300	600	2.0	160	576	3.6	200	560	2.8	250	0	0.0
Oat	300	1,200	4.0	250	550	2.2	490	1,960	4.0	200	600	3.0	150	0	0.0
Legumes															
Broad been	600	780	1.3	550	385	0.7	300		1.0	300	240	0.8	275	0	0.0
Green peas	200	240	1.2	100	60	0.6	500		1.0	400	400	1.0	350	0	0.0
Lentil	100	80	0.8	100	60	0.6	300		1.2	150	120	0.8	150	0	0.0
Vegetables															
Potato	50	1,400	28.0	50	1,300	26.0	60	1,800	30.0	100	2,800	28.0	120	2,400	20.0
Tomato	10	500	50.0	8	288	36.0	10	450	45.0	15	660	44.0	15	750	50.0
Pumpkin	2	48	24.0	4	80	20.0	5	110	22.0	5	120	24.0	4	72	18.0
Navet	5	100	20.0	7	98	14.0	5	100	20.0	5	100	20.0	6	96	16.0
Onion	10	300	30.0	11	286	26.0	5	150	30.0	10	300	30.0	5	125	25.0
Others	10	250	25.0	8	144	18.0	5	120	24.0	5	110	22.0	6	108	18.0
Fruits															
Grape	30	240	8.0	30	135	4.5	40	180	4.5	36	238	6.6			5.0
Olive	28	182	6.5	35	158	4.5	48	384	8.0	56	392	7.0			7.0
Almond	12	12	1.0	14	8	0.6	16	13	0.8	20	14	0.7			0.5
Fallow Land	933			1,400			1,000			1,500					
TOTAL	11,290			8,617			11,044			11,202			9,831		

Source: Benslimane DPA, 2000

Table XIII2.1.2: Crop Production of the Commune Rural "Ouled Yahya" in the N'Fifikh Upstream Area

Crops	95/96			96/97			97/98			98/99			99/2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Soft wheat	4,000	9,200	2.3	2,500	1,750	0.7	2,600	4,290	1.7	2,800	3,920	1.4	2,900	290	0.1
Hard wheat	2,000	4,400	2.2	1,500	750	0.5	1,400	2,240	1.6	1,200	1,560	1.3	1,200	120	0.1
Barley	300	720	2.4	250	200	0.8	300	660	2.2	350	630	1.8	350	53	0.2
Maize	200	200	1.0	200	200	1.0	200	240	1.2	300	180	0.6	450	0	0.0
Fodders															
Barley	100	460	4.6	200	500	2.5	300	1,080	3.6	300	840	2.8	350	0	0.0
Oat	300	1,350	4.5	150	330	2.2	100	400	4.0	300	900	3.0	250	0	0.0
Legumes															
Broad been	300	360	1.2	400	280	0.7	700	560	0.8	350	245	0.7	350	0	0.0
Green peas	200	240	1.2	180	90	0.5	160	160	1.0	100	90	0.9	100	0	0.0
Lentil	170	136	0.8	190	152	0.8	100	100	1.0	200	140	0.7	85	0	0.0
Vegetables															
Potato	50	1,500	30.0	40	960	24.0	60	1,680	28.0	60	1,560	26.0	50	1,000	20.0
Tomato	10	520	52.0	6	228	38.0	7	336	48.0	10	460	46.0	10	500	50.0
Pumpkin	10	260	26.0	6	108	18.0	5	120	24.0	8	176	22.0	5	80	16.0
Navet	5	110	22.0	4	60	15.0	7	140	20.0	5	90	18.0	6	96	16.0
Onion	5	180	36.0	7	196	28.0	10	320	32.0	10	300	30.0	12	300	25.0
Others	4	92	23.0	6	96	16.0	5	110	22.0	5	100	20.0	4	72	18.0
Fruits															
Grape	450	4,050	9.0	500	2,250	4.5	500	4,000	8.0	581	4,067	7.0	581	2,905	5.0
Olive	20	190	9.5	24	120	5.0	30	270	9.0	30	240	8.0	47	353	7.5
Almond	12	13	1.1	14	7	0.5	18	18	1.0	18	14	0.8	23	14	0.6
Fallow Land	120			160			140			130			100		
TOTAL	8,256			6,337			6,642			6,757			6,873		

Source: Benslimane DPA, 2000

Table XIII2.1.3: Crop Production of the Commune Rural of Monsouria in the N'Fifikh Downstream Area

Crops	95/96			96/97			97/98			98/99			99/2000		
	Area	Product.	Yield	Area	Product.	Yield	Area	Product.	Yield	Area	Product.	Yield	Area	Product.	Yield
	(ha)	(ton)	(ton/ha)	(ha)	(ton)	(ton/ha)	(ha)	(ton)	(ton/ha)	(ha)	(ton)	(ton/ha)	(ha)	(ton)	(ton/ha)
Cereals															
Soft wheat	2,260	5,198	2.3	950	665	0.7	2,000	3,200	1.6	1,900	2,470	1.3	2,100	27	0.0
Hard wheat	180	252	1.4	30	12	0.4	70	70	1.0	50	35	0.7	50	0	0.0
Barley	250	363	1.5	90	45	0.5	250	313	1.3	250	350	1.4	450	9	0.0
Maize	3	2	0.7	10	3	0.3	5	2	0.3	23	14	0.6	3	0	0.0
Oat	-	-	-	-	-	-	130	1,170	9.0	50	600	12.0	-	-	-
(Sub-total)	2,693			1,080			2,455			2,273			2,603		
Fodders															
Forage barley	230	1,725	7.5	100	350	3.5	180	720	4.0	100	400	4.0	30	0	0.0
Forage oat	150	450	3.0	60	180	3.0	50	175	3.5	100	0	0.0	50	0	0.0
Others	-	-	-	-	-	-	-	-	-	118	260	2.2	20	0	0.0
(Sub-total)	380			160			230	895		318	660		100	0	
Legumes															
Broad been	-	-	-	-	-	-	10	50	5.0	10	40	4.0	15	0	0.0
String bean	-	-	-	-	-	-	-	-	-	34	51	1.5	-	-	-
(Sub-total)	0			0			10			44			15		
Vegetables															
Potato (winter)	40.0	280	7	40.0	360	9	45.0	810	18	40.0	720	18	40.0	720	18
Tomato (GH) a/	3.5	350	100	4.0	400	100	4.0	420	105	4.5	495	110	4.5	473	105
Tomato	2.0	80	40	3.0	135	45	2.0	100	50	2.0	100	50	5.0	250	50
Potato	10.0	170	17	15.0	225	15	25.0	700	28	5.0	125	25	5.0	150	30
Tomato	2.0	80	40	2.0	80	40	2.0	80	40	-	-	-	-	-	-
Melon (GH) a/	0.8	38	50	-	-	-	-	-	-	1.0	50	50	1.0	55	55
Young marrow	0.9	7	8	3	24	8.0	4.0	36	9	3.0	27	9	5.0	40	8
Broad bean (GH) a/	0.8	15	20	-	-	-	-	-	-	-	-	-	-	-	-
Broad bean	1.0	10	10	-	-	-	-	-	-	-	-	-	-	-	-
Green peas	2.0	4	2	-	-	-	-	-	-	-	-	-	-	-	-
Others	4.0	12	3	6.0	54	9	2.0	20	10	8.0	80	10	3.0	27	9
(Sub-total)	63			67			82			56			61		
Fruits															
Grapes	253	1,139	5	253	1,265	5	138	759	6	195	1,073	6	188	846	5
(Sub-total)	253			253			138			195			188		
Fallow Land	587			2,413			1,062			1,235			962		
TOTAL	3,975			3,973			3,977			4,121			3,928		

Note: a/ GH: Greenhouse
Source: Senslimane DPA, 2000

Table XIII2.1.4: Crop Production of the Commune Rural of Asif El Mal in the Taskourt Area

Crops	95-96			96-97			97-98			98-99			99-2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Hard wheat	50	55	1.1	40	4	0.1	100	25	0.3	50	10	0.2	40	10	0.3
Soft wheat	150	99	0.7	60	0	0.0	100	0	0.0	50	20	0.4	100	60	0.6
Barley	650	520	0.8	700	175	0.3	600	150	0.3	750	413	0.6	660	198	0.3
(Sub-total)	850			800			800			850			800		
Fodders															
Alfalfa	20	1,440	72.0	20	840	42.0	20	960	48.0	20	1,200	60.0	20	1,200	60.0
Berseem	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Sub-total)	20			20			20			20			20		
Legumes															
Broad bean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green Peas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables															
Melon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Watermelon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potato	10	80	8.0	20	140	7.0	15	120	8.0	15	120	8.0	20	160	8.0
(Sub-total)	10			20			15			15			20		
Fruits a/															
Olive	283	226	0.8	283	2,264	8.0	283	1,698	6.0	283	57	0.2	283	708	2.5
Almond	1,437	42	0.03	1,437	719	0.50	1,437	503	0.35	1,437	575	0.40	1,473	442	0.30
(Sub-total)	1,720			1,720			1,720			1,720			1,756		

Note: a/ The cultivated areas of fruits are counted twice with the area of cereals.
Source: Chichaoua DPA, 2000

Table XIII2.1.5: Crop Production of the Commune Rural of Mzouda in the Taskourt Area

Crops	95-96			96-97			97-98			98-99			99-2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Hard wheat	200	80	0.4	400	100	0.3	200	20	0.1	100	15	0.2	8	3	0.5
Soft wheat	3,450	1,725	0.5	4,200	1,260	0.3	2,200	396	0.2	500	150	0.3	520	182	0.4
Barley	4,250	2,550	0.6	2,800	1,120	0.4	3,100	620	0.2	3,500	1,225	0.4	1,912	573	0.3
(Sub-total)	7,900														
Fodders															
Alfalfa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Berseem	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Legumes															
Broad bean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green Peas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables															
Watermelon	40	400	10.0	35	280	8.0	40	240	6.0	30	120	4.0	10	40	4.0
Pumpkin	60	900	15.0	15	150	10.0	15	105	7.0	20	60	3.0	15	75	5.0
Potato	30	510	17.0	10	120	12.0	10	100	10.0	10	100	10.0	5	30	6.0
Carrot	4	40	10.0	4	24	6.0	3	15	5.0	3	12	4.0	2	8	4.0
Rape	5	50	10.0	3	18	6.0	4	20	5.0	4	20	5.0	2	9	4.5
(Sub-total)	139			67			72			67			34		
Fruits a/															
Olive	600	210	0.4	600	60	0.1	600	30	0.1	600	180	0.3	500	100	0.2
Almond	210	46	0.2	210	42	0.2	210	63	0.3	210	53	0.3	210	67	0.3
(Sub-total)	810			810			810			810			710		

Note: a/ The cultivated areas of fruits are counted twice with the area of cereals.
Source: Chichaoua DPA, 2000

Table XIII2.1.6: Crop Production of the Commune Rural of Guemassa in the Taskourt Area

Crops	95-96			96-97			97-98			98-99			99-2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Hard wheat	250	275	1.1	600	120	0.2	800	320	0.4	20	4	0.2	100	9	0.1
Soft wheat	9,450	12,120	1.3	8,200	2,460	0.3	4,000	640	0.2	630	186	0.3	2,800	280	0.1
Barley	4,900	5,780	1.2	4,200	1,554	0.4	2,700	216	0.1	1,300	150	0.1	3,100	155	0.1
(Sub-total)	14,600			13,000			7,500			1,950			6,000		
Fodders															
Alfalfa	185	19,425	105.0	185	10,425	56.4	200	2,100	10.5	200	2,100	10.5	200	2,100	10.5
Berseem	50	6,000	120.0	20	1,440	72.0	-	-	-	20	1,440	72.0			
(Sub-total)	235			205			200			220			200		
Legumes															
Broad bean	100	600	6.0	150	1,125	7.5	50	375	7.5	46	138	3.0	100	600	6.0
Green Peas	30	180	6.0	40	300	7.5	40	300	7.5	-	-	-	50	425	8.5
(Sub-total)	130			190			90			46			150		
Vegetables															
Melon	60	1,500	25.0	20	400	20.0	36	1,080	30.0	15	375	25.0	50	1,250	25.0
Watermelon	-	-	-	10	170	17.0	-	-	-	10	100	10.0	5	100	20.0
(Sub-total)	60			30			36			25			55		
Fruits a/															
Olive	660	594	0.9	660	2,640	4.0	660	99	0.2	660	462	0.7	100	50	0.5
Apricot	185	3,700	20.0	185	6,475	35.0	185	1,850	10.0	185	1,480	8.0	185	2,960	16.0
(Sub-total)	845			845			845			845			285		

Note: a/ The cultivated areas of fruits are counted twice with the area of cereals.
Source: Chichaoua DPA, 2000

Table XIII2.1.7: Crop Production of the Commune Rural of Majjate in the Taskourt Area

Crops	95-96			96-97			97-98			98-99			99-2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Hard wheat	400	450	1.1	250	50	0.2	100	40	0.4	50	10	0.2	50	10	0.2
Soft wheat	14,800	19,560	1.3	13,000	3,900	0.3	6,000	960	0.2	1,400	403	0.3	7,500	666	0.1
Barley	8,000	10,280	1.3	9,250	3,423	0.4	2,450	196	0.1	3,650	420	0.1	3,750	214	0.1
(Sub-total)	23,200			22,500			8,550			5,100			11,300		
Fodders															
Alfalfa	250	26,250	105.0	250	26,250	105.0	250	26,250	105.0	250	26,250	105.0	300	31,500	105.0
Berseem	15	1,260	84.0	30	2,160	72.0	50	9,000	180.0	20	1,440	72.0	10	720	72.0
(Sub-total)	265			280			300			270			310		
Legumes															
Broad bean	180	1,080	6.0	200	1,500	7.5	100	750	7.5	100	300	3.0	170	1,020	6.0
Green Peas	50	425	8.5	100	850	8.5	80	600	7.5	40	120	3.0	150	1,275	8.5
(Sub-total)	230			300			180			140			320		
Vegetables															
Melon	100	2,500	25.0	80	1,600	20.0	70	2,100	30.0	50	1,250	25.0	300	7,500	25.0
Watermelon	20	400	20.0	60	1,020	17.0	19	380	20.0	40	400	10.0	20	400	20.0
(Sub-total)	120			140			89			90			320		
Fruits a/															
Olive	2,000	1,800	0.9	2,000	8,000	4.0	2,000	300	0.2	2,000	140	0.1	500	250	0.5
Apricot	185	5,550	30.0	445	15,575	35.0	445	4,450	10.0	445	3,560	8.0	445	7,120	16.0
(Sub-total)	2,185			2,445			2,445			2,445			945		

Note: a/ The cultivated areas of fruits are counted twice with the area of cereals.
Source: Chichaoua DPA, 2000

Table XIII2.1.8: Crops Production in the Timkit Area (Commune Rural: Ferkla el Oulia, Tinejdad, Ferkla Es Soufla)

Crops	95/96			96/97			97/98			98/99			99/2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Soft wheat	145	435	3.0	625	2,188	3.5	510	1,377	2.7	149	209	1.4	550	1,155	2.1
Hard wheat	1,225	4,900	4.0	892	2,854	3.2	873	2,270	2.6	224	448	2.0	650	1,235	1.9
Barley	61	110	1.8	86	163	1.9	72	130	1.8	71	78	1.1	300	510	1.7
Sub-Total	1,431			1,603			1,455			444			1,500		
Fodders															
Alfalfa	402	18,090	45	402	12,060	30	418	12,540	30	418	18,810	45	400	16,000	40
Sub-Total	402			402			418			418			400		
Legumes															
Broad been	37.0	55.5	1.5	26.0	26	1.0	30.0	36	1.2	19.0	15.2	0.8	100.0	100	1.0
Green bean	12.0	13.2	1.1	12.0	2.4	0.2	16.0	12.8	0.8	13.0	7.8	0.6	16.0	112	7.0
Sub-Total	49			38			46			32			116		
Vegetables															
Potato	8.0	256	32.0	19.0	760	40.0	20.0	560	28.0	14.0	196	14.0	12.0	240	20.0
Tomato	13.0	780	60.0	10.0	500	50.0	13.0	455	35.0	7.0	126	18.0	3.0	48	16.0
Melon	18.0	576	32.0	14.0	980	70.0	13.0	390	30.0	7.0	112	16.0	3.0	45	15.0
Water melon	13.0	455	35.0	8.0	640	80.0	8.0	256	32.0	6.0	120	20.0	3.0	60	20.0
Carrot	7.0	350	50.0	12.0	420	35.0	18.0	360	20.0	13.0	169	13.0	15.0	825	55.0
Onion	10.0	220	22.0	21.0	378	18.0	26.0	468	18.0	15.0	150	10.0	12.0	132	11.0
Turnip	6.0	300	50.0	6.0	90	15.0	10.0	180	18.0	6.0	72	12.0	10.0	500	50.0
Sub-Total	75.0			90.0			108.0			68.0			58.0		
TOTAL	1,957			2,133			2,027			962			2,074		
	Product. Tree (trees)	Product. (ton)	Yield (kg/Tree)	Product. Tree (trees)	Product. (ton)	Yield (kg/Tree)	Product. Tree (trees)	Product. (ton)	Yield (kg/Tree)	Product. Tree (trees)	Product. (ton)	Yield (kg/Tree)	Product. Tree (trees)	Product. (ton)	Yield (kg/Tree)
Fruits															
Dates	100,000	1,200	12	68,800	688	10	96,867	1,162	12	60,000	1,200	20	50,000	750	15
Olive	18,000	252	14	18,000	252	14	18,000	288	16	18,000	90	5	15,000	30	2
Almond	16,000	320	20	18,000	360	20	18,020	360	20	18,000	216	12	15,000	75	5
Pomegranate	600	12	20	1,000	15	15	1,000	10	10	10,000	150	15	11,000	110	10

*1 Area of fallow and tree crops are not including

Table XIII2.1.9: Crops Production of the Commune Rural of Ighezrane in the Azghar Area

Crops	95/96			96/97			97/98			98/99			99/2000		
	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)	Area (ha)	Product. (ton)	Yield (ton/ha)
Cereals															
Hard Wheat	2,300	2,415	1.1	2,050	718	0.4	2,380	1,428	0.6	1,950	878	0.5	246	25	0.1
Soft Wheat	290	406	1.4	115	46	0.4	125	81	0.7	150	83	0.6	210	32	0.2
Barley	2,450	3,675	1.5	1,970	985	0.5	2,580	2,064	0.8	2,530	1,771	0.7	2,700	405	0.2
Sub-Total	5,040			4,135			5,085			4,630			3,156		
Fodders															
Fodder Oat	250	1,250	5.0	165	165	1.0	180	207	1.2	195	117	0.6	110	39	0.4
Fodder Barley	200	900	4.5	40	36	0.9	75	120	1.6	110	77	0.7	80	32	0.4
Sub-Total	450			205			255			305			190		
Legumes															
Broad bean	300	255	0.9	110	17	0.2	230	58	0.3	100	20	0.2	250	25	0.1
Lentil	340	204	0.6	195	117	0.6	310	140	0.5	240	72	0.3	300	60	0.2
Sub-Total	640			305			540			340			550		
Vegetables															
Sub-Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fruits															
Olive	904	452	0.5	914	457	0.5	914	914	1.0	924	1,386	1.5	1,074	1,074	1.0
Apple	75	675	9.0	75	975	13.0	75	105	1.4	75	1,125	15.0	75	750	10.0
Sub-Total	979			989			989			999			1,149		
TOTAL	7,109			5,634			6,869			6,274			5,045		

Source: From Ribat Al Kheir CT 33.06 (2000)

Table XIII2.1.10: Present Farmland Condition of Commune Rurals (s) in Priority Project

	Priority Project	Commune Rural	Farm land				Irrigation/Non-irrigation		
			Farmer	Farm area	Farm plot	Average farm area	Irrigation	Non-irrigation	Irrigation rate
			(No.)	(ha)	(No.)	(ha/farme	(ha)	(ha)	(%)
5(1)	N'Fiikh	Ziaida	1,535	12,265	5,796	8.0	346	11,919	2.8
	(Upstream)	Oulad Yahya Loyta	1,113	10,269	4,407	9.2	236	10,033	2.3
		(Sub-total)	2,648	22,534	10,203	8.5	582	21,952	2.6
5(2)	N'Fiikh	El Mansouria	358	3,979	758	11.1	216	3,763	5.4
	(Downstream)								
9	Taskourt	Assif El Mal	774	3,136	4,900	4.1	1,334	1,802	42.5
		Guemassa	1,348	16,652	5,748	12.4	2,248	14,404	13.5
		Majjate	1,577	24,748	6,595	15.7	7,504	17,244	30.3
		M'zouda	1,837	10,448	10,031	5.7	6,350	4,098	60.8
		(Sub-total)	5,536	54,984	27,274	9.9	17,436	37,548	31.7
10	Timkit	Aghbalou N'Kerdous	1,046	725	9,545	0.7	692	33	95.4
		Ferkla el Oulia	1,374	1,416	10,745	1.0	1,175	241	83.0
		Tinejdad	155	93	1,342	0.6	51	42	54.8
		Ferkla Es Soufla	944	961	7,426	1.0	654	307	68.1
		Mellab	1,267	1,802	9,839	1.4	1,412	390	78.4
		(Sub-total)	4,786	4,997	38,897	1.0	3,984	1,013	79.7
17	Azghar	Igheznane	1,643	7,420	9,558	4.5	321	7,099	4.3
		Ouled Mkoudou	750	3,182	5,733	4.2	327	2,855	10.3
		(Sub-total)	2,393	10,602	15,291	4.4	648	9,954	6.1

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.1.11: Land Ownership and Farm Holding of Commune Rurals (s) in Priority Project

	Priority Project	Commune Rural	Farm land (ha)						Farm holding (ha)			
			Private	Group farm	Habous	Guich	Estate farm	Total	Owner	Tenant	Loan & work *	Total
5(1)	N'Fiikh	Ziaida	12,154	19	1	0	91	12,265	11,012	637	616	12,265
	(Upstream)	Oulad Yahya Loyta	8,817	312	24	0	1,116	10,269	8,994	442	833	10,269
		(Sub-total)	20,971	331	25	0	1,207	22,534	20,006	1,079	1,449	22,534
5(2)	N'Fiikh	El Mansouria	3,626	0	0	0	353	3,979	3,264	203	152	3,979
	(Downstream)											
9	Taskourt	Assif El Mal	2,022	1,078	35	0	1	3,136	2,867	39	230	3,136
		Guemassa	2,391	13,912	19	330	0	16,652	15,234	114	1,304	16,652
		Majjate	2,497	9,248	839	12,157	7	24,748	23,002	18	1,728	24,748
		M'zouda	8,980	1,466	2	0	0	10,448	7,702	33	2,713	10,448
		(Sub-total)	15,890	25,704	895	12,487	8	54,984	48,805	204	5,975	54,984
10	Timkit	Aghbalou N'Kerdous	721	0	4	0	0	725	698	11	16	725
		Ferkla el Oulia	1,376	34	6	0	0	1,416	1,363	11	42	1,416
		Tinejdad	93	0	0	0	0	93	87	0	6	93
		Ferkla Es Soufla	916	41	4	0	0	961	926	9	26	961
		Mellab	1,664	124	14	0	0	1,802	1,727	15	60	1,802
		(Sub-total)	3,106	75	14	0	0	4,997	4,801	46	150	4,997
17	Azghar	Igheznane	7,389	0	14	0	17	7,420	7,132	2	286	7,420
		Ouled Mkoudou	3,128	0	54	0	0	3,182	2,810	28	344	3,182
		(Sub-total)	10,517	0	68	0	17	10,602	9,942	30	630	10,602

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.1.12: Cultivated Cultivars and Shares of Crops

Azghar

	Variety	Price	(Unit)	Share (%)
Soft Wheat	Achtar R1	360	(DH/100kg)	30
	El Kanz R1	360	(DH/100kg)	10
	Achtar R2	350	(DH/100kg)	50
	Achtar Ba5	310	(DH/100kg)	10
Hard Wheat	Isiy R1	400	(DH/100kg)	4
	Vitron R2	390	(DH/100kg)	2
	Local	375	(DH/100kg)	94
Barley	Local	360	(DH/100kg)	100
Olive	P maso caire	8	(DH/Plant)	100
Almond	Ferraduel	1	(DH/Plant)	-
	Ferragnes	1	(DH/Plant)	-
	Marcona	1.4	(DH/Plant)	-
	Fournat	1.4	(DH/Plant)	-
Potato	Desiree Imp	440	(DH/100kg)	98
	Spnta Imp	565	(DH/100kg)	2
Bread Bean	Local	600	(DH/100kg)	100

Source: Hearing from DPA Ifrane, Ribat Al Kheyr Work Center, 2001

N'Fifikh （Benslimane)

	Variety	Price	(Unit)	Share (%)
Soft Wheat	Local	250-350	(DH/100kg)	80
	Achtar	310-450	(DH/100kg)	15
	Merchouch	310-450	(DH/100kg)	5
	Kanz	310-450	(DH/100kg)	
Hard Wheat	Local	220-280	(DH/100kg)	80
	Karim	350-400	(DH/100kg)	15
	Herzak	350-400	(DH/100kg)	
	Isly	350-400	(DH/100kg)	5
Barley	Local	200-250	(DH/100kg)	100
Olive	Local	9-12	(DH/Plant)	100
Potato	Desiree	500-750	(DH/100kg)	-
	Sponta	500-750	(DH/100kg)	-
Broad Bean	Local	600-1000	(DH/100kg)	100
Fodder Barley	Local	200-250	(DH/100kg)	100

Source: Hearing from DPA Benslimane, Benslimane Work Center, 2001

Timkit

	Variety	Price	(Unit)	Share (%)
Soft Wheat	Sarif R1	350	(DH/100kg)	75-80
	Achtar R1	300	(DH/100kg)	
	Local	250-300	(DH/100kg)	20-25
Barley	Local	200-400	(DH/100kg)	100
Watermelon	Selected	200	DH/100g	100
Melon	Selected	100	DH/100g	100
Broad Bean	Local	200-300	(DH/100kg)	100
Alfalfa	Moapa	70	DH/kg	-
	Sylvestre	60	DH/kg	-
Fodder Barley	Local	200-400	(DH/100kg)	100
Olive	Local	12	(DH/Plant)	100
Almond	Improved	-	-	10
	Local	10	(DH/Plant)	90
Dates	Khalta boufkouss	15	(DH/Plant)	Local (100)

Source: ORMVA Tafilalet, CMV712 de Tinejdad, 2000

N'Fifikh （Bouznika)

	Variety	Price	(Unit)	Share (%)
Soft Wheat	Achtar	350-360	(DH/100kg)	20-25
	Massical	350-360	(DH/100kg)	
	Local	260-300	(DH/100kg)	75-80
Hard Wheat	Vitron, Kurim	390-400	(DH/100kg)	5
	Local	350-400	(DH/100kg)	95
Barley	Local	200-320	(DH/100kg)	100
Olive	Plant C	10-12	(DH/Plant)	
	Marcona	10-12	(DH/Plant)	
Potato	Desica	500-700	(DH/100kg)	
	Nikda	500-700	(DH/100kg)	
	Lesita	500-700	(DH/100kg)	
Tomato	Hybrid	150-200	(DH/g)	
Bread Bean	Local	800-1000	(DH/100kg)	10
Alfalfa	Moapa	35-40	(DH/kg)	±0
	Local	15-20	(DH/kg)	100
Fodder Barley	Local	200-220	(DH/100kg)	100
Grape	Muscat	12-17	(DH/Plant)	
	Muscat Italie	12-17	(DH/Plant)	
	Alphonsi Lavallee	12-17	(DH/Plant)	

Source: Hearing from DPA Benslimane, Bouznika Work Center, 2001

Taskourt

	Variety	Price	(Unit)	Share (%)
Soft Wheat	Local	240	(DH/100kg)	95
	Merchouch	360	(DH/100kg)	5
	Achtar		(DH/100kg)	
Hard Wheat	Local	270	(DH/100kg)	90
	Sebou-Massa	400	(DH/100kg)	10
Barley	Local	140	(DH/100kg)	95
	Tamellalte	285	(DH/100kg)	5
Olive	Picholine	7	(DH/Plant)	100
	Marocaine	7	(DH/Plant)	
Almond	Feragnes	5	(DH/Plant)	100
	Geraduel-Touno	5	(DH/Plant)	
Potato	Local	350	(DH/100kg)	40
	Desiree	600	(DH/100kg)	60
	Spunta	600	(DH/100kg)	
Tomato	Local	500	(DH/100kg)	10
	Hectar	6,000	(DH/100kg)	90
	T6.56	6,000	(DH/100kg)	
Sweet Melon	Arava	7,500	(DH/100kg)	100
	Alma	7,500	(DH/100kg)	
	Galia	7,500	(DH/100kg)	
	Souihla	7,500	(DH/100kg)	
Water Melon	Star Brite	6,000	(DH/100kg)	100
	Mirage	6,000	(DH/100kg)	
Bread Bean	Local	1,000	(DH/100kg)	30
	Aguadule	5,000	(DH/100kg)	70
Alfalfa	Siliver	-	-	100
	Pmoapa	-	-	
	Pioneer	-	-	

Source: Hearing from Extension Workers from each Extension Center in PDAs and CV in ORMVA

Table XIII2.1.13: Utilization of Agricultural Input of Commune Rural(s) in Priority Project

	Priority Project	Commune Rural	No. of Farmer	Utilization of Agricultural Input (Number of applied farmers)				
				Mechanized Cultivation	Mechanized Harvest	Fertilizer	Selected Seeds	Agricultural
5(1)	N'Fiikh	Ziaida	1,535	1,082	1,005	1,072	569	1,055
	(Upstream)	Oulad Yahya Loyta	1,113	939	925	862	507	852
		(Sub-total)	2,648	2,021	1,930	1,934	1,076	1,907
5(2)	N'Fiikh	El Mansouria	358	189	187	177	134	150
	(Downstream)							
9	Taskourt	Assif El Mal	774	238	6	136	1	4
		Guemassa	1,348	1,174	594	35	30	35
		Majjate	1,577	1,473	910	122	54	152
		M'zouda	1,837	1,070	302	87	46	94
		(Sub-total)	5,536	3,955	1,812	380	131	285
10	Timkit	Aghbalou N'Kerdous	1,046	46	1	853	159	100
		Ferkla el Oulia	1,374	333	0	522	271	144
		Tinejdad	155	24	0	41	15	6
		Ferkla Es Soufla	944	446	4	682	247	123
		Mellab	1,267	701	1	917	392	167
		(Sub-total)	4,786	1,550	6	3,015	1,084	540
17	Azghar	Igheznane	1,643	403	164	976	222	591
		Ouled Mkoudou	750	84	11	623	96	549
		(Sub-total)	2,393	487	175	1,599	318	1,140

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.1.14: Utilizationof Agricultural Machineries of Commune Rural(s) in Priority Project

	Priority Project	Commune Rural	Number of machineries		
			Tractor	Harvestor	Pump
5(1)	N'Fiikh	Ziaida	63	8	227
	(Upstream)	Oulad Yahya Loyta	98	6	139
		(Sub-total)	161	14	366
5(2)	N'Fiikh	El Mansouria	35	2	130
	(Downstream)				
9	Taskourt	Assif El Mal	3	0	3
		Guemassa	22	0	52
		Majjate	56	1	227
		M'zouda	1	0	0
		(Sub-total)	82	1	282
10	Timkit	Aghbalou N'Kerdous	1	0	10
		Ferkla el Oulia	25	0	481
		Tinejdad	0	0	34
		Ferkla Es Soufla	9	0	304
		Mellab	9	0	705
		(Sub-total)	44	0	1,534
17	Azghar	Igheznane	22	3	29
		Ouled Mkoudou	13	1	46
		(Sub-total)	35	4	75

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.1.15: Estimated Present Input of Agricultural Materials and Labor Force for Production in N'Fifikh (Upstream) Area (per Hector)

Crops :Soft wheat

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Crop covering (machine)	DH/ha	150	1.0	150
Harvest	DH/ha	200	1.0	200
Baling	DH/Bale	2	135.0	203
Packing of grain	DH/Unit	2	13.0	26
Transportation	DH/100kg	5	13.0	65
Agricultural input materials				
Seed	DH/100kg	350	2.0	700
Fertilizer (14-28-14)	DH/100kg	250	0.5	125
Fertilizer (Urea)	DH/100kg	150	0.5	75
Chemicals	DH/liter	75	1.0	75
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	2.0	80
Total				2,029

Crops :Hard wheat

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Crop covering (machine)	DH/ha	150	1.0	150
Harvest	DH/ha	200	1.0	200
Baling	DH/Bale	2	135.0	203
Packing of grain	DH/Unit	3	18.0	45
Transportation	DH/100kg	5	20.0	100
Agricultural input materials				
Seed	DH/100kg	300	2.0	600
Fertilizer (14-28-14)	DH/100kg	250	1.0	250
Fertilizer (Urea)	DH/100kg	150	1.0	150
Chemicals	DH/liter	75	1.0	75
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	2.0	80
Treatment/Maintenance	DH/day	40	2.0	80
Total				2,223

Crops :Barley

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Crop covering (machine)	DH/ha	150	1.0	150
Harvest	DH/ha	200	1.0	200
Baling	DH/Bale	2	150.0	225
Packing of grain	DH/Unit	3	14.0	35
Transportation	DH/100kg	5	14.0	70
Agricultural input materials				
Seed	DH/100kg	150	2.0	300
Fertilizer (14-28-14)	DH/100kg	250	1.0	250
Labor Force				0
Fertilization	DH/day	40	2.0	80
Seeding/ seedling	DH/day	40	1.0	40
Total				1,600

Crops :Potato

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	300	1.0	300
Leveling	DH/ha	150	1.0	150
Crop covering (machine)	DH/ha	150	1.0	150
Transportation	DH/ton	12	25.0	300
Irrigation	DH/m3	1	2,400	1,200
Agricultural input materials				
Seed	DH/100kg	4,000	2.2	8,800
Fertilizer (14-28-14)	DH/100kg	250	1.0	250
Fertilizer (Others)	DH/100kg	100	2.0	200
Chemicals	DH/liter	200	3.0	600
Labor Force				0
Fertilization	DH/day	40	7.0	280
Seeding/ seedling	DH/day	40	3.0	120
Treatment/Maintenance	DH/day	40	16.0	640
Harvest	DH/day	40	8.0	320
Total				13,310

Crops :Tomato

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	300	1.0	300
Leveling	DH/ha	250	1.0	250
Crop covering (machine)	DH/ha	150	1.0	150
Supporting pole	DH/ha	0.8	5,000.0	4,000
Irrigation	DH/m3	0.5	2,400	1,200
Agricultural input materials				
Seed	DH/unit	300	1.0	300
Fertilizer (14-28-14)	DH/100kg	250	4.0	1,000
Fertilizer (Others)	DH/100kg	100	2.0	200
Chemicals	DH/liter	250	10.0	2,500
Labor Force				
Cultivation	DH/day	40	5.0	200
Fertilization	DH/day	40	8.0	320
Seeding/ seedling	DH/day	40	11.0	440
Treatment/Maintenance	DH/day	40	35.0	1,400
Harvest	DH/day	40	80	3,200
Total				15,460

Crops :Fodder barley

	Unit	Unit Price	Input value	Cost
Machineries				
Leveling	DH/ha	250	1.0	250
Crop covering (machine)	DH/ha	150	1.0	150
Harvest	DH/ha	150	1.0	150
Baling	DH/Bale	1.5	170.0	255
Transportation	DH/Bale	0.3	170.0	51
Agricultural input materials				
Seed	DH/100kg	200	2.5	500
Fertilizer (14-28-14)	DH/100kg	250	0.0	0
Fertilizer (Others)	DH/100kg	150	0.0	0
Chemicals	DH/liter	75	0.0	0
Labor Force				
Treatment/Maintenance	DH/day	40	3.0	120
Total				1,476

Crops :Broad Bean

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/Unit	250	1.0	250
Crop covering (machine)	DH/Unit	150	1.0	150
Agricultural input materials				
Seed	DH/kg	10	100.0	1,000
Fertilizer (14-28-14)	DH/100kg	250	0.5	125
Labor Force				
Cultivation	DH/day	40	4.0	160
Fertilization	DH/day	40	2.0	80
Seeding/ seedling	DH/day	40	2.0	80
Treatment/Maintenance	DH/day	40	4.0	160
Harvest	DH/day	40	5	200
Transportation	DH/day	40	5	200
Total				2,405

Crops :Grape

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/Unit	150	2.0	300
Transport	ton	10	10.0	100
Supporter	Unit	50	10.0	500
Treatment	Unit	500	0.5	250
Agricultural input materials				
Fertilizer	DH/100kg	240	3.0	720
Chemicals	DH/Unit	500	0.5	250
Labor Force				
Fertilization	DH/day	40	3.0	120
Treatment/Maintenance	DH/day	40	8.0	320
Harvest	DH/day	40	12.5	500
Total				3,060

Source: Projet de Mise en Valeur en Bour du Perimetre de Ziaida Province de Benslimane, Fishes Culturales, and Hearing from Farmer

Table XIII2.1.16: Estimated Present Input of Agricultural Materials and Labor Force for Production in N'Fifikh (Downstream) Area (per Hector)

Crops :Soft wheat

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Crop covering (machine	DH/ha	150	2.0	300
Harvest	DH/ha	400	1.0	400
Agricultural input materials				
Seed	DH/100kg	400	2.0	800
Fertilizer (14-28-14)	DH/100kg	255	2.0	510
Fertilizer (other)	DH/100kg	240	1.0	240
Chemicals	DH/liter			0
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	2.0	80
Harvest	DH/day	40	2	80
Total				2,740

Crops :Hard wheat

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Crop covering (machine)	DH/ha	150	2.0	300
Harvest	DH/ha	400	1.0	400
Agricultural input materials				
Seed	DH/100kg	400	2.0	800
Fertilizer (14-28-14)	DH/100kg	255	2.0	510
Fertilizer (other)	DH/100kg	240	1.0	240
Chemicals	DH/liter			0
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	2.0	80
Harvest	DH/day	40	2	80
Total				2,740

Crops :Barley

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Crop covering (machine	DH/ha	150	1.0	150
Harvest	DH/ha	400	1.0	400
Agricultural input materials				
Seed	DH/100kg	300	1.5	450
Fertilizer (14-28-14)	DH/100kg	250	1.5	375
Fertilizer (others)	DH/100kg	200	0.5	100
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Harvest	DH/day	40	4	160
Total				1,965

Crops :Potato

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Ridging	DH/ha	150	1	150
Agricultural input materials				
Seed	DH/100kg	4,000	2.0	8,000
Fertilizer (1)	DH/100kg	283	8.0	2,264
Fertilizer (2)	DH/100kg	185	2.0	370
Chemicals	DH/liter	300	3.0	900
Chemicals	DH/kg	200	3.5	700
Fuel	DH/liter	5	128.0	640
Labor Force				
Fertilization	DH/day	40	5.0	200
Seeding/ seedling	DH/day	40	15.0	600
Treatment/Maintenance	DH/day	40	12.0	480
Harvest	DH/day	40	23	920
Total				15,474

Crops :Fodder barley

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	Unit	250	1.0	250
Crop covering (machine	Unit	150	1	150
Baling	Unit	150	1.0	150
Other	Unit	200	1.0	200
Agricultural input materials				
Seed	100kg	480	1.5	720
Fertilizer (14-28-14)	100kg	255	1.0	255
Labor Force				
Fertilization	day	40	0.5	20
Seeding/ seedling	day	40	1.0	40
Harvest	day	40	5	200
Total				1,985

Crops :Alfalfa

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	Unit	250	1.0	250
Leveling	Unit	150	1.0	150
Ridging	Unit	150	1	150
Agricultural input materials				
Seed	100kg	4,800	0.25	1,200
Fertilizer (14-28-14)	100kg	250	6.0	1,500
Fuel	liter	5	640.0	3,200
Labor Force				
Fertilization	day	40	3.0	120
Seeding/ seedling	day	40	1.0	40
Treatment/Maintenance	day	40	100.0	4,000
Harvest	day	40	25	1,000
Total				11,610

Source: Project de Mise en Valeur en Bour du Perimetre Oued Hassar et Sidi Hajjaj, Fishes Culturales, and Hearing from farmers

Table XIII2.1.17: Estimated Present Input of Agricultural Materials and Labor Force for Production in Taskourt Area (per Hector)

Crops :Soft wheat

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	110	0.7	74
Crop covering (machine)	DH/ha	90	1.0	90
Harvest	DH/ha	100	0.3	33
Agricultural input materials				
Seed	DH/100kg	330	1.0	330
Fertilizer (14-28-14)	DH/100kg	230	0.3	78
Fertilizer (Urea)	DH/100kg	230	0.3	62
Labor Force				
Cultivation	DH/day	40	1.7	67
Fertilization	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	5.0	200
Harvest	DH/day	40	16	640
Total				1,614

Crops :Hard wheat

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	110	0.1	10
Plowing (animal)	DH/ha	70	0.27	19
Crop covering (machine)	DH/ha	100	0.7	73
Crop covering (animal)	DH/ha	70	0.3	19
Harvest	DH/ha	240	0.5	120
Agricultural input materials				
Seed	DH/100kg	330	1.0	330
Fertilizer (14-28-14)	DH/100kg	230	0.4	83
Fertilizer (Urea)	DH/100kg	230	0.7	168
Chemicals	DH/liter	35	0.2	6
Labor Force				
Cultivation	DH/day	40	1.5	60
Fertilization	DH/day	40	0.8	30
Seeding/ seedling	DH/day	40	0.5	20
Treatment/Maintenance	DH/day	40	11.8	470
Harvest	DH/day	40	14	540
Total				1,948

Crops :Barley

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	100	0.4	35
Plowing (animal)	DH/ha	70	0.25	18
Crop covering (machine)	DH/ha	100	0.8	75
Threshing	DH/ha	50	0.2	8
Agricultural input materials				
Seed	DH/Unit	220	1.0	220
Fertilizer (14-28-14)	DH/100kg	230	0.3	69
Fertilizer (Urea)	DH/100kg	230	0.1	12
Chemicals (24D)	DH/liter	35	0.0	1
Labor Force				0
Cultivation	DH/day	40	2.2	88
Fertilization	DH/day	40	1.8	72
Seeding/ seedling	DH/day	40	0.5	20
Treatment/Maintenance	DH/day	40	6.7	266
Harvest	DH/day	40	14.5	580
Total				1,463

Crops :Potato

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (animal)	DH/ha	70	1.0	70
Crop covering (animal)	DH/ha	60	1.0	60
Ridging	DH/ha	50	0.5	25
Agricultural input materials				
Seed	DH/100kg	350	7.5	2,625
Fertilizer (Urea)	DH/100kg	230	3.4	782
Labor Force				0
Cultivation	DH/day	40	13.0	520
Fertilization	DH/day	40	30.4	1,216
Seeding/ seedling	DH/day	40	70.0	2,800
Treatment/Maintenance	DH/day	40	40.0	1,600
Harvest	DH/day	40	40.0	1,600
Total				11,298

Crops :Alfalfa

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (animal)	DH/ha	70	0.2	14
Leveling	DH/ha	60	0.2	12
Crop covering (machine)	DH/ha	50	0.2	10
Harvest (Transport)	DH/ha	300	1.0	300
Agricultural input materials				
Seed	DH/100kg	3,000	0.1	150
Fertilizer (Urea)	DH/100kg	230	4.5	1,035
Labor Force				
Cultivation	DH/day	40	3.0	120
Fertilization	DH/day	40	15.0	600
Treatment/Maintenance	DH/day	40	12.0	480
Harvest	DH/day	40	30.0	1,200
Total				3,921

Crops :Olive (for production tree)

	Unit	Unit Price	Input value	Cost
Machineries				
Agricultural input materials				
Fertilizer (Urea)	DH/100kg	230	0.3	69
Chemicals (24D)	DH/Unit	120	0.1	12
Labor Force				
Fertilization	DH/day	40	23.4	936
Treatment/Maintenance	DH/day	40	19.2	768
Harvest	DH/day	40	24.0	960
Total				2,745

Crops :Almond (for production tree)

	Unit	Unit Price	Input value	Cost
Machineries				
Agricultural input materials				
Fertilizer ((NH4)2SO4)	DH/100kg	150	2.0	300
Maintenance	DH/Unit	150	2.0	300
Labor Force				
Fertilization	DH/day	40	2.0	80
Treatment/Maintenance	DH/day	40	7.0	280
Harvest	DH/day	40	12.5	500
Total				1,460

Crops :Broad bean

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing (machine)	DH/ha	110	0.4	44
Plowing (animal)	DH/ha	70	0.8	53
Crop covering (machine)	DH/ha	90	0.1	11
Crop covering (animal)	DH/ha	70	0.9	62
Agricultural input materials				
Seed	DH/100kg	500	0.8	375
Fertilizer (14-28-14)	DH/100kg	230	1.0	230
Labor Force				0
Cultivation	DH/day	40	9.0	360
Fertilization	DH/day	40	7.0	280
Seeding/ seedling	DH/day	40	4.0	160
Treatment/Maintenance	DH/day	40	4.0	160
Harvest	DH/day	40	18.0	720
Total				2,450

Source: Second Projet de Developpement de la Petite et Moyenne Hydraaulique, Perometre d'Amezmiz, Etudes de Perimetre Phase, Aituation Actuelle et Developpement Agricole, A1 Situation Actuelle, SCET-Maroc 1995, and hearing from Farmers

Table XIII2.1.18: Estimated Present Input of Agricultural Materials and Labor Force for Production in Timkit Area (per Hector)

Crops :Cereals (Wheat / Barley)

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing	hour	56	2	112
Crop covering	hour	56	1	56
Harvest	hour	96	4	384
Agricultural input materials				
Seed	100kg	385	1	462
Fertilizer (14-28-14)	100kg	212	1	159
Fertilizer (Urea)	100kg	190	1	95
Labor Force				
Cultivation	day	40	3	120
Fertilization	day	40	1	40
Seeding/ seedling	day	40	2	80
Treatment/Maintenance	day	40	10	400
Harvest	day	40	6	240
Total				2,148

Crops :Barley

	Unit	Unit Price	Input value	Cost
Machineries				
Plowing	hour	56	2	112
Harvest	hour	96	4	336
Agricultural input materials				
Seed	100kg	180	1	216
Labor Force				
Seeding/ seedling	day	40	2	80
Harvest	day	40	18	720
Total				1,464

Crops :Vegetable (general) Potato

	Unit	Unit Price	Input value	Cost
Cultivation by machineries & animal				
Plowing	hour	56	3	168
Agricultural input materials				
Seed	Unit	1,500	3	4,500
Fertilizer (14-28-14)	100kg	212	3	636
Labor Force				0
Cultivation	day	40	9	360
Fertilization	day	40	8	320
Seeding/ seedling	day	40	15	600
Treatment/Maintenance	day	40	28	1,120
Harvest	day	40	45	1,800
Total				9,504

Crops :Fodder Alfalfa

	Unit	Unit Price	Input value	Cost
Cultivation by machineries & animal				
Plowing	hour	56	3	168
Agricultural input materials				
Seed	Unit	3,000	0.2	600
Fertilizer (14-28-14)	100kg	212	1	106
Labor Force				0
Cultivation	day	40	10	400
Fertilization	day	40	10	400
Seeding/ seedling	day	40	5	200
Harvest	day	40	65	2,600
Total				4,474

Crops :Dates (Existing Trees)

from 3rd year	Unit	Unit Price	Input value	Cost
Cultivation by machineries & animal				
Agricultural input materials				
Fertilizer (14-28-14)	100kg	212	2	424
Labor Force				
Fertilization	day	40	4	160
Treatment/Maintenance	day	40	12	480
Harvest	day	40	31	1,240
Total				2,304

Crops :Olive (Existing Trees)

from 3rd year	Unit	Unit Price	Input value	Cost
Cultivation by machineries & animal				
Plowing	hour	56	3	168
Agricultural input materials				
Seed	Unit	3,000	0.2	600
Fertilizer (14-28-14)	100kg	212	1	106
Labor Force				
Cultivation	day	40	10	400
Fertilization	day	40	10	400
Seeding/ seedling	day	40	5	200
Harvest	day	40	65	2,600
Total				4,474

Source: Reexamen des Dossieres de Prefactibilite des Perimetre d'Epandage des Eaux de Crue dans le Tafilalet, Piece 4: Perimetre Ait Labzam, Waten s.a. And Hering from Farmers and Extension workers

Table XIII2.1.19: Estimated Present Input of Agricultural Materials and Labor Force for Production in Azghar Area (per Hector)

Crops :Soft wheat

	Unit	Unit Price	nput valu	Cost
Machineries				
Plowing (machine)	DH/ha	300	0.9	270
Plowing (animal)	DH/ha	70	0.1	7
Crop covering (machine)	DH/ha	150	0.9	135
Crop covering (animal)	DH/ha	70	0.1	7
Harvest (machine)	DH/ha	350	0.9	315
Harvest (animal)	DH/ha	70	0.1	7
Baling	DH/Bale	3	120.0	360
Transportation	Dh/100kg	1	120.0	60
Agricultural input materials				
Seed	Dh/100kg	350	1.3	455
Fertilizer (14-28-14)	Dh/100kg	250	1.0	250
Fertilizer (Urea)	Dh/100kg	153	0.5	77
Chemicals (2-4-D)	Dh/liter	40	1.0	40
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	1.0	40
Harvest	DH/day	40	1	40
Total				2,143

Crops :Hard wheat

	Unit	Unit Price	nput valu	Cost
Machineries				
Plowing (machine)	DH/ha	300	0.9	270
Plowing (animal)	DH/ha	70	0.1	7
Crop covering (machine)	DH/ha	150	0.9	135
Crop covering (animal)	DH/ha	70	0.1	7
Harvest (machine)	DH/ha	350	0.9	315
Harvest (animal)	DH/ha	70	0.1	7
Baling	DH/Bale	3	120.0	360
Transportation	Dh/100kg	1	120.0	60
Agricultural input materials				
Seed	Dh/100kg	390	1.3	507
Fertilizer (14-28-14)	Dh/100kg	250	1.0	250
Fertilizer (Urea)	Dh/100kg	153	0.5	77
Chemicals (2-4-D)	Dh/liter	40	1.0	40
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	1.0	40
Harvest	DH/day	40	1	40
Total				2,195

Crops :Barley

	Unit	Unit Price	nput valu	Cost
Machineries				
Plowing (machine)	DH/ha	300	0.9	270
Plowing (animal)	DH/ha	70	0.1	7
Crop covering (machine)	DH/ha	150	0.9	135
Crop covering (animal)	DH/ha	70	0.1	7
Harvest (machine)	DH/ha	350	0.9	315
Harvest (animal)	DH/ha	70	0.1	7
Baling	DH/Bale	3	120.0	360
Transportation	Dh/100kg	1	120.0	60
Agricultural input materials				
Seed	Dh/100kg	275	1.0	275
Fertilizer (14-28-14)	Dh/100kg	250	1.0	250
Fertilizer (Urea)	Dh/100kg	153	0.5	77
Chemicals (2-4-D)	Dh/liter	40	1.0	40
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Treatment/Maintenance	DH/day	40	1.0	40
Harvest	DH/day	40	1	40
Total				1,963

Crops :Legume

	Unit	Unit Price	nput valu	Cost
Machineries				
Plowing (machine)	DH/ha	250	1.0	250
Agricultural input materials				
Seed	Dh/100kg	1,000	1.3	1,300
Fertilizer (TSP)	Dh/100kg	220	1.0	220
Labor Force				
Cultivation	DH/day	40	2.0	80
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	1.0	40
Harvest	DH/day	40	3	120
Total				2,050

Crops :Fodder barley

	Unit	Unit Price	nput valu	Cost
Machineries				
Plowing (machine)	DH/ha	300	1.0	300
Crop covering (machine)	DH/ha	150	1.0	150
Harvest	DH/ha	200	1.0	200
Baling	DH/Bale	4	100.0	400
Transportation	Dh/100kg	5	10.0	50
Agricultural input materials				
Seed	Dh/100kg	275	1.5	413
Fertilizer (TSP)	Dh/100kg	250	1.0	250
Fertilizer ((NH4)2SO4)	Dh/100kg	200	0.5	100
Labor Force				
Fertilization	DH/day	40	1.0	40
Seeding/ seedling	DH/day	40	2.0	80
Total				1,983

Crops : Olive (for production tree)

	Unit	Unit Price	nput valu	Cost
Machineries				
Transportation	DH/100kg	5	9.0	45
Agricultural input materials				
Fertilizer (14-28-14)	Dh/100kg	250	3.0	750
Fertilizer ((NH4)2SO4)	Dh/100kg	170	1.0	170
Labor Force				
Fertilization	DH/day	40	2.0	80
Treatment/Maintenance	DH/day	40	2.0	80
Harvest	DH/day	40	12	480
Total				1,605

Source: Data from Ribat Al Khayr Work Center, DPA Sefrou 2001

Table XIII2.1.20: Number of Livestock of Commune Rurals in Priority Project

	Priority Project	Commune Rural	Cattle	Sheep	Goat	Camel	Horse	Mule	Donkey
5(1)	N'Fifikh	Ziaida	4,388	12,453	780	16	287	463	1,356
	(Upstream)	Oulad Yahya Loyta	2,375	10,070	706	34	216	349	753
		(Sub-total)	6,763	22,523	1,486	50	503	812	2,109
5(2)	N'Fiikh (Downstr	El Mansouria	1,016	8,228	172	21	26	19	145
9	Taskourt	Assif El Mal	1,232	4,877	3,391	0	20	120	818
		Guemassa	1,425	22,255	2,392	0	17	176	1,271
		Majjate	2,479	37,349	2,980	11	15	73	1,468
		M'zouda	3,472	29,236	6,450	3	57	281	1,851
		(Sub-total)	8,608	93,717	15,213	14	109	650	5,408
10	Timkit	Aghbalou N'Kerdous	1,415	7,779	12,293	26	0	394	239
		Ferkla el Oulia	973	13,578	15,759	404	1	129	496
		Tinejdad	100	629	3	0	0	4	15
		Ferkla Es Soufla	573	5,437	1,978	1	0	80	377
		Mellab	1,232	8,128	8,328	49	1	96	514
		(Sub-total)	4,293	35,551	38,361	480	2	703	1,641
17	Azghar	Igheznane	2,097	20,339	16,405	6	57	1,539	722
		Ouled Mkoudou	980	7,493	1,935	1	20	674	406
		(Sub-total)	3,077	27,832	18,340	7	77	2,213	1,128

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.1.21: Non-agricultural Activities of Farmers of Commune Rurals in Priority Project

	Priority Project	Commune Rural	Agricultur e only	Non-agricultural activities of farmers								
				Fishing	Energy / Industry	Const- ruction	Handy craft	Services	Officer	Private business	Others	Sub-total
5(1)	N'Fifikh	Ziaida	1,282	3	7	5	2	49	49	23	114	252
	(Upstream)	Oulad Yahya Loyta	846	2	13	1	5	89	48	17	63	238
		(Sub-total)	2,128	5	20	6	7	138	97	40	177	490
5(2)	N'Fifikh (Downstream)	El Mansouria	236	6	9	1	0	14	16	5	65	116
9	Taskourt	Assif El Mal	697	1	2	3	7	18	12	3	31	77
		Guemassa	1,186	0	0	0	9	30	39	26	58	162
		Majjate	1,270	1	5	36	20	114	19	12	99	306
		M'zouda	1,607	1	2	14	23	43	5	42	100	230
		(Sub-total)	4,760	3	9	53	59	205	75	83	288	775
10	Timkit	Aghbalou N'Kerdous	784	0	0	64	0	7	2	22	156	251
		Ferkla el Oulia	999	0	8	160	3	64	50	73	17	375
		Tinejdad	110	0	1	16	1	6	9	5	6	44
		Ferkla Es Soufla	647	1	4	140	4	26	23	48	49	295
		Mellab	965	0	4	130	3	24	39	41	61	302
		(Sub-total)	3,505	1	17	510	11	127	123	189	289	1,267
17	Azghar	Igheznane	1,455	2	2	2	0	22	113	4	39	184
		Ouled Mkoudou	660	1	1	0	0	8	34	7	39	90
		(Sub-total)	2,115	3	3	2	0	30	147	11	78	274

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.1.22: Educational Background of Farmers of Commune Rurals in Priority Project

	Priority Project	Commune Rural	Illiteracy	Religious school	Primary school	Secondar y school	High school	Universit y	Total
5(1)	N'Fifikh	Ziaida	1,251	73	87	41	25	57	1,534
	(Upstream)	Oulad Yahya Loyta	822	58	100	30	31	43	1,084
		(Sub-total)	2,073	131	187	71	56	100	2,618
5(2)	N'Fiikh (Downstream)	El Mansouria	266	14	28	18	10	16	352
9	Taskourt	Assif El Mal	656	79	35	0	1	3	774
		Guemassa	1,096	132	76	18	16	10	1,348
		Majjate	1,293	160	97	15	3	8	1,576
		M'zouda	1,637	138	53	7	1	1	1,837
		(Sub-total)	4,682	509	261	40	21	22	5,535
10	Timkit	Aghbalou N'Kerdous	728	70	222	15	4	6	1,045
		Ferkla el Oulia	956	138	198	35	29	18	1,374
		Tinejdad	106	12	25	4	5	2	154
		Ferkla Es Soufla	558	166	171	30	9	8	942
		Mellab	877	166	170	31	13	10	1,267
		(Sub-total)	3,225	552	786	115	60	44	4,782
17	Azghar	Igheznane	1,358	164	69	27	8	13	1,639
		Ouled Mkoudou	648	37	36	15	8	6	750
		(Sub-total)	2,006	201	105	42	16	19	2,389

Source: Recensement General de l'Agriculture, Resultsts par Commune,
Ministere de l'Agriculture de Development Rural et des Peches Maritimes, Janvier 2001

Table XIII2.2.1: Major Agricultural Chemical and Fertilizer

Crops	Insecticide	Fungicide	Herbicide
Olive	Chlorpyriphose ethyl Methyl parathion Dimethoate Fenthion	Cupper oxychlolocide Zinebe cupper Cupper sulphate	Neant
Vegetable	Chlorpyriphose ethyl Pyrimicarbe Dicofol Deltamethrine Fenazaquin Bifenthrine	Sulphur Benomyl Cupper sulphate Mancozebe Zinebe Manebe	Trifluraline
Legume / Oil seeds	Dicofol Methomyl Chlorpyriphose ethyl Deltamethtine Endosulfan Bifenthrine	Sulphur Manebe Benomyl Cupper sulphate	
Cereals	(No need fro cereals)	Tebuconazole Manecozebe Prochlotazt Cyproconazole	2.4 D 2.4D+2.4MCPA 2.4D+MCPP

Source: HassanII

Table XIII2.2.2: Estimated Input Values for the Cultivation of Major Crops (1/2)

Cereal

	Application Amount				Unit Price		Sub-Total	
Seed	120	kg/ha			4	DH/kg	480	DH/ha
Manure	10	ton/ha			0	DH/ton	0	DH/ha
Fertilizer								
N	120	kg/ha as N	46% as Urea	261	272.00	DH/100kg	710	DH/ha
P2O5	84	kg/ha as P2O5	45% as TSP	187	220.00	DH/100kg	411	DH/ha
K2O	90	kg/ha as K2O	50% as K2SO4	180	228.00	DH/100kg	410	DH/ha
Agricultural Chemicals		DH/ha			50	DH/ha	50	DH/ha
Mechanization								
Tractor	6.0	hr/ha			318	DH	239	DH/ha
Animal Traction	5.0	day/ha			40	DH/day	200	DH/ha
Baler	4.0	hr/ha			318	DH/day	159	DH/ha
Labor Force	23	day/ha			40	DH/day	920	DH/ha
Other (bags, case, etc)	10	%				%	358	DH/ha
					Grand Total		3,936	DH/ha

Potato

	Application Amount				Unit Price		Sub-Total	
Seed	2000	kg/ha			3.5	DH/kg	7,000	DH/ha
Manure	30	ton/ha			0	DH/ton	0	DH/ha
Fertilizer								
N	90	kg/ha as N	46% as Urea	196	272.00	DH/100kg	532	DH/ha
P2O5	90	kg/ha as P2O5	45% as TSP	200	220.00	DH/100kg	440	DH/ha
K2O	120	kg/ha as K2O	50% as K2SO4	240	228.00	DH/100kg	547	DH/ha
Agricultural Chemicals	200	DH/ha			200	DH/ha	200	DH/ha
Mechanization								
Tractor	13	hr/ha			318	DH	497	DH/ha
Animal Traction	19	day/ha			40	DH/day	760	DH/ha
Labor Force	120	day/ha			40	DH/day	4,800	DH/ha
Other (bags, case, etc)	15	%				%	2,216	DH/ha
					Grand Total		16,993	DH/ha

Carrot

	Application Amount				Unit Price		Sub-Total	
Seed	3	kg/ha			250	DH/kg	750	DH/ha
Manure	10	ton/ha			150	DH/ton	1,500	DH/ha
Fertilizer								
N	105	kg/ha as N	46% as Urea	228	1.26	DH/kg	288	DH/ha
P2O5	135	kg/ha as P2O5	45% as TSP	300	1.84	DH/kg	552	DH/ha
K2O	150	kg/ha as K2O	50% as K2SO4	300	2.46	DH/kg	738	DH/ha
Agricultural Chemicals	100	DH/ha			100	DH/ha	100	DH/ha
Mechanization								
Tractor	13	hr/ha			157	DH	245	DH/ha
Animal Traction	19	Jours/ha			40	DH/day	760	DH/ha
Labor Force	120	Jours/ha			40	DH/day	2,400	DH/ha
Other (bags, case, etc)	15	%				%	1,100	DH/ha
					Grand Total		8,433	DH/ha

Tomota

	Application Amount				Unit Price		Sub-Total	
Seed	0.5	kg/ha			820	DH/kg	410	DH/ha
Manure	30	ton/ha			0	DH/ton	0	DH/ha
Fertilizer								
N	92	kg/ha as N	46% as Urea	200	272.00	DH/100kg	544	DH/ha
P2O5	90	kg/ha as P2O5	45% as TSP	200	220.00	DH/100kg	440	DH/ha
K2O	170	kg/ha as K2O	50% as K2SO4	340	228.00	DH/100kg	775	DH/ha
Agricultural Chemicals	600	DH/ha			600	DH/ha	600	DH/ha
Mechanization								
Tractor	10	hr/ha			318	DH	378	DH/ha
Animal Traction	38	day/ha			40	DH/day	1,520	DH/ha
Labor Force	200	day/ha			40	DH/day	8,000	DH/ha
Other (bags, case, etc)	20	%				%	2,533	DH/ha
					Grand Total		15,200	DH/ha

Water Melon

	Application Amount				Unit Price		Sub-Total	
Seed	3	kg/ha			250	DH/kg	750	DH/ha
Manure	5	ton/ha			0	DH/ton	0	DH/ha
Fertilizer								
N	210	kg/ha as N	46% as N	457	272.00	DH/100kg	1,242	DH/ha
P2O5	210	kg/ha as P2O5	45% asP2O5	467	220.00	DH/100kg	1,027	DH/ha
K2O	150	kg/ha as K2O	50% as K2O	300	228.00	DH/100kg	684	DH/ha
Agricultural Chemicals	600	DH/ha			600	DH/ha	600	DH/ha
Mechanization								
Tractor	10	hr/ha			318	DH	378	DH/ha
Animal Traction	21	day/ha			41	DH/day	861	DH/ha
Labor Force	155	day/ha			41	DH/day	6,355	DH/ha
Other (bags, case, etc)	15	%				%	1,784	DH/ha
					Grand Total		13,680	DH/ha

Fodder (Alfalfa)

	Application Amount				Unit Price		Sub-Total	
Seed	360DH	kg/ha			360	DH/kg	360	DH/ha
Manure	10	ton/ha				DH/ton		DH/ha
Fertilizer								
N	46	kg/ha as N	46% as Urea	100	272.00	DH/100kg	272	DH/ha
P2O5	135	kg/ha as P2O5	45% as TSP	300	220.00	DH/100kg	660	DH/ha
K2O	100	kg/ha as K2O	50% as K2SO4	200	228.00	DH/100kg	456	DH/ha
Agricultural Chemicals		DH/ha			0	DH/ha	0	DH/ha
Mechanization								
Tractor	0	hr/ha			318	DH	0	DH/ha
Animal Traction	19	day/ha			40	DH/day	760	DH/ha
Labor Force	114	day/ha			40	DH/day	4,560	DH/ha
Other (bags, case, etc)	10	%				%	707	DH/ha
					Grand Total		7,775	DH/ha

Table XIII2.2.2: Estimated Input Values for the Cultivation of Major Crops (2/2)

Olive **Estimation from Timkit Data**

	Application Amount				Unit Price		Sub-Total	
Seed	140DH *10	kg/ha	Renewal for 30 years	0	DH/kg	140	DH/ha
Manure		ton/ha			DH/ton		DH/ha
Fertilizer							
N	60	kg/ha as Urea	46% as Urea	130	272.00	DH/100kg	355	DH/ha
P2O5	50	kg/ha as TSP	45% as TSP	111	220.00	DH/100kg	244	DH/ha
K2O	30	kg/ha as K2SO4	50% as K2SO4	60	228.00	DH/100kg	137	DH/ha
Agricultural Chemicals	150	DH/ha			150	DH/ha	150	DH/ha
Mechanization								
Tractor		hr/ha			157	DH	0	DH/ha
Animal Traction	12	day/ha			40	DH/day	480	DH/ha
Labor Force	68	day/ha			40	DH/day	2,720	DH/ha
Other (bags, case, etc)	15	%				%	634	DH/ha
New Plantation	1st year	12904DH/ha			Grand Total		4,860	DH/ha
	2nd year	1276DH/ha						

Almond **Estimation from Timkit Data**

	Application Amount		Unit Price		Sub-Total	
Seed		kg/ha	0	DH/kg	0	DH/ha
Manure		ton/ha		DH/ton		DH/ha
Fertilizer						
Lump sum		kg/ha	2.46	DH/kg	848	DH/ha
Agricultural Chemicals		DH/ha	150	DH/ha		DH/ha
Mechanization						
Tractor		hr/ha	157	DH		DH/ha
Animal Traction		day/ha		DH/day		DH/ha
Labor Force		day/ha	41	DH/day	1,260	DH/ha
Other (bags, case, etc)	10	%		%	211	DH/ha
			Grand Total		2,319	DH/ha

Grapes **Estimation based on the Bensliman data**

	Application Amount				Unit Price		Sub-Total	
Seed		kg/ha		0	DH/kg		DH/ha
Manure		ton/ha			DH/ton		DH/ha
Fertilizer							
12-24-12		kg/ha		400	252.00	DH/100kg	1,008	DH/ha
P2O5		kg/ha as P2O5	45% as TSP	0		DH/100kg	0	DH/ha
K2O		kg/ha as K2O	50% as K2SO4	0		DH/100kg	0	DH/ha
Agricultural Chemicals	Toltal	DH/ha			500	DH/ha	500	DH/ha
Mechanization							800	
Tractor	8	hr/ha	chemical Treatment		142	DH	142	DH/ha
Animal Traction		day/ha				DH/day		DH/ha
Labor Force	31	day/ha			40	DH/day	1,240	DH/ha
Other (bags, case, etc)	20	%				%	738	DH/ha
New plantation	1st year	15960DH/ha			Grand Total		4,428	DH/ha
	2nd year	4960DH/ha						

Citrus **Estimation based on Traditional cultivation wiyhout Project**

	Application Amount				Unit Price		Sub-Total	
Seed	540	kg/ha		540	DH/kg	540	DH/ha
Manure	-	ton/ha			DH/ton		DH/ha
Fertilizer							
N	180	kg/ha as N	46% as Urea	543	2.72	DH/kg	1,478	DH/ha
P2O5	250	kg/ha as P2O5	45% as TSP	300	2.53	DH/kg	759	DH/ha
K2O	135	kg/ha as K2O	50% as K2SO4	1000	2.53	DH/kg	2,530	DH/ha
Agricultural Chemicals	500	DH/ha			500	DH/ha	500	DH/ha
Mechanization								
Tractor	0	hr/ha			157	DH		DH/ha
Animal Traction	10	day/ha			40	DH/day	400	DH/ha
Labor Force	160	day/ha			40	DH/day	3,200	DH/ha
Other (bags, case, etc)	20	%				%	941	DH/ha
					Grand Total		10,348	DH/ha

Dates **Estimation based on Timkit data** **100 trees/ha**

	Application Amount				Unit Price		Sub-Total	
Seed		kg/ha		0	DH/kg	0	DH/ha
Manure		ton/ha			DH/ton		DH/ha
Fertilizer							
12-24-12		kg/ha		400	252.00	DH/100kg	1,008	DH/ha
P2O5		kg/ha as P2O5	45% as TSP	0		DH/100kg	0	DH/ha
K2O		kg/ha as K2O	50% as K2SO4	0		DH/100kg	0	DH/ha
Agricultural Chemicals		DH/ha			150	DH/ha		DH/ha
Mechanization								
Tractor		hr/ha			157	DH		DH/ha
Animal Traction		day/ha				DH/day		DH/ha
Labor Force	50	day/ha			40	DH/day	2,000	DH/ha
Other (bags, case, etc)		%			10	%	0	DH/ha
New plantation	1st year	23588DH/ha			Grand Total		3,008	DH/ha
	2nd year	823DH/ha						

Beans

	Application Amount				Unit Price		Sub-Total	
Seed	60	kg/ha		10	DH/kg	600	DH/ha
Manure	20	ton/ha		0	DH/ton	0	DH/ha
Fertilizer							
N	33	kg/ha as N	46% as Urea	72	272.00	DH/100kg	195	DH/ha
P2O5	110	kg/ha as P2O5	45% as TSP	244	220.00	DH/100kg	538	DH/ha
K2O	150	kg/ha as K2O	50% as K2SO4	300	228.00	DH/100kg	684	DH/ha
Agricultural Chemicals	200	DH/ha			50	DH/ha	50	DH/ha
Mechanization								
Tractor	9.5	hr/ha			318	DH	378	DH/ha
Animal Traction	21.0	day/ha			40	DH/day	840	DH/ha
Baler		hr/ha			318	DH/day	0	DH/ha
Labor Force	194	day/ha			40	DH/day	7,760	DH/ha
Other (bags, case, etc)	10	%				%	1,104	DH/ha

Source: The Development of Small and Medium Scale Irrigation Project
Collected data from Rural Engineering Administration, Ministry of Agriculture, Rural Development and Fisheries
Estimation by the Team

Table XIII2.2.3: Expected Increasing of Yield after Installation of Irrigation Facilities (Modern Irrigation Scheme)

		Unit	0	1	2	3	4	5	6	7	8	9	10	11
1	Grain cereals (Sprinkle	qx/ha	10/10/7 c/	10/10/7 c/	19	28	34	40	40	40	40	40	40	40
2	Grain cereals (Gravity)	qx/ha	10/10/7 c/	10/10/7 c/	17	25	30	35	35	35	35	35	35	35
3	Straw of cereals	UF/ha	600	600	720	840	920	1,000	1,000	1,000	1,000	1,000	1,000	1,000
4	Grain corn	qx/ha	7/7/6 c/	7/7/6 c/	17	27	34	40	40	40	40	40	40	40
5	Dry veggies	qx/ha	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/	8/8/5 c/
6	Green veggies	qx/ha	80	80	95	110	130	150	150	150	150	150	150	150
7	Green beans	qx/ha	-	-	30	39	46	50	50	50	50	50	50	50
8	Peppers	qx/ha	-	-	80	93	104	120	120	120	120	120	120	120
9	Winter veggies a/	qx/ha	150	150	189	228	254	280	280	280	280	280	280	280
10	Summer veggies b/	qx/ha	250	250	280	310	330	350	350	350	350	350	350	350
11	Sugar beets	qx/ha	-	-	300	360	420	450	450	450	450	450	450	450
12	Sugar beet leaves	UF/ha	-	-	800	800	800	800	800	800	800	800	800	800
13	Bersim	UF/ha	3,300	3,300	4,000	4,600	5,100	5,500	5,500	5,500	5,500	5,500	5,500	5,500
14	Alfalfa	UF/ha	5,200	5,200	6,200	7,200	7,800	8,500	8,500	8,500	8,500	8,500	8,500	8,500
15	Fodder Maize	qx/ha	4,200	4,200	4,600	5,000	5,300	5,600	5,600	5,600	5,600	5,600	5,600	5,600
16	Citrus	qx/ha	300	300	300	300	300	300	300	300	300	300	300	300
17	Existing olive trees	qx/ha	20	20	25	40	80	100	100	100	100	100	100	100
18	Newly planted Apple	qx/ha	-	-	-	-	-	-	-	40	80	120	170	200
19	Existing Apple	UF/ha	100	100	110	130	170	200	200	200	200	200	200	200
20	Unplanted land	UF/ha	500	500	500	500	500	500	500	500	500	500	500	500
21	Dry veggies	UF/ha	300	300	300	300	300	300	300	300	300	300	300	300
22	Oats	UF/ha	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300

Note: a/ 50% of potato and 50% of carrot
b/ 50% of potato and 50% of water melon
c/ Sebou / Grou / Jemaa Sahim

qx: 100kg
UF: Fodder Unit

Source: The Development of Small and Medium Scale Irrigation Project
Collected data from Rural Engineering Administration, Ministry of Agriculture, Rural Development and Fisheries

Table XIII3.1.1: Reference Crop Evapotranspiration (ETo) For Each Zone (Modified Penman Method)

Zone	Zone I		Zone II		Zone III		Zone IV		Zone V	
Month/Unit	mm	mm/day	mm	mm/day	mm	mm/day	mm	mm/day	mm	mm/day
January	73	2.45	89	2.88	86	2.87	87	2.91	81	2.69
February	87	3.05	102	3.6	102	3.59	105	3.68	98	3.43
March	134	4.32	152	4.9	155	4.99	157	5.07	150	4.84
April	157	5.24	183	6.11	184	6.13	185	6.17	179	5.98
Nay	196	6.32	223	7.2	221	7.14	252	7.48	225	7.26
June	233	7.77	243	8.11	247	8.25	256	8.52	250	8.34
July	261	8.42	261	8.43	271	8.76	261	8.43	264	8.52
August	223	7.2	220	7.11	232	7.49	222	7.15	220	7.11
September	174	5.79	177	5.9	184	6.14	180	5.99	179	5.96
October	141	4.54	153	4.93	155	4.99	156	5.03	152	4.92
November	94	3.13	106	3.52	108	3.61	106	3.52	100	3.35
December	70	2.25	83	2.68	85	2.73	84	2.71	79	2.53
Annual Mean	1,843	(60.48)	1,992	(65.37)	2,030	(66.69)	2,031	(66.66)	1,977	(64.93)
Monthly Mean	154	(5.04)	166	(5.45)	169	(5.56)	169	(5.56)	165	(5.41)

Notes:
(1) ETo for Zone I is calculated using the meteorological data observed at the Fes-Sais Station.
(2) ETo for Zone II is based on the meteorological data observed at the Marrakech Station and modified by using temperature recorded at the Sidi Jaber Station.
(3) ETo for Zone III is calculated using the meteorological data observed at the Marrakech Station.
(4) ETo for Zone IV is calculated using the meteorological data observed at the Ouarzazate Station.
(5) ETo for Zone V is calculated using the meteorological data observed at the Rachidia Station.
(6) Meteorological data used for the calculation of ETo for each zone are 20 years from 1980 to 1999.

Table XIII3.1.2: Monthly Mean Precipitation at Feddane Taba

Period : 1976-2000
Station : Feddane Taba (for N'fifikh)
Latitude :
Longitude :
Altitude :

(Unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	TOTAL
1976									14.1	90.1	6.7	98.9	
1977	58.2	14.1	15.7	1.7	4.6	2.7	0.4	-	0.6	42.2	52.8	41.3	234.3
1978	88.3	77.1	10.8	57.1	0.2	0.3	-	0.2	-	22.0	14.2	156.0	426.2
1979	155.1	97.1	131.0	21.4	3.8	0.2	-	-	0.1	126.6	13.2	20.0	568.5
1980	75.5	13.6	89.7	23.9	11.1	0.1	-	0.8	2.8	28.4	41.1	7.1	294.1
1981	14.3	4.3	21.1	21.1	9.0	6.4	-	-	0.2	0.8	0.2	53.9	131.3
1982	34.8	5.8	34.9	63.5	1.6	-	0.2	-	2.2	14.7	43.6	47.3	248.6
1983	0.3	88.5	54.5	27.6	2.3	-	-	-	2.8	1.5	58.0	63.4	298.9
1984	12.0	7.0	98.4	43.8	105.8	1.2	-	-	-	2.5	81.3	26.7	378.7
1985	84.5	31.6	2.2	17.7	18.2	0.9	-	-	0.3	-	61.2	54.4	271.0
1986	55.4	156.0	30.2	36.8	1.1	16.8	-	-	0.8	4.9	59.9	17.6	379.5
1987	86.4	81.0	12.5	13.6	6.4	0.5	1.4	0.1	3.3	31.9	83.3	110.0	430.4
1988	81.9	78.7	7.6	20.3	15.3	7.4	-	-	0.2	20.5	79.2	8.9	320.0
1989	27.7	30.1	55.4	76.4	1.6	0.7	-	1.4	-	8.0	80.3	139.0	420.6
1990	67.9	-	47.5	59.0	2.9	0.9	-	-	0.9	34.3	42.0	78.6	334.0
1991	45.9	125.8	93.0	19.7	0.4	0.5	0.2	-	55.0	111.9	7.2	21.9	481.5
1992	-	33.4	31.2	89.5	3.6	24.3	-	0.2	1.1	23.6	9.7	14.0	230.6
1993	14.8	21.3	45.4	34.8	12.5	-	-	-	4.5	25.9	110.0	14.6	283.8
1994	36.8	44.1	7.8	3.2	1.0	-	-	-	1.0	7.2	17.4	0.2	118.7
1995	6.4	30.5	11.0	22.7	0.1	8.9	-	0.4	1.0	5.1	45.7	59.7	191.5
1996	172.5	34.6	63.3	20.0	39.1	0.1	-	0.1	5.1	18.0	29.0	254.0	635.8
1997	64.5	0.4	2.4	36.9	0.0	0.3	6.0	-	6.2	21.1	60.6	32.8	231.2
1998	20.5	32.8	6.8	8.8	1.2	6.1	-	0.7	4.2	3.8	0.0	77.5	162.4
1999	67.6	-	61.4	7.7	8.0	14.0	-	-	-	46.7	39.7	11.3	256.4
2000	20.2	-	-										
Total	1291.5	1007.8	933.8	727.2	249.8	92.3	8.2	3.9	106.4	691.7	1036.3	1409.1	
Average	53.8	42.0	38.9	31.6	10.9	4.0	0.4	0.2	4.4	28.8	43.2	58.7	

Analysis of Rainfall Probability

Order	1	2	3	4	5	6	7	8	9	10	11	12
Annual rainfall (mm)	118.7	131.3	162.4	191.5	230.6	231.2	234.3	244.4	248.6	256.4	271.0	283.8
Probability (%)	2.2	6.5	10.9	15.2	19.6	23.9	28.3	32.6	37.0	41.3	45.7	50.0
Order	13	14	15	16	17	18	19	20	21	22	23	
Annual rainfall (mm)	294.1	320.6	334.0	378.7	379.5	420.6	426.2	430.4	481.5	568.5	635.8	
Probability (%)	54.3	58.7	63.0	67.4	71.7	76.1	80.4	84.8	89.1	93.5	97.8	

Table XIII3.1.3: Monthly Mean Precipitation at Amizmiz

Period : 1975-2000
Station : Amizmiz (for Taskourt)
Latitude :
Longitude :
Altitude :

(Unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	TOTAL
1975									14.3	8.6	21.6	3.4	
1976	14.5	36.8	55.9	141.0	81.0	-	-	-	8.2	45.3	-	42.1	424.8
1977	120.0	32.0	32.5	-	5.0	-	-	-	27.0	60.3	63.0	60.0	399.8
1978	83.6	16.5	-	76.2	39.3	42.0	8.5	19.0	7.7	43.8	2.7	45.9	385.2
1979	51.8	40.8	9.8	9.1	14.0	-	-	-	29.2	124.2	-	5.8	284.7
1980	25.7	64.3	96.1	54.5	-	-	-	13.0	19.7	28.8	59.9	-	362.0
1981	22.8	47.6	48.7	19.0	-	-	-	-	25.5	28.4	-	13.9	205.9
1982	56.2	32.6	22.4	197.0	93.4	-	-	-	2.0	17.0	36.9	47.0	504.5
1983	-	42.6	15.0	14.0	13.8	-	-	-	-	6.5	36.4	10.0	138.3
1984	45.1	-	65.2	43.4	36.6	-	-	-	-	20.0	71.8	-	282.1
1985	145.0	32.6	17.6	66.3	31.8	-	-	-	-	-	34.6	32.9	360.8
1986	68.0	47.7	38.2	32.8	36.3	31.3	-	-	3.1	14.1	41.7	-	313.2
1987	26.0	50.0	34.3	9.2	1.5	43.0	-	1.0	16.0	61.1	62.5	25.0	329.6
1988	94.0	82.6	59.5	1.5	22.5	-	6.0	-	-	46.2	147.0	-	459.3
1989	39.8	81.0	101.5	63.0	-	-	-	10.0	-	100.2	13.0	26.5	435.0
1990	29.0	-	54.7	11.0	17.5	12.0	-	-	-	2.5	10.0	68.9	205.6
1991	10.0	103.0	106.5	24.5	24.0	6.0	-	-	32.9	11.1	13.5	21.0	352.5
1992	-	76.5	80.5	83.0	-	20.0	-	-	-	80.0	15.0	9.5	364.5
1993	27.0	36.1	11.1	34.0	3.0	-	-	-	-	23.0	85.0	39.0	258.2
1994	102.0	47.5	83.0	-	7.0		-	47.0	4.0	17.7	-	-	308.2
1995	-	64.5	55.5	161.0	-		-	-	8.0	16.0	18.5	29.5	353.0
1996	110.0	92.3	145.5	-	27.0	44.5	-	-	4.0	9.5	43.6	77.6	554.0
1997	71.4	7.0	35.6	127.0	26.0	-	-	-	55.2	45.5	31.8	49.5	449.0
1998	72.8	16.5	26.0	50.8	42.0	-	-	-	17.5	38.3	-	30.5	294.4
1999	92.0	65.0	116.0	2.8	7.5	15.0	-	10.0	12.5	140.3	51.4	75.7	588.2
2000	11.0	-	23.0	-	27.8	13.9	-			2.8			
Total	1317.7	1115.5	1334.1	1221.1	557.0	227.7	14.5	100.0	286.8	991.2	859.9	713.7	
Moyenne	52.7	44.6	53.4	48.8	22.3	9.9	0.6	4.2	11.5	38.1	34.4	28.5	

Analysis of Rainfall Probability

Order	1	2	3	4	5	6	7	8	9	10	11	12
Annual rainfall(mm)	138.3	205.6	205.9	258.2	282.1	284.7	294.4	308.2	313.2	329.6	337.2	352.2
Probability (%)	2.1	6.3	10.4	14.6	18.8	22.9	27.1	31.3	35.4	39.6	43.8	47.9
Order	13	14	15	16	17	18	19	20	21	22	23	24
Annual rainfall(mm)	352.8	360.5	362.1	364.5	385.2	434.8	435.0	449.0	459.3	504.5	554.0	588.2
Probability (%)	52.1	56.3	60.4	64.4	68.8	72.9	77.1	81.3	85.4	89.6	93.8	99.9

Table XIII3.1.4: Monthly Mean Precipitation at Rachidia

Period : 1980-1999
Station : Rachidia (for Timkit)
Latitude : 31 56'N
Longitude : 004 24'W
Altitude : 1037.2 Metres

(Unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	TOTAL
1980	10.2	29.1	28.3	30.6	1.4	0	0	6.2	3.8	0.8	19.9	28.5	158.8
1981	2.3	11	0	3.8	0	4.6	0.9	2.9	9.3	0	6.5	0	41.3
1982	32.3	6.5	1.8	34.4	23.8	13.3	0	1.3	0	1.1	2	0	116.5
1983	0.2	0.2	0.2	4.3	28	0	0	3.6	3.9	2.9	0.1	0	43.4
1984	0	1.6	0.7	0	17.9	1	0	1.1	7.8	0.3	17.1	0.6	48.1
1985	13.7	25.1	0.2	5.5	9.8	0	0	0	10.7	3.6	16.7	31.2	116.5
1986	3	3.3	1.4	0	8.3	3	0	1.2	6.1	31.4	0.6	0	58.3
1987	1.5	0	17.1	0	8.7	22.3	1.3	0.3	6.5	0.4	36	19.3	113.4
1988	9.6	34	4.9	0.4	11.6	1.5	0	0	8.8	24.2	37.5	0	132.5
1989	3.7	30.7	3	8.1	0.9	17.9	2.8	7.9	8.6	50.8	30.7	47.5	212.6
1990	4.9	0.1	27.1	14.6	28.3	1.2	0.4	5.7	10.8	0.7	1.3	28.3	123.4
1991	1.5	23.8	13.5	18.5	0.8	12.2	2	1.3	9.2	10.9	0	36.3	130
1992	0	15.6	2.3	0.8	19.9	1.8	3.5	1.4	0.7	0	20.1	18.5	84.6
1993	6.6	28.1	7.9	0.8	0.4	0	0.3	1.6	0.4	14.1	89.2	6.2	155.6
1994	31.4	1.5	1	12.8	0.2	0	0.7	1.8	2.7	71	6.5	0.2	129.8
1995	0	0	21.3	26.2	1.8	0.2	4.3	1.5	2.8	71.2	0.1	6	135.4
1996	19.2	56.8	37.1	4.1	2	42.2	30.7	0.4	1.4	2.8	0	26.5	223.2
1997	29.6	0	6	27.1	1.1	0	1	7.3	34.6	5.6	0	0.2	112.5
1998	13	48.9	2.7	1	1.6	16.3	0	5.2	5.9	1	2.3	2.3	100.2
1999	16.4	4.6	4.7	-	0.5	0.7	0	6.4	3.4	58.6	4.4	0.4	100.1
TOTAL	199.1	320.9	181.2	193	167	138.2	47.9	57.1	137.4	351.4	291	252	2336.2
MEAN	10.0	16.0	9.1	10.2	8.4	6.9	2.4	2.9	6.9	17.6	14.6	12.6	117.6

Analysis of Rainfall probability

Annual rainfall (mm)	11.0	12.5	24.0	75.5	107.9	164.5	192.4	219.0	233.7
Probability (%)	1	5	10	20	50	80	90	95	99

Table XIII3.1.5: Monthly Mean Precipitation at Ribat Al Keir

Period : 1978-2000
Station : Ribat al kheir (for Azghar)
Latitude :
Longitude :
Altitude :

(Unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	TOTAL
1978	81.1	110.0	56.6	115.2	27.6	16.5	-	-	-	9.9	27.3	77.8	522.0
1979	48.7	255.1	46.6	26.8	35.6	-	-	-	43.4	-	92.0	25.5	573.7
1980	37.8	38.8	78.1	49.4	48.9	3.9	-	12.4	-	3.5	118.5	39.7	431.0
1981	28.0	51.8	109.2	67.5	42.8	14.9	1.3	1.2	11.8	20.2		47.3	396.0
1982	63.2	94.8	35.2	141.1	78.4	-	5.3	2.8	4.5	176.4	92.6	80.8	775.1
1983	0.5	56.3	69.8	16.5	36.0	2.9	-	5.7	-	4.2	100.8	56.7	349.4
1984	27.6	17.5	70.5	57.5	141.9	6.3	2.0	-	6.5	3.5	121.6	20.4	475.3
1985	104.3	37.1	48.8	45.8	91.9	-	-	0.8	27.9	39.0	74.8	56.3	526.7
1986	104.7	116.1	119.3	82.1	16.5	36.5	20.0	-	16.9	24.9	42.5	42.4	621.9
1987	96.2	154.1	8.2	12.7	15.0	2.5	7.1	-	75.8	29.3	98.8	32.6	532.3
1988	109.8	92.0	43.0	35.4	69.8	7.5	0.5	-	-	29.7	68.4	19.0	475.1
1989	21.6	57.0	69.6	124.9	16.8	30.4	-	23.2	57.0	77.4	89.9	113.5	681.3
1990	48.0	1.2	32.8	99.7	18.4	5.6	29.5	3.7	52.1	14.4	50.9	137.0	493.3
1991	21.8	113.9	194.5	35.4	17.4	4.2	16.8	19.3	63.0	67.7	36.8	39.8	630.6
1992	2.3	52.5	79.1	101.1	54.0	118.5	9.0	20.5	-	52.8	18.5	35.2	543.5
1993	26.0	38.5	80.0	54.0	27.3	9.7	-	2.0	5.2	24.4	116.3	30.0	413.4
1994	63.3	115.6	62.2	20.0	25.3	1.0	-	0.5	30.5	27.5	21.5	5.0	372.4
1995	11.5	35.7	93.8	59.5	7.5	28.5	-	3.0	38.1	25.5	41.4	139.8	484.3
1996	245.3	100.7	100.9	88.4	79.8	43.9	0.9	-	48.5	34.5	18.0	216.7	977.6
1997	129.9	-	6.5	108.0	53.7	15.1	-	6.0	107.0	30.0	100.0	87.0	643.2
1998	70.0	48.5	-	26.6	56.5	8.0	-	9.5	18.0	9.0	1.0	18.0	265.1
1999	135.0	50.0	84.0	4.0	35.0	7.0	-	4.0	19.0	51.0	64.0	45.0	498.0
2000	16.0	-	-	42.0	60.0	-	-	-	29.0				
Total	1492.6	1637.2	1488.7	1413.6	1056.1	362.9	92.4	114.6	654.2	754.8	1395.6	1365.5	
Average	64.9	71.2	64.7	61.5	45.9	15.8	4.0	5.0	28.4	34.3	66.5	62.1	

Analysis of Rainfall Probability

Order	1	2	3	4	5	6	7	8	9	10	11
Annual rainfall (mm)	265.1	349.4	372.4	396.0	413.4	431.0	475.1	475.3	484.3	493.3	498.0
Probability(%)	2.3	6.8	11.4	15.9	20.5	25.0	29.5	34.1	38.6	43.2	47.7
Order	12	13	14	15	16	17	18	19	20	21	22
Annual rainfall(mm)	522.0	526.7	532.3	543.5	573.7	621.9	630.6	643.2	681.3	795.1	911.6
Probability (%)	52.3	56.8	61.4	65.9	70.5	95.0	99.5	84.1	88.6	93.2	99.9

Table XIII3.2.1: Calculation Sheet for Project Water Requirement for the N'fifikh Upstream Area

(unit : mm)

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
(In case dependable rainfall is 4 out of 5 years)													
1. Reference crop evapotranspiration, ETo: (1)	177.0	152.8	105.6	83.1	89.3	101.7	151.9	183.3	223.2	243.3	261.3	220.4	
2. Crop coefficient, kc: (2)	0.08	0.10	0.28	0.53	0.80	0.94	0.81	0.41	0.15	0.08	0.08	0.08	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	14.2	15.3	29.6	44.0	71.4	95.6	123.0	75.2	33.5	19.5	20.9	17.6	559.8
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	3.3	21.7	32.4	44.1	38.7	30.2	26.3	22.7	7.8	2.9	0.3	0.1	230.5
5. Cropped area: (5)	0.15	0.22	0.53	0.97	0.99	0.91	0.90	0.90	0.62	0.18	0.15	0.15	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	3.6	12.9	32.1	28.7	20.6	17.7	15.3	-	-	-	-	130.9
7. Net irrigation requirement, In: (7)=(3)-(6)	14.2	11.7	16.7	11.9	42.7	75.0	105.3	59.9	33.5	19.5	20.9	17.6	428.9
8. Project water requirement , V: (8)=(7)/0.52[*1]	27.3	22.5	32.1	22.9	82.1	144.2	202.5	115.2	64.4	37.5	40.2	33.8	824.7
9. Project water requirement, V: (8)=(7)/0.68[*2]	20.9	17.2	24.6	17.5	62.8	110.3	154.9	88.1	49.3	28.7	30.7	25.9	630.9
(In case dependable rainfall is 1 out of 5 years)													
10. Dependable rainfall 1 out of 5 years or 20% probability: (9)	6.1	40.0	60.0	81.5	71.6	55.9	48.7	42.0	14.5	5.3	0.5	0.3	426.4
11. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	-	6.6	23.9	57.5	53.2	38.2	32.9	28.0	6.7	-	-	-	247.0
12. Net irrigation requirement, In: (11)=(3)-(10)	14.2	8.7	5.7	-	18.2	57.4	90.1	47.2	26.8	19.5	20.9	17.6	326.3
13. Project water requirement, V: (11)/0.52[*1]	27.3	16.7	11.0	-	35.0	110.4	173.3	90.8	51.5	37.5	40.2	33.8	627.5
14. Project water requirement, V: (11)/0.68[*2]	20.9	12.8	8.4	-	26.8	84.4	132.5	69.4	39.4	28.7	30.7	25.9	479.9

Note: [*1] In case of gravity irrigation.
[*2] In case of mechanical irrigation.

Table XIII3.2.2: Calculation Sheet for Project Water Requirement for the N'fifikh Upstream Area (Alternative NU2)

(unit : mm)

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
(In case dependable rainfall is 4 out of 5 years)													
1. Reference crop evapotranspiration, ETo: (1)	177.0	152.8	105.6	83.1	89.3	101.7	151.9	183.3	223.2	243.3	261.3	220.4	
2. Crop coefficient, kc: (2)	0.06	0.07	0.25	0.53	0.82	0.99	0.86	0.49	0.13	0.06	0.06	0.06	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	10.6	10.7	26.4	42.4	73.2	100.7	130.6	89.8	29.0	14.6	15.7	13.2	556.9
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	3.3	21.7	32.4	44.1	38.7	30.2	26.3	22.7	7.8	2.9	0.3	0.1	230.5
5. Cropped area: (5)	0.15	0.22	0.53	1.00	1.00	0.95	0.95	0.95	0.62	0.18	0.15	0.15	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	3.6	12.9	35.3	31.0	23.0	20.0	17.3	-	-	-	-	143.1
7. Net irrigation requirement, In: (7)=(3)-(6)	10.6	7.1	13.5	7.1	42.2	77.7	110.6	72.5	29.0	14.6	15.7	13.2	413.8
8. Project water requirement , V: (8)=(7)/0.52	20.4	13.7	26.0	13.7	81.2	149.4	212.7	139.4	55.8	28.1	30.2	25.4	796.0
(In case dependable rainfall is 1 out of 5 years)													
9. Dependable rainfall 1 out of 5 years or 20% probability: (9)	6.1	40.0	60.0	81.5	71.6	55.9	48.7	42.0	14.5	5.3	0.5	0.3	426.4
10. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	-	6.6	23.9	65.2	57.3	42.5	37.0	31.9	-	-	-	-	264.4
11. Net irrigation requirement, In: (11)=(3)-(10)	10.6	4.1	2.5	-	15.9	58.2	93.6	57.9	29.0	14.6	15.7	13.2	315.3
12. Project water requirement, V: (11)/0.52	20.4	7.9	4.8	-	30.6	111.9	180.0	111.3	55.8	28.1	30.2	25.4	606.4

Table XIII3.2.3: Calculation Sheet for Project Water Requirement for the N'fifikh Upstream Area (Alternative NU3)

(unit : mm)

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
(In case dependable rainfall is 4 out of 5 years)													
1. Reference crop evapotranspiration, ETo: (1)	177.0	152.8	105.6	83.1	89.3	101.7	151.9	183.3	223.2	243.3	261.3	220.4	
2. Crop coefficient, kc: (2)	0.15	0.18	0.33	0.51	0.67	0.69	0.56	0.40	0.28	0.33	0.30	0.18	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	26.6	27.5	34.8	42.4	59.8	70.2	85.1	73.3	62.5	80.3	78.4	39.7	680.6
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	3.3	21.7	32.4	44.1	38.7	30.2	26.3	22.7	7.8	2.9	0.3	0.1	230.5
5. Cropped area: (5)	0.28	0.4	0.50	0.85	0.85	0.70	0.70	0.80	0.75	0.42	0.42	0.42	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	6.5	12.2	28.1	24.7	15.9	13.8	13.6	-	-	-	-	114.8
7. Net irrigation requirement, In: (7)=(3)-(6)	26.6	21.0	22.6	14.3	35.1	54.3	71.3	59.7	62.5	80.3	78.4	39.7	565.8
8. Project water requirement , V: (8)=(7)/0.52	51.2	40.4	43.5	27.5	67.5	104.4	137.1	114.8	120.2	154.4	150.8	76.3	1,088.1
(In case dependable rainfall is 1 out of 5 years)													
9. Dependable rainfall 1 out of 5 years or 20% probability: (9)	6.1	40.0	60.0	81.5	71.6	55.9	48.7	42.0	14.5	5.3	0.5	0.3	426.4
10. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	-	12.0	22.5	54.3	45.6	29.3	25.6	25.2	-	-	-	-	214.5
11. Net irrigation requirement, In: (11)=(3)-(10)	26.6	15.5	12.3	-	14.2	40.9	59.5	48.1	62.5	80.3	78.4	39.7	478.0
12. Project water requirement, V: (11)/0.52	51.2	29.8	23.7	-	27.3	78.7	114.6	92.5	120.2	154.4	150.8	76.3	919.5

Table XIII3.3.1: Calculation Sheet for Project Water Requirement for N'fifikh Downstream Area (Alternative ND1 and ND2)

(unit : mm)

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
(In case dependable rainfall is 4 out of 5 years)													
1. Reference crop evapotranspiration, ETo: (1)	177.0	152.8	105.6	83.1	89.3	101.7	157.9	183.3	223.2	243.3	261.3	220.4	
2. Crop coefficient, kc: (2)	0.08	0.10	0.26	0.50	0.74	0.86	0.73	0.43	0.17	0.14	0.08	0.09	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	14.2	15.3	27.5	41.6	66.1	87.5	110.9	78.8	37.9	34.1	20.9	19.8	554.6
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	3.3	21.7	32.4	44.1	38.7	30.2	26.3	22.7	7.8	2.9	0.3	0.1	230.5
5. Cropped area: (5)	0.18	0.24	0.54	0.92	0.94	0.86	0.85	0.88	0.62	0.25	0.23	0.21	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	3.9	13.1	30.4	27.3	19.5	16.8	15.0	-	-	-	-	126.0
7. Net irrigation requirement, In: (7)=(3)-(6)	14.2	11.4	14.4	11.2	38.8	68.0	94.1	63.8	37.9	34.1	20.9	19.8	428.6
8. Project water requirement , V: (8)=(7)/0.75	18.9	15.2	19.2	14.9	51.7	90.6	125.4	85.0	50.5	45.5	27.9	26.4	571.2
(In case dependable rainfall is 1 out of 5 years)													
9. Dependable rainfall 1 out of 5 years or 20% probability: (9)	6.1	40.0	60.0	81.5	71.6	55.9	48.7	42.0	14.5	5.3	0.5	0.3	426.4
10. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	-	7.2	24.3	56.2	50.5	36.1	31.0	27.7	6.7	-	-	-	239.7
11. Net irrigation requirement, In: (11)=(3)-(10)	14.2	8.1	3.2	-	15.6	51.4	79.9	51.1	31.2	34.1	20.9	19.8	329.5
12. Project water requirement, V: (11)/0.75	18.9	10.8	4.3	-	20.8	68.5	106.5	68.1	41.6	45.5	27.9	26.4	439.3

Table XIII3.3.2: Irrigation Area of N'fifikh Downstream Area
Estimate of Base Flow in 1/5 years Drought

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total/Mean
1. Mean Discharge (m^3/sec)	0.149	0.173	0.415	0.629	1.239	1.453	0.801	0.685	0.319	0.229	0.090	0.087	0.5
2. 1/5 year drought discharge, average (m^3/s	0.056	0.065	0.155	0.234	0.463	0.542	0.299	0.256	0.119	0.085	0.034	0.032	0.2
3. 1/5 year drought discharge, 1949/50 (m^3/s	0.200	0.197	0.200	0.197	0.359	0.188	0.182	0.185	0.182	0.185	0.117	0.117	0.2
4. 1/5 year drought discharge, 1981/82 (m^3/s	0.021	0.025	0.024	0.194	0.487	0.427	0.413	0.870	0.035	0.025	0.021	0.018	0.2
5. 1/5 year drought discharge, 1944/45 (m^3/s	0.154	0.151	0.154	0.151	0.234	0.148	0.145	0.145	0.145	0.430	0.111	0.111	0.2
6. Base flow, the least of 2. To 5 ·($x10^3m^3$)	54.4	64.8	62.2	391.4	606.5	383.6	375.8	375.8	90.7	64.8	54.4	46.7	2,571.1

Water Balance Sheet

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total/Mean
1. Base flow ($x10^3m^3$)	54.4	64.8	62.2	391.4	606.5	383.6	375.8	375.8	90.7	64.8	54.4	46.7	2,571.1
2. 1/5Project water requirement. V(mm)	19.6	15.5	20.1	15.9	48.5	90.4	128.1	85.4	50.1	46.1	47.1	27.9	594.7
3.V for 300 ha ($x10^3m^3$)	58.8	46.5	60.3	47.7	145.5	271.2	384.3	256.2	150.3	138.3	141.3	83.7	1,784.1
4.Balance (1)-(3)($x10^3m^3$)	(-)4.4	18.3	1.9	343.7	461.0	112.4	(-)8.5	119.6	38.5	(-)73.5	(-)86.9	(-)37.0	787.0
5. Supply V.S demand (%)	93.0	100.0	100.0	100.0	100.0	100.0	97.8	100.0	46.9	46.9	38.5	55.8	978.9

Table XIII3.3.3: Monthly Discharge

BASIN AREA at ZIAIDA SITE : 395 km^2 unit: m^3/s

Year	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	may	Jun.	Jul.	Aug.	mean	Order
1939 / 40	0.170	0.164	0.732	0.706	2.890	3.201	1.464	1.513	0.507	0.524	0.164	0.164	1.008	49
1940 / 41	0.177	0.172	0.762	0.737	3.014	3.338	1.525	1.575	0.527	0.546	0.172	0.172	1.044	50
1941 / 42	0.122	0.122	0.326	0.617	0.838	1.367	0.948	0.820	0.413	0.221	0.122	0.122	0.498	32
1942 / 43	0.204	0.197	0.525	0.990	1.349	2.198	1.521	1.317	0.669	0.359	0.197	0.197	0.801	43
1943 / 44	0.081	0.080	0.082	0.080	0.221	0.071	0.064	0.066	0.064	0.066	0.009	0.009	0.074	3
1944 / 45	0.154	0.151	0.154	0.151	0.234	0.148	0.145	0.145	0.145	0.430	0.111	0.111	0.173	10
1945 / 46	0.119	0.113	0.309	0.583	0.797	1.303	0.898	0.779	0.393	0.214	0.113	0.113	0.472	29
1946 / 47	0.422	0.414	0.422	0.414	1.150	0.376	0.337	0.345	0.337	0.345	0.046	0.048	0.388	23
1947 / 48	0.129	0.123	0.331	0.628	0.858	1.396	0.965	0.836	0.426	0.224	0.123	0.123	0.510	33
1948 / 49	0.121	0.115	0.314	0.592	0.810	1.324	0.913	0.792	0.399	0.218	0.115	0.115	0.480	31
1949 / 50	0.200	0.197	0.200	0.197	0.359	0.188	0.182	0.185	0.182	0.185	0.117	0.117	0.192	12
1950 / 51	0.153	0.148	0.398	0.746	1.019	1.659	1.149	0.996	10.505	0.269	0.148	0.148	0.605	37
1951 / 52	0.427	0.420	0.427	0.420	1.165	0.381	0.342	0.350	0.342	0.350	0.047	0.047	0.393	24
1952 / 53	0.464	0.449	0.464	0.449	1.249	0.404	0.366	0.381	0.366	0.381	0.045	0.045	0.422	27
1953 / 54	0.191	0.184	0.492	0.927	1.261	2.054	1.423	1.231	0.627	0.338	0.184	0.184	0.750	41
1954 / 55	0.175	0.171	0.457	0.861	1.171	1.909	1.322	1.142	0.579	0.310	0.171	0.171	0.695	39
1955 / 56	0.259	0.050	1.112	1.076	4.400	4.872	2.226	2.300	0.771	0.797	0.251	0.251	1.517	54
1956 / 57	0.217	0.214	0.217	0.214	0.401	0.202	0.194	0.197	0.194	0.197	0.120	0.120	0.207	14
1957 / 58	0.129	0.124	0.340	0.641	0.878	1.428	0.986	0.857	0.437	0.232	0.124	0.124	0.519	34
1958 / 59	0.473	0.459	0.473	0.459	1.288	0.418	0.376	0.390	0.376	0.390	0.049	0.049	0.433	28
1959 / 60	0.152	0.147	0.389	0.736	1.006	1.633	1.130	0.978	0.498	0.266	0.147	0.147	0.598	36
1960 / 61	0.121	0.115	0.313	0.591	0.808	1.320	0.910	0.790	0.398	0.217	0.115	0.115	0.479	30
1961 / 62	0.211	0.204	0.543	1.024	1.398	2.273	1.571	1.363	0.692	0.374	0.204	0.204	0.829	44
1962 / 63	0.182	0.176	0.781	0.756	3.095	3.425	1.565	1.617	0.542	0.561	0.176	0.149	1.069	51
1963 / 64	0.233	0.227	0.606	1.140	1.553	2.526	1.749	1.513	0.770	0.413	0.227	0.227	0.926	47
1964 / 65	0.405	0.389	0.405	0.389	1.093	0.356	0.324	0.332	0.324	0.332	0.040	0.040	0.369	21
1965 / 66	0.419	0.411	0.419	0.411	1.143	0.373	0.335	0.343	0.335	0.343	0.046	0.046	0.386	22
1966 / 67	0.287	0.287	0.287	0.287	0.797	0.255	0.223	0.239	0.223	0.239	0.032	0.032	0.266	18
1967 / 68	0.189	0.186	0.496	0.936	1.273	2.072	1.436	1.243	0.633	0.341	0.1 s6	0.186	0.760	42
1968 / 69	0.188	0.180	0.805	0.778	3.181	3.523	1.609	1.665	0.558	0.577	0.180	0.180	1.102	52
1969 / 70	0.153	0.149	0.399	0.748	1.021	1.662	1.151	0.998	0.506	0.269	0.149	0.149	0.606	38
1970 / 71	0.229	0.223	0.987	0.954	3.904	4.324	1.976	2.042	0.683	0.707	0.223	0.223	1.353	53
1971 / 72	0.200	0.196	0.522	0.113	1.340	2.176	1.506	1.306	0.662	0.357	0.196	0.196	0.724	40
1972 / 73	0.228	0.228	0.228	0.228	0.570	0.114	0.114	0.114	0.114	0.114	0.000	0.000	0.171	9
1973 / 74	0.233	0.227	0.606	1.141	1.554	2.527	1.750	1.514	0.771	0.413	0.227	0.227	0.922	46
1974 / 75	0.217	0.214	0.217	0.214	0.401	0.202	0.194	0.197	0.194	0.197	0.120	0.120	0.207	14
1975 / 76	0.019	0.026	0.041	0.103	0.051	0.253	0.549	0.649	0.249	0.036	0.019	0.610	0.166	8
1976 / 77	0.015	0.599	0.046	0.994	2.026	2.533	0.192	0.089	0.069	0.076	0.046	0.040	0.550	35
1977 / 78	0.023	0.063	0.108	0.276	1.166	4.394	0.077	0.271	0.131	0.028	0.008	0.005	0.519	34
1978 / 79	0.050	0.120	0.096	1.808	4.645	10.521	1.304	0.480	0.314	0.291	0.246	0.153	1.612	55
1979 / 80	0.118	0.828	0.217	0.180	0.555	0.211	2.412	0.223	0.169	0.067	0.020	0.002	0.421	26
1980 / 81	0.055	0.104	0.474	0.085	0.079	0.051	0.225	0.062	0.044	0.023	0.018	0.019	0.103	5
1981 / 82	0.021	0.025	0.024	0.194	0.487	0.427	0.113	0.870	0.035	0.025	0.021	0.018	0.186	11
1982 / 83	0.020	0.028	0.103	0.121	0.050	0.512	0.089	0.071	0.058	0.038	0.034	0.027	0.093	4
1983 / 84	0.020	0.026	0.277	0.354	0.035	0.024	0.381	0.269	0.509	0.028	0.010	0.010	0.163	7
1984 / 85	0.011	0.011	1.603	0.111	0.576	0.131	0.028	0.015	0.037	0.011	0.009	0.010'	0.211	15
1985 / 86	0.030	0.008	0.452	0.092	0.319	1.615	0.123	0.209	0.011	0.004	0.001	0.001	0.228	16
1986 / 87	0.001	0.004	1.720	0.031	0.158	1.274	0.030	0.022	0.004	0.001	0.001	0.002	0.261	17
1987 / 88	0.015	0.095	0.394	0.976	0.962	2.134	0.390	0.042	0.035	0.030	0.010	0.002	0.418	25
1988 / 89	0.007	0.032	0.241	0.025	0.221	0.317	0.605	0.866	0.010	0.006	0.002	0.002	0.193	13
1989 / 90	0.002	0.012	0.923	1.688	0.768	0.041	0.125	0.031	0.019	0.010	0.003	0.001	0.305	19
1990 / 91	0.001	0.050	0.085	0.784	0.051	1.019	1.333	0.982	0.058	0.040	0.023	0.019	0.366	20
1991 / 92	0.138	0.250	0.056	0.138	0.051	0.113	0.104	0.637	0.134	0.107	0.010	0.010	0.161	6
1992 / 93	0.010	0.100	0.098	0.057	0.048	0.015	0.316	0.049	0.015	0.015	0.014	0.014	0.063	2
1993 / 94	0.019	0.026	0.041	0.103	0.051	0.253	0.549	0.649	0.249	0.036	0.019	0.010	0.166	8
1994 / 95	0.004	0.005	0.049	0.001	0.001	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.006	1
1995 / 96	0.003	0.007	0.428	0.902	5.215	1.249	2.507	0.110	0.156	0.051	0.014	0.005	0.893	45
1996 / 97	0.007	0.014	0.052	5.553	4.855	0.196	0.143	0.474	0.053	0.034	0.020	0.013	0.966	48
Mean	0.149	0.173	0.415	0.629	1.239	1.453	0.801	0.685	0.319	0.229	0.090	0.087	0.517	

Annual inflow (Mm^3/yr) : 16.31

Table XIII3.4.1: Calculation Sheet for Project Water Requirement for Taskourt Area

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
(In case dependable rainfall is 4 out of 5 years)													
1. Reference crop evapotranspiration, ETo: (1)	179.7	155.9	105.9	84.0	87.3	105.0	157.2	185.1	231.9	255.6	261.3	221.7	
2. Crop coefficient, kc: (2)	0.12	0.11	0.23	0.43	0.68	0.86	0.80	0.49	0.22	0.19	0.20	0.16	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	21.60	17.10	24.30	36.10	59.40	90.30	125.80	90.70	51.00	48.60	52.30	35.50	652.7
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	9.0	31.2	26.2	23.4	43.2	36.6	43.8	40.0	18.3	7.5	0.5	3.2	282.9
5. Cropped area: (5)	0.21	0.20	0.46	0.87	0.90	0.90	0.91	0.95	0.73	0.33	0.30	0.27	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	4.7	9.0	15.3	29.2	24.7	29.9	28.5	10.0	-	-	-	151.3
7. Net irrigation requirement, In: (7)=(3)-(6)	21.6	12.4	15.3	20.8	30.2	65.6	95.9	62.2	41.0	48.6	52.3	35.5	501.4
8. Project water requirement , V: (8)=(7)/0.52 [*1]	41.5	23.8	29.4	40.0	58.1	126.1	184.4	119.6	78.8	93.5	100.6	68.3	964.1
9. Project water requirement, V: (8)=(7)/0.68 [*2]	31.8	18.2	22.5	30.6	44.4	96.5	141.0	91.5	60.3	71.5	76.9	52.2	737.4
(In case dependable rainfall is 1 out of 5 years)													
10. Dependable rainfall 1 out of 5 years or 20% probability: (9)	14.2	49.1	41.1	36.7	67.9	57.5	68.9	62.9	28.8	11.7	0.8	5.0	444.6
11. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	2.2	7.4	14.2	23.9	45.8	38.8	47.0	44.8	15.8	-	-	-	
12. Net irrigation requirement, In: (11)=(3)-(10)	19.4	9.7	10.1	12.2	13.6	51.5	78.8	45.9	35.2	48.6	52.3	35.5	412.8
13. Project water requirement, V: (11)/0.52 [*1]	37.3	18.7	19.4	23.5	26.2	99.0	151.5	88.3	67.7	93.5	100.6	68.3	794.0
14. Project water requirement V: (11)/0.68	28.5	14.3	14.9	17.9	20	75.7	116	67.5	51.8	71.5	76.9	52.2	607.1

Note: [*1] In case of gravity irrigation.
[*2] In case of mechanical irrigation.

Table XIII3.5.1: Calculation Sheet for Project Water Requirement for Ifegh Area in Timkit

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
						(In case dependable rainfall is 4 out of 5 years)							
1. Reference crop evapotranspiration, ETo: (1)	178.8	152.4	100.4	28.5	80.7	98.0	150.0	179.4	225.1	250.2	264.1	220.4	
2. Crop coefficient, kc: (2)	0.19	0.27	0.39	0.51	0.71	0.84	0.75	0.47	0.24	0.19	0.16	0.16	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	34.0	41.1	39.2	40.0	57.3	82.3	112.5	84.3	54.0	47.5	42.3	35.3	669.8
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	4.2	10.7	8.9	7.7	6.1	9.8	5.5	6.2	5.1	4.2	1.5	1.8	71.7
5. Cropped area: (5)	0.35	0.39	0.66	0.94	0.90	0.90	0.93	0.91	0.65	0.33	0.27	0.28	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	3.1	4.4	5.4	-	6.6	-	-	-	-	-	-	19.5
7. Net irrigation requirement, In: (7)=(3)-(6)	34.0	38.0	34.8	34.6	57.3	75.7	112.5	84.3	54.0	47.5	42.3	35.3	650.3
8. Project water requirement , V: (8)=(7)/0.58	58.6	65.5	60.0	59.7	98.8	130.5	194.0	145.3	93.1	81.9	72.9	60.9	1,121.2
						(In case dependable rainfall is 1 out of 5 years)							
9. Dependable rainfall 1 out of 5 years or 20% probability: (9)	9.7	24.1	20.5	17.7	14.0	22.4	12.8	14.3	11.8	9.7	3.4	4.1	164.5
10. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	-	7.2	10.1	12.7	9.5	15.1	8.9	9.8	-	-	-	-	73.3
11. Net irrigation requirement, In: (11)=(3)-(10)	34.0	33.9	29.1	27.3	47.8	67.2	103.6	74.5	54.0	47.5	42.3	35.3	596.5
12. Project water requirement, V: (11)/0.58	58.6	58.4	50.2	47.1	82.4	115.9	178.6	128.4	93.1	81.9	72.9	60.9	1,028.4

Table XIII3.5.2: Calculation Sheet for Project Water Requirement For Tinejdad Area in Timkit

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
	(In case dependable rainfall is 4 out of 5 years)												
1. Reference crop evapotranspiration, ETo: (1)	178.8	152.4	100.4	78.5	80.7	98.0	150.0	129.4	225.1	250.2	264.1	220.4	
2. Crop coefficient, kc: (2)	0.23	0.29	0.38	0.47	0.64	0.28	0.24	0.50	0.28	0.23	0.20	0.20	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	41.1	44.2	38.2	36.9	51.6	76.4	111.0	89.7	63.0	57.5	52.8	44.1	706.5
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	4.2	10.7	8.9	7.7	6.1	9.8	5.5	6.2	5.1	4.2	1.5	1.8	71.7
5. Cropped area: (5)	0.45	0.45	0.66	0.95	0.90	0.90	0.93	0.95	0.74	0.42	0.38	0.38	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction		3.6	4.4	5.5		6.6							20.1
7. Net irrigation requirement, In: (7)=(3)-(6)	41.1	40.6	33.8	31.4	51.6	69.8	111.0	89.7	63.0	57.5	52.8	44.1	686.4
8.1 Project water requirement , V: (8)=(7)/0.75 *1	54.8	54.1	45.1	41.9	68.8	93.1	148.0	119.6	84.0	76.7	70.4	58.8	915.2
8.2 Project water reuirement, V: (8)=(7)/0.45 *2	89.3	88.3	73.5	68.3	112.2	151.7	241.3	195	137	125	114.8	95.9	1492
A. By surface water from Timkit dam	-	88.3	73.5	68.3	112.2	151.7	241.3	-	-	-	-	-	-
B. By sub-surface water	54.8	-	-	-	-	-	-	120	84	76.7	70.4	58.8	464.7

Note *1 In case that the water source is from ground water

*2 In case that the water source is from the Timkit Dam

Table XIII3.5.3: Calculation Sheet for Project Water Requirement for Chitam Area in Timkit

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
						(In case dependable rainfall is 4 out of 5 years)							
1. Reference crop evapotranspiration, ETo: (1)	178.8	152.4	100.4	78.5	80.7	98.0	150.0	129.4	225.1	250.2	264.1	220.40	
2. Crop coefficient, kc: (2)	0.11	0.11	0.23	0.45	0.72	0.91	0.86	0.52	0.21	0.15	0.12	0.11	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	19.7	16.8	23.1	35.3	58.1	89.2	129.0	93.3	47.3	37.5	31.7	24.2	605.2
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	4.2	10.7	8.9	7.7	6.1	9.8	5.5	6.2	5.1	4.2	1.5	1.8	
5. Cropped area: (5)	0.20	0.20	0.48	0.92	0.95	0.95	0.98	1.00	0.74	0.28	0.23	0.20	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	-	1.6	3.2	5.3	-	7.0	-	-	-	-	-	-	17.1
7. Net irrigation requirement, In: (7)=(3)-(6)	19.7	15.2	19.9	30.0	58.1	82.2	129.0	93.3	47.3	37.5	31.7	24.2	588.1
8.1 Project water requirement , V: (8)=(7)/0.75	26.3	20.3	26.5	40.0	77.4	109.6	172.0	124.4	63.1	50.0	42.3	32.3	784.1
8.2 Project water requirement V: (8)=(7)/0.45 *1	42.8	33.0	43.3	65.2	126.3	178.7	280.4	202.8	102.8	81.5	68.9	52.6	1278.5
A. By surface water from Timkit dam	-	33.0	43.3	65.2	126.3	178.7	280.4	-	-	-	-	-	726.9
B. By sub-surface water	26.3	-	-	-	-	-	-	124.4	63.1	50.0	42.3	32.3	338.4

Note *1 In case the water source is from ground water.
*2 In case that the water source is from the Timkit Dam.

Table XIII3.6.1: Calculation Sheet for Project Water Requirement for Azghar Area

Factors in estimating water requirement	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total
					(In case dependable rainfall is 4 out of 5 years)								
1. Reference crop evapotranspiration, ETo: (1)	173.7	140.7	93.9	69.8	73.5	86.5	133.9	157.2	195.9	233.1	261.0	223.2	
2. Crop coefficient, kc: (2)	0.10	0.09	0.25	0.46	0.67	0.86	0.92	77.00	0.39	0.14	0.13	0.12	
3. Crop evapotranspiration, ETcrop (3): (1)·(2)	17.4	12.7	23.5	32.1	49.2	73.6	123.2	121.0	76.4	32.6	33.9	26.8	622.4
4. Dependable rainfall 4 out of 5 years or 80% probability: (4)	22.5	27.2	50.3	49.2	51.4	56.4	51.3	48.7	36.4	12.5	3.9	4.0	413.8
5. Cropped area: (5)	0.20	0.22	0.49	0.95	1.00	0.96	0.95	0.95	0.99	0.70	0.26	0.23	
6. Effective rainfall, Pe:(6)=(4)·(5)·fraction	3.4	4.5	18.5	35.1	38.6	40.6	36.6	34.7	27.0	6.6	-	-	
7. Net irrigation requirement, In: (7)=(3)-(6)	14.0	8.2	5.0	-	10.6	33.0	86.6	86.3	49.4	26.0	33.9	26.8	379.8
8. Project water requirement , V: (8)=(7)/0.52	26.9	15.8	9.6	-	20.4	63.5	166.5	166.0	95.0	50.0	65.2	51.5	730.4
					(In case dependable rainfall is 1 out of 5 years)								
9. Dependable rainfall 1 out of 5 years or 20% probability: (9)	34.3	41.5	76.7	75.0	78.3	86	78.2	74.2	55.5	19.0	5.9	6.0	630.6
10. Effctive rainfall, Pe: (10) =(9)·(5)·fraction	5.1	6.8	28.2	53.4	58.7	61.9	55.7	52.9	41.2	10.0	-	-	373.9
11. Net irrigation requirement, In: (11)=(3)-(10)	12.3	5.9	-	-	-	11.7	67.5	68.1	35.2	22.6	33.9	26.8	284.0
12. Project water requirement, V: (11)/0.52	23.7	11.3	-	-	-	22.5	129.8	131.0	67.7	43.5	65.2	51.5	546.2

Table XIII4.3.1: Weekly Markets in the Study Area (1/2)

Study Area	Taskourt (No.9)			
Particulars/Name of the/Souk	Arbaa Sidi Bouatmun	Had M'jjate	Arbaa Frouga	Sebt Mzouda
R.C/Municipality	Assif El Mal	M'jjate	Goumassa	Mzouda
Area	3 ha	5 ha	3 ha	2 ha
Opening Day	Wednesday	Sunday	Wednesday	Saturday
Facilities				
Water	Ground water	Ground water	Ground water	Ground water
Toilets	none	none	none	none
Wall	1.4 m	1.6 m	1.5 m	1.5 m
Slaughter House	covered with roof	covered with roof	covered with roof	covered with roof
Market Charges (Tax)				
Cereals [1]	1 Dh/Abra[2] or 5Dh/ Ql	2 Dh/Ql	1 Dh/Abra	6 Dh/Ql
Vegetable/Fruits	1Dh/m2	4-5 Dh per trader	1 Dh/m2	1 Dh/box or 5 Dh/one space (about 2m2)
Cattle		12 Dh/head	-	
Mule/Donkey		5 Dh/head	-	
Sheep/Goats		5 /Dh/head	-	10 Dh/head
Chicken	1 Dh/head	1 Dh/head	1 Dh/head	1.5 Dh/head
Butchers	0.4 Dh/kg	3 Dh/one space (about 2 m2)	1 Dh/m2	(includes in slaughtering)
Slaughter House	40 Dh/head (cattle)	90 Dh/head (cattle)	40 Dh/head (cattle)	80 Dh/head (cattle)
	7 Dh/head (sheep/goats)	12 Dh/head (Sheep/goats)	7 Dh/head (Sheep,goat)	10 Dh/head (sheep,cattle)
Daily Use Commodities	1 Dh/m2	5-10 Dh per trader	1 Dh/m2	5 Dh per trader
Fodder	1 Dh/m2 (rare)	1 Dh/bale	1 Dh/bale	30 Dh per trader
Annual Collected Amount (Dh)	55,200/year	96,000 Dh/year	48,000 Dh/year	273,000/year
Management of the Souk	C.R	C.R	C.R	C.R

Source of Commodities[3]	Local (%))	Outside (%)	Local (%))	Outside (%)	Local (%))	Outside (%)	Local (%))	Outside (%)
Cereals	100		100	0	50	50	100	
Vegetable/Fruits	20	80	20	80	50	50	100	
Cattle	(for slaughter)	100	90	10				
Mule/Donkey			100	0				
Sheep/Goats			100	0				
Chicken			90	10	100	0	100	
No. of Traders	60		500		30		400	

Origin of the Traders[4]	Local (%)	Outside (%)	Local (%)	Outside (%)	Local (%)	Outside (%)	Local (%)	Outside (%)
Cereals	7 (100%)		20(100.0%)	0 (0.%)	4(70.0%)	1(30.0%)	40(100.0%)	
Vegetable/Fruits	20 (100%)		55(100.0%)	0 (0%)	13(70.0%)	5(30.0%)	120(100.0%)	
Cattle	5 (100%)		240(80.0%)	60 (20.0%)	-	-	20 (100.0%)	
	(including sheep/goat)		(including sheep/goat, mule		-	-	(including sheep/goats)	
Sheep/Goats			and donkeys)		-	-		
Mule/Donkey	-				-	-		
Chicken	-				-	-		
Others	-	28 (100.0%)	125 (mainly local)		13 (100.0%)	0 (0.0%)	220 (100%)	

Table XIII4.3.1: Some Weekly Markets in the Study Area (2/2)

Study Area	N'fifkh (No.5)		Timkit (No.10)		Azghar(No. 17)	
Particulars/Name of the/Souk	Jemma Fedalatte		Souk Gulmima		Tnin Ribat Al Kheim	
R.C/Municipality	Fedalatte		Gulmima		Al Kheim	
Area	2.57 ha		8 ha (including parking lot)		3.0 ha	
Opening Day	Friday		Tuesday		Monday	
Facilities						
Slaughter House	covered with roof		covered with roof		covered with roof	
Market Charges (Tax)						
Cereals	3 Dh/Ql		1 Dh/m2		5 Dh/Ql	
Vegetable/Fruits	3 Dh/Box		1 Dh/m2		50-100 Dh/Truck	
Cattle	10 Dh/head		10 Dh/head		15 Dh/head	
Mule/Donkey			3 Dh/head		15 Dh/head	
Sheep/Goats			3 Dh/head		5 Dh/head	
Chicken					2 Dh/head	
Butchers	160 Dh/head (cattle) 32 Dh/head				64.5 Dh/head (cattle), 13.0 Dh/	
Slaughter House	(sheep/goat) including slaughter house				head (sheep/goat) including slaughter house	
Daily Use Commodities	2 Dh/m2		1 Dh/m2		1 Dm/m2	
Annual Collected Amount (Dh)	370,000 Dh/year		212,000 Dh/year		450,000 Dh/year	
Management of the Souk	C.R		Municipality		Municipality	
Source of Commodities	Local (%))	Outside (%)	Local (%))	Outside (%)	Local (%))	Outside (%)
Cereals					30	70
Vegetable/Fruits					30	70
No. of Traders			102			
Origin of the Traders	Local (%)	Outside (%)	Local (%)	Outside (%)	Local (%)	Outside (%)
Cereals			4 (100.0%)			
Vegetable/Fruits			34 (100.0%)			
Others			26 (25.0%)	76 (75.0%)		

Note: 1) Cereals include hard and soft quality wheat, barley, maize etc. and seeds

2) Abra: There are different kinds Abras, and the Abras for tax collecion here are approximitely 30 kg.

3) Sources of agricultural commodities are not stable and vary due to the weather condition

4) Origin of the traders varies due to the weather condition. If there is lot of rain the percentage of local traders is high

5) At the time of the survey the major source of vegetable supply was the whole sale market of Marrakech.

Source: Hearing survey with the respective Commune offices and the traders in the market, November, 2000

Table XIII4.5.1: FDA Subsidy Ratio for Some Items

Particulars	Subsidy Ratio		Remarks
	Individual Companies	Cooperatives	
Agricultural Equipment			
-Tractor less than 40 horse power	25%	25%	
-Tractor more than 40 horse power	0%	30%	
-Ploughs, chizels, rotary harrows fertilizers and seed drills	35%	35%	
-Materials of treatment and mowing	25%	30%	
-Threshing machines with rotary cultivators	25%	25%	
-Sugar cane/beets harvester	10%	20%	
-Small equipment and harness	50%	50%	
Hydro-Agricultural Equipment			Maximum
-Wells sinking	30%	30%	2 million Dh/farm
-Equipment of irrigation: sprinklers	10%	10%	2 million Dh/farm
-Materials of irrigation: local	30%	30%	2 million Dh/farm
-Stone removing	30%	30%	2 million Dh/farm
Breeding			
Genetic Improvement			
-Animal reproduction: Cattle Male (Dh/head)	1200	1300	
Cattle Female (Dh/head)	1500	1600	
Ovine Female (Dh/head)	500	700	
Ovine Male (Dh/head)	400	450	
Cattle for meat (Dh/heifer)	1000	1000	
-Queens' production of selected bees (Dh/beehive)	250	300	
-Buildings and materials for breeding	20%	25%	
Equipment			
-Cold storage	10-15%	10-15%	Maximum 2 million Dh/unit
-Seed storage	10-20%	15-20%	Maximum 2 million Dh/unit
-Vegetable/fruits packing stations	10%	15%	

Source: Bulletin D'information et de Laision du Pntta, Transfert de Technologie en Agriculture MADRPM/DERD, No. 56, Mai, 1999.

Table XIII4.6.1: Cooperatives in the Study Area (No. 5 N'Fifikh)

Name of the Cooperatives	Date of Establish-ment	No. of Members	Capital (Dh)	Activities
Sahb Lassel	1977	165	62,200	Milk collection/marketing
El Wafa	1977	174	42,200	Milk collection/marketing
Ennasr	1979	135	48,400	Milk collection/marketing
Mabrouka	1992	22	42,000	Milk collection/marketing
B. Yakhlef	1980	65	25,500	Breeding/improvement
El Alamia	1972	27	80,000	Agrerian Reform
El Hassania I	1971	30	120,000	Agrerian Reform
El Manssouria	1972	12	65,000	Agrerian Reform

Source: DPA Ben Slimane

Table XIII4.6.2: Farmers Associations/Cooperatives in the Study Area (No.9 Taskourt)

(1) Associations

name of the Association	Commune	Date of Establish-ment	No. of Members	Membership Fee (Dh)	Activities
Izdihar	Assif El Mal	1996	400	100 Dh/ha	Water Distribution
Al Baraka	Assif El Mal	1997	200	100 Dh/ha	Water Distribution
Lalla Sfia	Guemassa	1997	26	100 Dh/ha	Water Valorization
Belkantaoui	M'jjate	1998	23	100 Dh/ha	Water facilities Management

Source: CT in Chichaoua

(2) Cooperatives

Name of the Cooperatives	Commune	Date of Establish-ment	No. of Members	Capital (Dh)	Activities	Collected Quantity (liter)[1)]	Amount (Dh)
Frougma	Guemassa	1978	61	28,000	Milk C/M[2)]	452,777	1,314,974
El M'jjatia	M'jjate	1990	84	36,900	Milk C/M	290,318	845,269
Al Izdihar	Mzouda	1995	83	19,000	Milk C/M	128,761	376,040
Mabrouka	Assif El Mal	1997	62	9,600	Milk C/M	106,841	309,000
Najah	Assif El Mal	1996	18	22,400	Milk C/M	75,141	221,863
Albaamrania	M'jjate	2000	86	27,700	Milk C/M	-	-
Tazrdaht	Guemassa	on process			Milk C/M	-	-
Sidi Said Amhil	M'jjate	1984	24	12,000	Service	-	-
Annabdouria	Assif El Mal	2000	20	2,000	Goat	-	-

Note: 1) from January 1, 2000 to June 30, 2000
2) C/M: Collection and Marketing

Source: CT in Chichaua

Table XIII4.6.3: Cooperatives in the Study Area (No. 10 Timkit)

Name of the Cooperatives	Commune	Date of Establish-ment	No. of Members	Activities
Essada	Tinejdad	1986	46	Sheep breeding
Lalla Mimouna	Tinejdad	1990	30	Sheep breeding
Chifa	Tinejdad	1997	42	Bee keeping
Tamounte	Tinejdad	1997	30	Sheep breeding
El Anal	Tinejdad	1997	8	Pumping
Aghbalou	Aghbalou	2000	39	Sheep breeding

Source: ORMVA/TF, Errachidia

Table XIII4.7.1: Major Economic Activities and Family Income in the Study Area

Particulars	N'fifikh (No.5) Household N=63 (%)	Taskourt (No.9) Household N=75 (%)	Timkit (No.10) Household N=77 (%)	Azghar (No.17) Household N=44 (%)
Economic Activities				
-Agricultural Activities Only	52.0	37.0	19.0	43.0
-Agricultural and Other Side Jobs (Employment, Commerce/Small Business etc.)	48.0	63.0	77.0	57.0
-Non Agricultural Activities Only	0.0	0.0	4.0	0.0
Total	100.0	100.0	100.0	100.0

Annual Average Family Income

	N'fifikh DH/Annum	Share (%)	Taskourt DH/Annum	Share (%)	Timkit DH/Annum	Share (%)	Azghar DH/Annum	Share (%)
-Agricultural Income Including Non Agricultural Activities	32,800	68.5	20,800	77.0	12,600	38.9	16,500	69.6
-Remittance from Migrant Workers	15,100	31.5	6,200	23.0	19,800	61.1	7,200	30.4
Total	47,900	100.0	27,000	100.0	32,400	100.0	23,700	100.0
Annual Average Family Expenditure								
	15,600		17,100		16,100		16,300	
Reserve	32,300		9,900		16,300		7,400	

Note: Agricultural activities/income include livestock production/income

Source: Household Interview Survey on Socioeconomic Conditions of Beneficiary Areas, 2000