

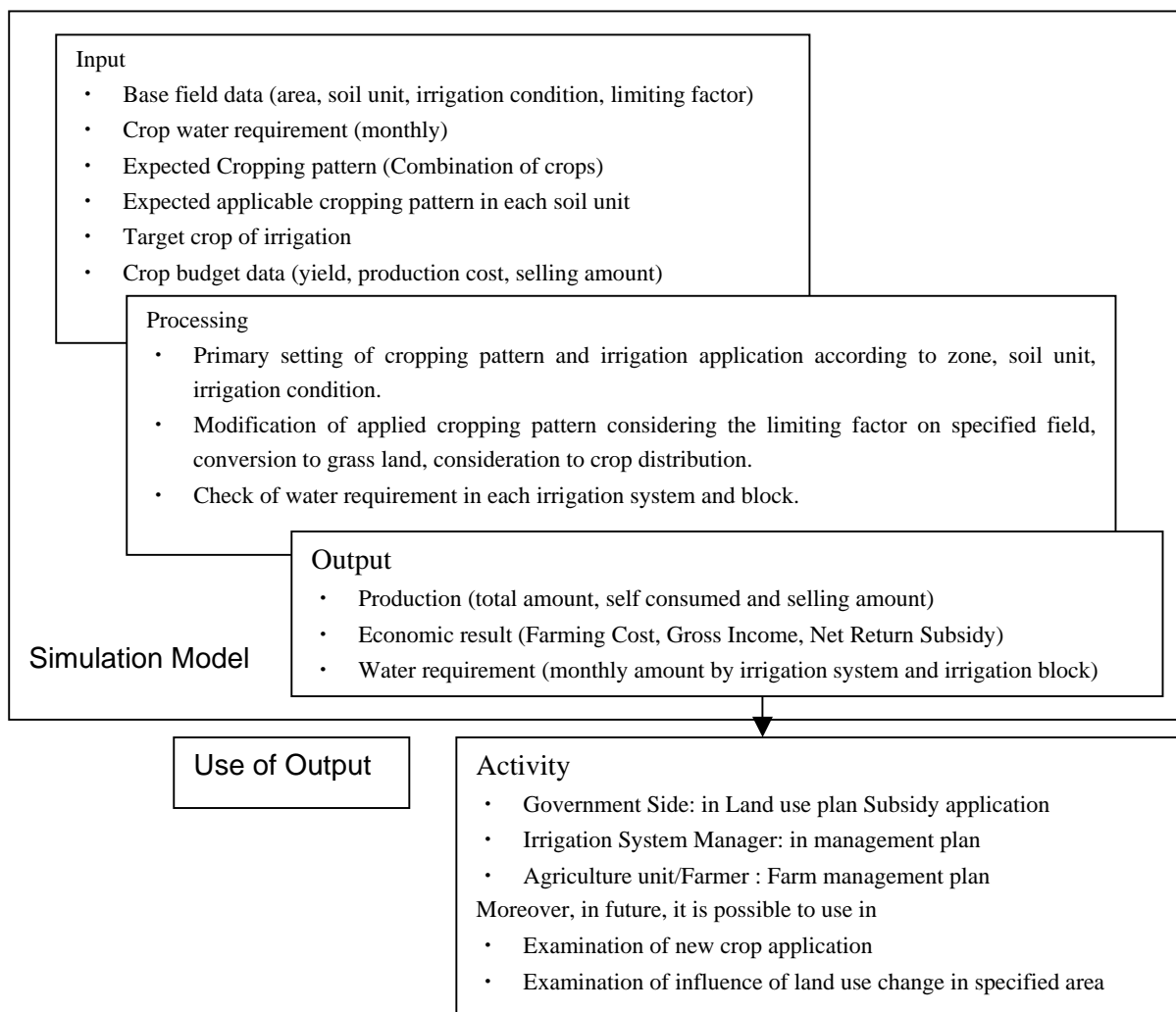
Figure 4.3.4 Cropping Sample – Scenario A – 1st Year

5. SIMULATION MODELLING

5.1 Objectives of Preparing the Simulation Model

The land use is changed when the Guideline is applied in the area. Because of that, several effects on agricultural production (crop, amount and domestic consumption) and income structure are expected. In order to study these effects, simulation modelling was carried out to examine the change in water use, production amount and economic balance when agricultural productivity is improved in the region by applying the combined measures written in the Guideline.

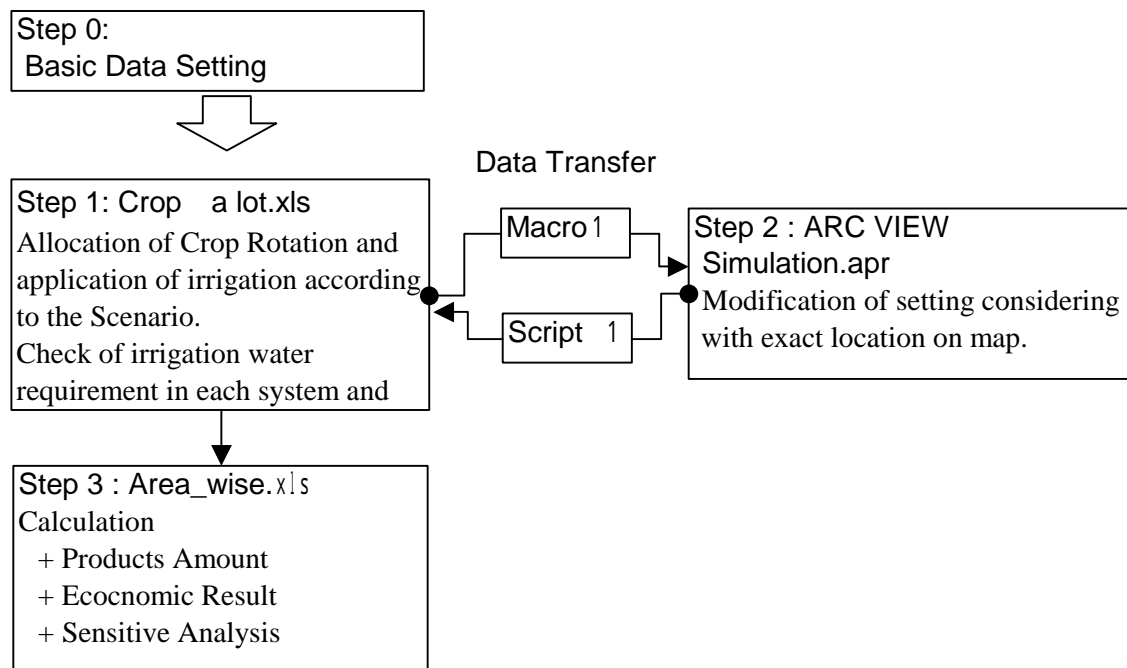
Moreover, the following studies are possible with the output of this model. First, the examination of the regional land use plan or appropriate subsidy application by the government. Second, conversion of crops and land use, effects of using irrigation and change of economic balance by farming units. The results of calculation of water requirement in each irrigation system and irrigation block can be used to prepare the management and maintenance plan for irrigation facilities by the responsible organization or Maintenance Company, as well.



5.2 Structure of Simulation Model

The simulation model is constructed with two programmes, named Microsoft Excel and ArcView. The version of ArcView should be ver.3.1 or higher and Microsoft Excel should be 2000 or higher because of its macro language.

Sturcture of Simulation Model



(1) Step0:Base Data Setting

The following data should be prepared properly before program running.

Item	File Name	Sheet Name
Crop Water Requirement	Crop_alot.xls	Water req
Adaptable Cropping Pattern in each Zone, Irrigation Condition and soil unit		Pattern
Cultivated Crops in each Cropping pattern		crop
Basic Field Data		base
Irrigation Cost	area_wise.xls	Irrigation cost
Crop Budget and economy		Crop Budget

(2) Step1:Allocation of cropping pattern according the basic idea of the Scenario

Draft cropping pattern is applied in each field according to the character of each field automatically. This draft cropping pattern is confirmed on the map with ArcView and monthly water requirements in each irrigation system and irrigation block are checked with its capacity. If it is needed, cropping pattern shall be modified. The procedure is as follows:

- ① The characteristics of each field are copied into Scenario_X, that are Field no, Soil unit category, Zone, Irrigation condition, Area.

② Applied draft Cropping Pattern (Start Macro)

Suitable Cropping pattern with soil unit, application of irrigation in crop and crop rotation is applied automatically.

③ Modification of application of irrigation (Irrigation Identification: Macro4)

Application of irrigation is renewed according to the crops, if needed.

- ④ Comparison of the amount of monthly water requirement in each irrigation system with its pump capacity. (Crop_area_x)
- ⑤ Comparison of the amount of monthly water requirement in each irrigation block with its irrigation pipe-line capacity. (IB_SCN_X)
- ⑥ Cropping pattern, irrigation application and crop rotation should be modified manually.

⑦ Data transfer – export to dbf file (File export to DBF format:Macro 1)

Data in Scenario_X is exported to DBF format file, available in ArcView program.

⑧ Data transfer – export to Excel file for economic examination

(Copy to area_wise.xls :Macro 6)

Result of allocation data is exported to “Area_wise.Xls : Crop_area_X sheet”.

- (3) Step2 Confirmation of applied cropping pattern on map in ArcView, consideration of limiting factor on specified field and crop distribution.

- ① Modification of cropping pattern on field where limiting factor is confirmed on.
(Simulation Project File)

② Export to Microsoft Excel (Script 1)

Modified data are exported to Crop_X sheet in Crop_alot.Xls

- ③ Back to Step 1 ④ and ⑤ to confirm the total water requirement in irrigation system and irrigation block.

- ④ After the above confirmation, results should be exported to Area_wise.xls use with Step1 ⑧

(4) Step3 Output

Output will be as follows:

Output

Item	File Name	Sheet Name
Monthly Water requirement in Irrigation Block	Crop_alot.xls	IB_SCN_X
Monthly water requirement in each Irrigation System (6 Years average and every year)		Crop_area_X
Farming Cost, Gross Income, Net return, Subsidy based on the Crop_area Sheet	Area_wise.xls	balance_A
Summary of Balance_X		crop_wise
Cultivated Area and Production amount in each crop		Yield
Summary of Financial Balance、 Estimated Subsidy Expenditure、 Net Return Excluding		Summary
Sensitivity Analysis of Net Return		Sensitivity

5.3 Data-Set Format

(1) Microsoft Excel Files

1) File Format

Crop_A_lot 2.Xls

Sheet Name	Note
water req	Basic Setting Monthly water requirement of each crop
base	Basic Data of each Field. They are not used in actual calculation.
crop	Basic Setting Cropping Pattern
Pattern	Basic Setting Relations between Cropping pattern and soil unit, zone
Sheet 0	Macro Control Sheet
Scenario_A (B,C)	Basic data of calculation It is the result of combined calculation source data such as basic field data, cropping pattern, and irrigation application in each scenario.
Crop_area_A (B,C)	Calculated Result cropped area according to the crop and monthly water requirement of each irrigation system in each year and 6 year average to compare with its pump capacity.

Crop_A (B,C)	Sheet to data transfer Export/Import to ArcView in DBF file format about necessary contents in Scenario_A
IB_A (B,C)	Basic Setting Modified Filed data to calculate the water requirement in each irrigation blocks. Number of fields is more than the basic number, because they are divided into some irrigation blocks when needed.
IB_SCN_A (B,C)	Calculated Result Irrigated area and monthly water requirement of each irrigation block in each year and 6 year average to compare with its pipeline size and flow velocity.

Area_wise.Xls

Sheet Name	Note
Irrigation Cost	Basic Setting Irrigation cost of each crop
Crop Budget	Basic Setting Budget and economic data (Production Cost and Net Income of Crops , subsidy) of each crop according the plan, soil and zone category
crop_wise	Basic Setting Crop Budget - Crop Wise Summary
Crop_area_X (01,02,A,B,C)	Transcribed from average of “Crop_A_lot 2.Xls Crop_area_X sheet” It is copied by MACRO.
balance_01 (02,A,B,C)	Calculation Results Summary of calculated economic balance according to the site, irrigation system and production.
Production	Calculation Results Summary of production volume of crop. Calculation of volumes of self-supply feed and selling and their costs.
Sheet1	Calculation Results Average production cost in each scenario to calculate the “Production” Sheet.
Yield	Calculation Results Cropped area and production amount of each crop
Summary	Calculation Results Summary of calculated subsidies
Sensitivity	Calculation Results Sensitivity Analysis of Net Return (Sensitivity on Subsidy Level, Sensitivity on Production Cost, Sensitivity on Products Price)

2) Sheet Format

File Name : Crop_alot.XLS Sheet Name : Water Req

Amount of Crop Water Requirement of each crop is expressed as gross water requirement per hectare. It is calculated from climatic conditions, crop character and irrigation efficiency according to the type of irrigation.

The method and procedure to obtain it is described in [Part-3 Case Study Chapter 3.3 Irrigation and Drainage Management in Guideline.](#)

Name	Contents	Type
Water requirement	Monthly water requirement for unit area indicated in mm	Input Data

Input Data : They are used in calculation, Output Data : They are generated by automatic calculation.

Reference : It is not used, only to help understanding by user

Sample Data Format

E: Irrigation Efficiency: 0.85									
Item	Water Requirement (mm)							Total	
	Average year (1993,1998)							(mm)	(m3/ha)
Crop	APR	MAY	JUN	JUL	AUG	SEP	OCT		
Wheat	0	70.1	61.1	0.0	0.0	0.0	0	131.3	1,313
Spring Barley	0	77.8	83.1	5.0	0.0	0.0	0	165.9	1,659
Maize	0	44.6	77.6	89.8	85.0	16.1	0	313.2	3,132
Vegetable	0	67.7	70.8	69.8	26.9	0.0	0	235.2	2,352
Sunflower	0	0.0	33.9	84.1	88.8	0.0	0	206.8	2,068
Alfalfa	0	107.6	3.6	79.8	22.5	24.2	0	237.6	2,376
Rape Seed	0	9.4	10.7	0.0	0.0	0.0	0	20.1	201
Rye	0	0	0	0	0	0	0	0	0
Soybeans	0	0.0	49.9	74.1	0.0	0.0	0	124.0	1,240
Apple	0	0	0	0	0	0	0	0	0
Meadow/Turf	0	108	4	80	22	24	0	238	2,376
Asparagus	0	57.6	57.0	55.5	58.5	13.7	0	242.3	2,423

File Name : Crop_alot.XLS Sheet Name : Crop

Cropping pattern is expected to be applied for 6 years. The blank cell does not have to be filled in, when the number of crops is less than 6. In the case of perennial, the same name should be written continuously. For example, alfalfa is written in three cells when it is cultivated in three years. New cropping pattern can be added at the bottom. [Detail of cropping pattern is described in Part-3](#)

[Chapter 2.7 Crop Cultivation Techniques and Chapter 3.2.3 Possible Crop Rotation in the Guideline.](#)

Name	Contents	Type
Cropping Pattern	Exact description	Reference
Code	Code of respective cropping pattern	Input Data
Rotation	Number of crops in respective cropping pattern	Input Data
Year-X	Cultivated crops in X-year	Input Data

Sample Data Format

No.	Cropping pattern	Code	Rotation y	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
17	apple	apple	1	apple					
16	asparagus	asp	1	asparagus					
1	sunflower-s. barley-rapeseeds-food wheat	IR1	4	sunflower s.barley	rapeseed	f.wheat			
3	sunflower-food wheat-rapeseeds-food wheat	IR2	4	sunflower f.wheat	rapeseed	f.wheat			
4	sunflower-soybean-food wheat-s. barley	IR3	4	sunflower soybean	f.wheat	s.barley			
5	maize-maize-s. barley-alfalfa-alfalfa	IR4	6	maize maize	s.barley	alfalfa	alfalfa		alfalfa
6	maize-maize-s. barley-maize- w. wheat	IR5	5	maize maize	s.barley	maize	wheat		
13	artificial meadow	meadow	1	meadow					
14	sunflower-s. barley-maize-food wheat	NR1	4	sunflower s.barley	maize	f.wheat			
15	sunflower-s. barley-maize-maize	NR2	4	sunflower s.barley	maize	maize			
7	rapeseeds-food wheat/s. barley	RF1	3	rapeseed f.wheat	s.barley				
8	food wheat-maize-maize-alfalfa-alfalfa	RF2	6	f.wheat maize	maize	alfalfa	alfalfa		alfalfa
9	wheat-maize-maize-rapeseeds	RF3	4	wheat maize	maize	rapeseed			
10	wheat-rye	RF4	2	wheat rye					
11	wheat-rye-maize-alfalfa-alfalfa-alfalfa	RF5	6	wheat rye	maize	alfalfa	alfalfa		alfalfa
12	rye	rye	1	rye					

File Name : Crop_alot.XLS Sheet Name : Pattern

The Cropping Pattern is categorised according to the Zone, Irrigation and Soil in each Scenarios. New pattern should be added following (right of) the same categories. Cropping pattern is written in Code shown in “Crop” sheet. This part is one of the major points in the land use planning. [Details](#) to apply the cropping pattern is described in Part-3 Chapter 3.2.3 Possible Crop Rotation in the [Guideline](#).

Name	Contents	Type
Scenario	Scenario Name	Reference
Zone	Zone number	Reference
Irrigation	Irrigation code that is used in “Scenario_X” Sheet	Reference
Soil	Soil Unit classification	Reference
Pattern	Expected cropping pattern in each category. All cropping pattern code should be shown in “Crop” sheet.	Input Data

Input Data : They are used in calculation, Output Data :They are generated by automatic calculation.

Reference : It is not used, only to help understanding by user

Sample Data Format

Scenario	A				B				C				
Zone	Irrigation	Soil	Pattern			Soil	Pattern			Soil	Pattern		
2	0	A1	RF1			A1	RF1			A1	RF1		
		A2	RF4			A2	RF4			A2	RF4		
		A3	RF5	rye		A3	RF5	rye		A3	RF5	rye	
		A4	meadow			A4	meadow			A4	meadow		
		A5	meadow			A5	meadow			A5	meadow		
		B1				B1				B1			
		B2				B2				B2			
		B3				B3				B3			
		B4				B4				B4			
		Not 0		A1	IR1			A1	IR1			A1	RF1
A2	IR2			IR3		A2	IR2	IR3		A2	RF2	RF3	
A3	IR4			IR5		A3	IR4	IR5		A3	RF5	rye	
A4	IR4			IR5		A4	meadow	RF5		A4	meadow	RF5	
A5	meadow					A5	meadow			A5	meadow		
B1	IR2			IR3		B1	IR2	IR3		B1	RF2	RF3	
B2	IR4			IR5		B2	IR4	IR5		B2	RF5	rye	
B3	IR4			IR5		B3	meadow	RF5		B3	meadow	RF5	
B4	meadow					B4	meadow			B4	meadow		
999				A1				A1				A1	
		A2	IR5			A2	IR5			A2	IR5		
		A3				A3				A3			
		A4				A4				A4			
		A5				A5				A5			
		B1				B1				B1			
		B2				B2				B2			
		B3				B3				B3			
		B4				B4				B4			
		3	0	A1	NR1	meadow		A1	NR1	meadow		A1	NR1
A2	meadow					A2	meadow			A2	meadow		
A3	meadow					A3	meadow			A3	meadow		
A4	meadow					A4	meadow			A4	meadow		
A5	meadow					A5	meadow			A5	meadow		
B1				B1				B1					
B2				B2				B2					
B3				B3				B3					
B4				B4				B4					

File Name : Crop_alot.XLS Sheet Name : Scenario_X

This sheet serves for the control of simulation calculation. The calculation conditions of each field are filled into this sheet in accordance with the scenario. [Details are described in Part-3 Chapter 3](#)

[Soil and Water Management Plan in Guideline.](#)

Name	Contents	Type
Field_No	ID Number of each Field	Reference
Soil	Soil Unit classification. It is used to decide the pattern. Its details are written in Part-2 Chapter 3 Land Evaluation and Expected Cultivation/Land Use in Guideline	Reference
Zone	Zone number. It is used to decide the pattern. Details of Zonation are written in Part-2 Chapter 2 Current Situation and Future of Regional Agriculture in Guideline.	Reference
IRRGS	Irrigation Category (Number of pump) is used to decide the pattern. 12: Gajary Area 11: Male Levare Irrigation System 21: Male Levare Irrigation System, 999:Underground sub Irrigation are 0 :Non Irrigation Area	Reference
Area	Field Area in hectare	Reference
Pattern	Expected cropping pattern, which is set automatically by expression with crop and patterns.	Input Data
CC	Start of cropping pattern set by MACRO 12 (it should be less than the number of rotation crops)	Input Data
1	Cultivated Crop of First Year set by expression.	Input Data
Cult-01	Application of irrigation for First year's crop set by expression. 1: no irrigation, 2: irrigated	Input Data

Input Data : They are used in calculation, Output Data : They are generated by automatic calculation.

Reference : It is not used, only to help understanding by user

Sample Data Format

FILED_NO	SOIL	ZONE	IRRIGS	NAME	AREA(ha)	Pattern	CC	1	cult-01	2	cult-02	3	cult-03	4
L-23-1	A1	3	0	Unknown	32	meadow	1	meadow	1	meadow	1	meadow	1	meadow
L-19	A1	3	0	Stomfa	32	NR2	3	s.barley	1	maize	1	maize	1	sunflower
L-24-1	A1	3	0	Stomfa	30	meadow	1	meadow	1	meadow	1	meadow	1	meadow
L-15-2	A1	3	0	Stomfa	30	NR1	1	f.wheat	1	sunflower	1	s.barley	1	maize
L-17-2	A1	3	0	Stomfa	30	NR1	4	maize	1	f.wheat	1	sunflower	1	s.barley
L-20-1	A1	3	0	Stomfa	30	NR1	2	sunflower	1	s.barley	1	maize	1	f.wheat
L-25-2	A1	3	0	Unknown	29	meadow	1	meadow	1	meadow	1	meadow	1	meadow
L-09-1	A1	3	0	Stomfa	29	NR1	3	s.barley	1	maize	1	f.wheat	1	sunflower

File Name : Crop_alot.XLS Sheet Name : Crop_X

These data are transcribed from “Scenario_X”, when you run the Macro to prepare the DBF file in ArcView folder. Moreover, it should be overwritten when you run Script1 in ArcView to export data from ArcView to Excel. The field which is not target of this case study is shown as a blank row.

Name	Contents	Type
Field_No	ID Number of each Field	Reference
Pattern	Given Cropping Pattern in each field	Reference
Scn y-X	X years crop	Reference
Cult-yX	Application of irrigation for X years crop 1:non-irrigated, 2: irrigated	Reference

Sample Data Format

Filed_no	Pattern	Scn_y-01	Cult-y01	Scn_y-02	Cult-y02	Scn_y-03	Cult-y03	Scn_y-04	Cult-y04	Scn_y-05	Cult-y05	Scn_y-06
G-07-3	veg	veg	2	veg	2	veg	2	veg	2	veg	2	veg
G-07-4	IR3	s.barley	2	sunflower	2	soybean	2	f.wheat	1	s.barley	2	sunflower
G-07-5	veg	veg	2	veg	2	veg	2	veg	2	veg	2	veg
G-08	meadow	meadow	2	meadow	2	meadow	2	meadow	2	meadow	2	meadow
G-09												
L-01	IR3	f.wheat	1	s.barley	2	sunflower	2	soybean	2	f.wheat	1	s.barley
L-01-1	IR2	sunflower	2	f.wheat	2	rapeseed	1	f.wheat	2	sunflower	2	f.wheat
L-01-2												
L-01-3												
L-02-1	IR5	s.barley	2	maize	2	wheat	1	maize	2	maize	2	s.barley
L-02-2												
L-02-3	IR5	maize	2	wheat	1	maize	2	maize	2	s.barley	2	maize
L-02-4	IR5	maize	2	maize	2	s.barley	2	maize	2	wheat	1	maize
L-02-5												
L-02-6												
L-03-1	RF4	rye	1	wheat	1	rye	1	wheat	1	rye	1	wheat

File Name : Crop_alot.XLS Sheet Name : IB_SCN_X

Name	Contents	Type
Irrigation Block	Irrigation block name Ex.ML2B2 :Male Levare Area Irrigation Block No.2	Reference
Irrigation Area	Calculated irrigated area in each crop	Output
Necessary Water Amount	Calculated amount of monthly water requirement in each crop	Output
Diameter	Diameter of main supply pipeline for respective irrigation block.	Input
Area of Pipe	Cross section of pipeline, in which irrigation water flows through	Output
Max Speed	Maximum velocity of water flow in pipeline	Output

Sample Data Format

ML2 B2 Irrigation Area(ha)							Necessity Water Amount (m3)							Diameter Area of Pipe Max Speed
	1	2	3	4	5	6	1	2	3	4	5	6		
Wheat	43.0	4.2	50.6	0.0	43.0	4.2	30,153	2,919	35,458	0	30,153	2,919		
Spring Barley	0.0	3.3	4.2	0.0	0.0	0.0	0	2,784	3,459	0	0	0		
Maize	3.3	0.0	0.0	0.0	0.0	3.3	3,006	0	0	0	0	3,006		
Vegetable	84.5	84.5	84.5	84.5	84.5	84.5	59,791	59,791	59,791	59,791	59,791	59,791		
Sunflower	0.0	43.0	0.0	11.7	0.0	43.0	0	38,193	0	10,417	0	38,193		
Alfalfa	0.0	0.0	3.3	3.3	0.0	0.0	0	0	3,602	3,602	0	0		
Rape Seed	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0		
Rye	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0		
Soybeans	4.2	0.0	0.0	0.0	4.2	0.0	3,083	0	0	0	3,083	0		
Apple	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0		
Meadow/Turf	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0		
Asparagus	15.7	15.7	15.7	15.7	15.7	15.7	9,192	9,192	9,192	9,192	9,192	9,192		
Total	150.7	150.7	158.3	115.3	147.4	150.7	105,225	112,879	111,502	83,002	102,219	113,101		

Design standard of diameter and allowable flow velocity in pipe.

Diameter(m)	0.15	0.4	0.5
Max Flow velocity (m/s)	1.0	1.6	1.8

File Name : area_wise.XLS Sheet Name : Irrigation Cost

Irrigation Cost consists of water charge, construction cost of irrigation facilities and operation/maintenance cost of equipment. The methodology of its calculation is described in [Part-3](#)

Case Study Chapter 3.3 Irrigation and Drainage Management in the Guideline.

Name	Contents	Type
Irrigation Scale	Covered area by one sprinkler according to the type of irrigation.	Input
Number of Sprinkler	Unit number of sprinklers	Input
Man power (Transportation and irrigation)	Labour Cost for all Irrigation facilities in field.	Input
Drive administrative expenses	Transport fuel cost from storehouse to field. Purchases of vehicles are not included.	Input
Expenditure of Sprinkler	Calculated annual cost of one sprinkler and it is converted cost for one hectare. Expected use period of sprinkler is 12 years. Subsidy (30% of total purchase cost of sprinkler) is already included.	Input
Water Cost	Calculation of water cost for one hectare. Unit amount irrigation water is the same as total water requirement shown in “Water Requirement” sheet. Unit Water Cost in irrigation scheme is calculated as unit water charge multiplied by the amount of irrigation water. Unit water charge of 0.9 SKK/m ³ is 30% share of irrigation unit cost 2.85SKK/m ³ (See Supporting Report Page G-39), because of subsidy.	Input
Grand Total (Unit Cost)	Average Unit Cost in each category. Calculated from above data	Output
Subsidy for Irrigation per hectare	Subsidy is included in the above calculation. In this table, the total amount of subsidy in expenditure of equipment as sprinkler and water charge is re-calculated as reference.	Reference

Irrigation Cost

No.	Description	unit	wheat	spring Barley	Grain maize	Sunflower	Soybeans	Alfalfa	Asparagus	Vegetable
1)	Irrigation scale	ha	16.1	16.1	16.1	16.1	16.1	16.1	16.1	9.2
2)	Number of Sprinklers	unit	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3)	Man power (Transportation and irrigation)									
	Transportation and setting	Labor	day	0.5	0.5	0.5	0.5	0.5	0.5	1.0
	Irrigation	7day X 2(3) parson	day	14.0	14.0	14.0	14.0	14.0	14.0	24.0
	Clear away		day	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Total		day	15.5	15.5	15.5	15.5	15.5	15.5	26.0
	Man power Cost (16.1ha)	500.1	sk/day	7,751.8	7,751.8	7,751.8	7,751.8	7,751.8	7,751.8	13,003.0
	i)Man power Cost (ha)			481.5	481.5	481.5	481.5	481.5	481.5	1,413.4
4)	Drive administrative expenses									
	Transportation work	Track and trailer	day	0.5	0.5	0.5	0.5	0.5	0.5	1.0
	Transportation cost	1,250.0	sk/day	625.0	625.0	625.0	625.0	625.0	625.0	1,250.0
	Irrigation work	Tractor	day	14.0	14.0	14.0	14.0	14.0	14.0	24.0
	Irrigation cost (16.1ha)	400.0	sk/day	5,600.0	5,600.0	5,600.0	5,600.0	5,600.0	5,600.0	9,600.0
	ii)Irrigation cost (ha)			347.8	347.8	347.8	347.8	347.8	347.8	1,043.5
5)	Expenditure of Sprinkler									
	Sprinkler cost(One unit)	450,000.0	sk							568,122.0
	After-subsidy price(30%)	135,000.0	sk	135,000.0	135,000.0	135,000.0	135,000.0	135,000.0	135,000.0	170,436.6
	Annual depreciation expense	Redemption for twelve years(1/12)Irrigation Scale	sk	698.8	698.8	698.8	698.8	698.8	698.8	1,543.8
	Maintenance expense	5% of repair cost(ha)	sk	34.9	34.9	34.9	34.9	34.9	34.9	77.2
	iii) Total of year expenditure(ha)	(ha)	sk	733.7	733.7	733.7	733.7	733.7	733.7	1,621.0
6)	Water cost									
	Amount of Irrigation water	Unit/ha	m ³ /ha/year	1,313	1,659	3,132	2,068	1,240	2,376	2,423
	Amount of Irrigation water	Total (in Irrigation Scale)	m ³ /ha/year	21,132	26,713	50,422	33,296	19,959	38,251	39,007
	Unit Water cost in irrigation Scale (30%)	0.90	sk	19,018.9	24,041.3	45,379.4	29,966.5	17,963.1	34,425.7	35,106.0
	iv) Unit Water cost (ha)	(ha)	sk	1,181.3	1,493.3	2,818.6	1,861.3	1,115.7	2,138.2	2,116.8
	Ground Total (i-ii+iii-iv)	(ha)	sk	2,744.3	3,056.2	4,381.6	3,424.3	2,678.7	3,701.2	3,743.5
	Amount of Subsidy for Irrigation per ha	Subsidy rate								
5)	Expenditure of Sprinkler	70%	SKK/ha	1,630	1,630	1,630	1,630	1,630	1,630	3,602
6)	Water cost	70%	SKK/ha	2,756	3,484	6,577	4,343	2,603	4,989	4,939
	Total		SKK/ha	4,386	5,114	8,207	5,973	4,233	6,619	8,541

File Name : area_wise.XLS Sheet Name : Crop Budget

To evaluate the effects of the plan, crop budget is estimated for two zones (equivalent to typical soil type) in the study area. It consists of cost, average yield, price and subsidies. These data were collected, analysed and compiled from various data-sources and they can be applied only in the study area, since the yield, efficiency of input and amount of production work are dependent on the local conditions such as soil type, market accesses, etc.

The concept to set these parameters according the balance between the agricultural input and yield is described in [Supporting Report G.3.2.1 Production Cost and Table G.3.18 Basic factors for the estimation of the crop budget.](#)

Name	Contents	Type
Costs	Estimated cost for 1 hectare field in each categories.	Input
Yield ton/ha	Expected yield in 1 hectare field. Supporting Report G.3.2.1 Production Cost and Table G.3.18 Basic factors for the estimation of the crop budget.	Input
Price SKK/ton	Expected selling price of 1 ton of products. Different price should be set when it is changed according to its quality.	Input
Subsidies SKK/ha: Basic and Disadvantage	Obtain subsidy for 1 hectare field. It consists of two subsidies, which are payments depending on crop production volume and average amount of subsidy for the compensation of lower revenue rate in disadvantaged area.	Input
Subsidies SKK/ha: Irrigation (incl. In item I-12)	Subsidy related to irrigation, which is estimated in Irrigation Cost sheet. Number of equipment and amount of irrigation water are the bases of this calculation.	Input

Table 5.5.1 Production Cost and Net Income of Crops (1/6)

Crop: Wheat	Unit	Zone II (Sandy Soil)								
		Without Plan			With Plan - Non-Irrigated			With Plan - Irrigated		
		Per ha Amount	Price (SKK/Unit)	Total (SKK)	Per ha Amount	Price (SKK/Unit)	Total (SKK)	Per ha Amount	Price (SKK/Unit)	Total (SKK)
I Costs										
1 Land Rental	ha		500	500		500	500		500	500
2 Ploughing	ha		1,300	1,300		1,500	1,500		1,500	1,500
3 Chemical Fertilizers	kg	80	13	1,040	100	13	1,300	135	13	1,755
4 Fertilizer Application			500	500		500	500		500	500
5 Seeds	kg	150	7.5	1,125	150	7.5	1,125	150	7.5	1,125
6 Seeding			1,450	1,450		1,450	1,450		1,450	1,450
7 Agricultural Chemicals (Herbicides)		3	600	1,800	4	600	2,400	4	600	2,400
8 Chemicals Application (Herbicide)				500			500			500
9 Agricultural Chemicals (Plant protection)				700			700			700
10 Chemicals Application (Plant protection)				500			500			500
11 Harvesting			1,700	1,700		1,870	1,870		1,870	1,870
12 Water Charge										2,744
Total				11,115			12,345			15,544
13 Management Cost (10% of the cost above)				1,112			1,235			1,554
14 Other miscellaneous Cost				-			-			-
Total Cost				12,227			13,580			17,099
II Yield ton/ha				3.20			3.80			4.70
III Price SKK/ton				3,300			3,300			4,200
IV Total Amount (II*III)				10,560			12,540			19,740
V Subsidies SKK/ha: Basic and Disadvantage				1,700			1,700			1,700
Subsidies SKK/ha: Irrigation (incl. In item I-				-			-			4,386
VI Gross Income (IV+V)				12,260			14,240			21,440
VII Net Income (VI-I)				34			661			4,341

File Name : area_wise.XLS Sheet Name : Production

Name	Contents	Type
Production Amount	Calculated production amount in each case study scenarios. It will be transcribed from the “Yield” sheet automatically.	Output
Demand in Area	Calculated demand of self-supply feed based on the supplied crop balance in Malacky district. Input : Area (ha) in Case Study Output : Head of each livestock in Case Study Area	Input/Output
Unit Demand Amount	Amount of consumed feed in one day.	Input
Demand in CS Site	Annual amount of consumed feed in Case Study Site (ton) It is calculated as number of livestock animals multiplied by the unit demand.	Output
Balance between Self-consumption and selling		
Demand	Summary and Sum up of feed demand, which is calculated in “Demand in CS Site”. At this time, the following assumptions are expected. Wheat: demand of barley is included Maize: Silage maize is included as equivalent (Unit yield in Silage maize is 16 ton/ha, and grain maize is 3.5 ton/ha)	Input
Possible amount for Sell	Calculated Result Calculated as self-consumed subtracted from total products	Output
Consumed Amount for livestock	Calculated Result When it is not enough for demand, the shortage is filled up by other crop, which is converted to equivalent TDN. This calculation is carried out by MACRO and the table is also changed automatically.	Output (MACRO BASE)
Production Cost for selling amount (SKK)	Calculated total cost from “Possible amount for Sell” and unit cost of each crop in Scenario, which is written in Sheet1.	Output
Production Cost for self supply feed (SKK)	Calculated cost from “Consumed Amount for livestock” and unit cost of each crop in Scenario, which is written in Sheet 1	Output

Sample Data Format

Demand		Possible Amount for Sell (Ton)					Consumed Amount for livestock (Ton)				
Ton/Year		Current 2001	Current 2002	Scenario A	Scenario B	Scenario C	Current 2001	Current 2002	Scenario A	Scenario B	Scenario C
578	Wheat	0	0	0	169	63	61	13	352	544	543
0	f.Wheat	940	481	566	349	349	0	0	0	0	0
0	Spring Barley	106	202	1,093	840	451	0	0	0	0	0
434	Maize	0	0	1,499	751	794	1,222	1,214	656	434	434
0	Vegetable	684	684	7,344	5,220	3,636	0	0	0	0	0
0	Sunflower	172	618	415	446	223	0	0	0	0	0
1,090	Alfalfa	0	0	766	367	1,228	160	160	1,166	1,090	1,090
0	Rape Seed	158	109	50	74	105	0	0	0	0	0
0	Rye	1,129	832	114	207	569	254	306	0	0	0
0	Soybeans	0	0	36	48	0	0	0	0	0	0
0	Apple	0	0	0	0	0	0	0	0	0	0
2,059	Meadow	0	0	0	0	0	1,809	1,836	1,896	2,206	2,211
	Asparagus	416	416	420	420	420	0	0	0	0	0
*Total Yield of Maize is equivalent as Grain Maize				1,492	873	1,155					

File Name : area_wise.XLS Sheet Name : Crop_wise

Name	Contents	Type
Crop Budget-Crop Wise Summary	Transcribed from “crop budget” sheet. Farming cost, Gross income, Net Return, Subsidy	Reference
Yield	Transcribed from “crop budget” sheet. Yield	Reference
Unit Cost	Average Unit Cost in each category. Calculated from above data	Reference

File Name : area_wise.XLS Sheet Name : Balance_X

Name	Contents	Type
Area (ha)	Sum up Cultivated area from “crop_Scenario A” in each category	Output
Unit Price (farming cost, gross income, net return, subsidy)	Transcribe from “crop budget” in each category	Reference
Amount (SKK) (farming cost, gross income, net return, subsidy)	Calculation result from cultivated area and unit price of each item	Output
Unit Yield	Transcribe from crop budget in each category	Reference
Amount Yield	Calculation result from cultivated area and unit yield of each item	Output

File Name : area_wise.XLS Sheet Name : Yield

Name	Contents	Type
Area (ha)	Sum up Cultivated area from “Balance_X” in crop in both site	Reference
Amount Yield	Sum up Cultivated area from “Balance_X” in crop in both site	Reference

File Name : area_wise.XLS Sheet Name : Summary

Name	Contents	Type
Summary of Financial Balance of Crop Cultivation	Sum up from “Balance_X”sheet in each category	Output
Summary of Estimated Subsidy Expenditure	Sum up from “Balance_X”sheet in each category	Output

File Name : area_wise.XLS Sheet Name : Sensitivity

Sensitivity on subsidy level

Name	Contents	Type
Subsidy level	Setting	Input Data
Net return	Calculated as follows: Subtract the total subsidy* multiplied by subsidy level from net return*.	Output
Ratio of cost	Net return / farming cost*	Output
Net Return per hectare	Net return / cultivated area (2,232hectares)”	Output

Sensitivity on Production Cost

Name	Contents	Type
Cost increase	Setting	Input Data
Net return	Calculated as follows: Subtract farming cost* multiplied by cost increase from gross income*.	Output
Ratio of cost	Net return / farming cost* multiplied by cost increase.	Output
Net Return per hectare	Net return / cultivated area (2,232hectare)”	Output

Sensitivity on Production Price

Name	Contents	Type
Cost increase	Setting	Input Data
Net return	Calculated as follows: Subtract farming cost* from variable - total Gross income and add the total subsidy. This variable -total Gross income is calculated as the rest of gross income minus obtained total subsidy multiplied reduction ratio.	Output
Ratio of cost	Net return / farming cost*	Output
Net Return per hectare	Net return / cultivated area (2,232hectare)”	Output

* data are shown in “Balance X”.

(2) Arc View Files

View : Crop Pattern Scenario X

Theme Name	Contents
Crop Pattern Scenario X	Soildissilv2.dbf + crop_scn_X.dbf (Joined with Filed No) “Pattern” data are selected to show

View : Crop Scenario X Year-XX

View Name	Contents
Field Irrigation	Soildissilv2.dbf + crop_scn_X.dbf (Joined with Filed No) “Cult-yXX” data is selected to shown
Sample of Cropping	Soildissilv2.dbf + crop_scn_X.dbf (Joined with Filed No) “Scn_y-XX” data are selected to show

6. RECOMMENDATIONS

6.1 Maintenance of the Database

R.1. Technical specifications

The GIS database was designed to obtain an open structure. The incorporation of external data in their original form or with reduced conversion requirements would maintain the flexibility of the database. Instead of building a giant database it is recommended to keep the “loose integration” of data allowing easy updates and upgrading or/and changing processing and application software.

R.2 Organizational issues and personnel

It is recommended that one organisation is appointed as a co-ordinating body that is in charge of the maintenance of the GIS database. The organisation should have a GIS department with trained GIS staff. It is suggested that their work is not limited to the maintenance of the database but they are also involved in application development (e.g. simulation modelling). Therefore, the GIS department should have at least one member who has experience not only in data processing but in application development and mathematical modelling as well.

6.2 Utilization of the Database

R.3 Application development

In addition to the significant amount of basic data and information, application tools (analysis and evaluation methods, simulation model, etc.) were developed. It is recommended that the tools are not only used but further developed. Moreover, it is suggested that the applications are tested and adapted/calibrated in other case study sites. To this end, more field acquisition is necessary.

R.4 Dissemination of information

It is recommended that data and information are openly shared among stakeholders and the general public. Taking into account copyright issues reports and summaries including the description details of the GIS database shall be published on the Internet for the interest of the general public. In addition, for the stakeholders and the scientific community the overall results and the GIS database should be available on request.