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30th December 1988.

Mr. B.K.Jayasundara

Mr. B.K.Jayasundara, is working in the Irrigation Department as a Senior Irrigation Engineer. I have known him personally for the last ten years. He has gained wide and varied professional experience in designs, construction, operation and maintenance of Irrigation Schemes.

During the last few years he was working under the Major Irrigation Project, namely the Kirindi Oya Irrigation and Settlement Project. Here he was directly responsible for the distribution of water for Irrigation, which included water scheduling, operation and monitoring of the system. He developed his own computer programme for water scheduling which was implemented.

He is very hard working and attends to what ever task assigned to him with deligence and care. He is well suited to follow a course in Hydraulics Engineering for which he has applied.

I wish him all sucess.

E.P.Wimalabandu
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APPLICATION OF LOTUS - 123 IN WATER MANAGEMENT IN KIRINDI OYA IRRIGATION & SETTLEMENT PROJECT

by

B.K. Jayasundera

1.0 Introduction

With the help of LOTUS-123, computer programmes were developed for the scheduling of irrigation and for the monitoring of the operation of the irrigation system.

This paper describes a package of programmes for the scheduling of irrigation of paddy. First a brief summary of the various aspects of the calculation of water requirements is given and thereafter the programmes are discussed in detail.

This programme package can be used for monitoring of water issues in Kirindi Oya Irrigation & Settlement Project (KOISP) as it has facilities to update irrigation schedules for actual rainfall, land preparation etc.

It takes about one minute to prepare rotational water issue schedules up to tract level (with FCC, DCC, BCC & MCC schedules) using the programmes.

These programmes can easily be adapted to other irrigation projects with simple changes. To make the programs user friendly MACRO commands were used.

2.0 Application of LOTUS - 123 for Water Management Work

Preparation of water issue schedules for paddy:-

Most crucial variables in irrigated paddy farming which are difficult to assess accurately, can be listed as follows:

1. Effective rainfall & Evapotranspiration
2. Soil types
3. Land preparation progress
4. Paddy varieties & growth period

2.1 Rainfall

In K.O.I.S.P. there are four existing rainfall stations namely Badagiriya, Weerawila, Tissa and Lunugamvehera. Rainfall records collected at above stations for a considerable period are available in the Hydrology Division of Irrigation Department.

When more accurate data are available at the three meteorological stations constructed in the irrigable area, the computer programmes can be used to update water issue schedules at any moment.

As there is a provision for the accommodation of the rainfall in the computer programmes, the water issue schedules can be prepared for zero rainfall, dependable rainfall or actual rainfall.

2.2 Evapotranspiration

In the absence of accurate ET values for the KOISP area, pan evaporation data at Angunakolapallassa Agricultural Research Station were used to compute 75% probability of non-exceedance ET values.

In future it is hoped that more accurate and up to date ET values would be availalbe from the 3 fully equipped meteorological stations that will soon come in to operation in KOISP area.

Mr. B.K. Jayasundera, BSc(Eng), CEng, MICE, MIE(SL), obtained BSc(Eng) in Civil Engineering from the University of Ceylon, Peradeniya in 1977.

He is a member of the Institution of Civil Engineers, London and the Institution of Engineers, Sri Lanka.

At present he is working as the Senior Irrigation Engineer in Kirindi Oya Irrigation and Settlement Project.

3.0 Soil Types

For irrigation purpose the soil types in KOISP can be generalized and grouped into two main categories namely, upland and lowland. Characteristics of these two types of soils pertaining to irrigation scheduling are described below.

The B.O.P.P. can be used to assess the upland and lowland area.

Percolation

Although the percolation is a variable with location, time, type of rotation ground water table etc., for simplicity constant percolation rate is assumed throughout the time. Assumed percolation for up and lowland soils are 6mm/day and 3mm/day respectively. When more accurate data are available, percolation can be revised easily in the computer programme.

4.0 The Calculation of Irrigation Requirements

Rotational water issues cannot be practiced successfully during land preparation period since the land preparation progress cannot be planned or predicted sufficiently accurately.

The progress of land preparations mainly depends on the timely availability of credit, farm power, seed paddy and other social factors which are beyond the control of Irrigation Department.

Therefore, continuous supply of water during the land preparation period is more practicable.

In "Kanna" meetings the period allowed for land preparation is generally taken as 4 weeks; the required period for an individual lot is about 2 weeks.

Land Preparation requirement for Paddy

Land preparation of paddy consist of two main activities :

1. Land Soaking
2. Puddling

The land soaking water requirement depends on the soil type, the initial soil moisture content and the effective rainfall and evapotranspiration.

The puddling requirement depends on the soil type, the effective rainfall, the ponding depth, the evapotranspiration and the percolation. Sometimes the ground water contribution due to rising of water table is also affecting water requirements for land soaking.

Therefore for a large project like KOISP, it is obvious that the actual water requirement for above activities cannot be assessed very accurately due to non uniform distribution of soil types and initial moisture content.

But as a practical approach by considering research study results published by Agricultural Institutions in Sri Lanka, total land preparation requirement can be generalized as follows:

Upland $\sim$300 mm
Lowland $\sim$200 mm

Other than the prediction of initial moisture content in soil, another major difficulty encountered in scheduling is to differentiate between land soaking and puddling requirements. Usually water application rate for land soaking is higher than for puddling (Ref Design of Irrigation Headworks for Small Catchments by Eng. A.J.P. Ponrajah).

Generally for one farm lot, the duration for each land soaking and puddling is about 7 days.

For upland & lowland soils, land soaking and puddling requirements can be generalized as follows :

Soil Type	Excluding percolation & Evapotranspiration		Including percolation & Evapotranspiration		
Soil Type	LS mm/day	Pud mm/day	LS mm	Pud mm	Total mm
Lowland	5	2	135-80	100-60	235-200
Upland	8	3.5	195-120	145-90	340-300

Land Preparation Progress

If we consider the progress of land preparation, progress in 1st week is usually low. The progress

comes to a peak in the 2nd week and in the 3rd week progress is again low.

By considering experience in other projects 3 unequal staggers of 20%, 60%, 20% with one week interval for each have been assumed for preparation of schedules.

The amount of issue at the start can be based on an assumed stagger. Then depending on the actual progress and rainfall, issues can be rescheduled using the computer programme.

Land preparation progress can be collected in a pilot area or FC wise and can be averaged up to tract level. Thus it can be used in the computer programme to reschedule the issue.

4.1 Irrigation Requirement during Land Preparation Period

For a particular O&M week, (at farm offtake level)

Irrigation requirement at farm turnout level
= [land soaking (or puddling) requirement + ET * factor + Percolation - Effective rainfall] / Application efficiency

4. 2 Irrigation Requirement during Crop Growth Stage

For a particular O&M week, (at farm offtake level)

Irrigation requirement at farm turnout level
= [ET * Crop factor + Percolation - Effective rainfall] / Application efficiency

5.0 Continuous Supply versus Rotational Supply

Although the continuous supply is easy in operation it consumes lot of water when compared with rotational supply. The rotational supply leads to erratic flow conditions and thereby complications in operation unless careful attention is paid on operation. It also may cause difficulties in operation if the demand varies rapidly. (ie. during land preparation period)

The rotational supply can be implemented after the land preparation is over since the water requirement does not vary rapidly during this period. Therefore to utilize the water resources effectively, rotational supply is implemented during the crop growth stage.

Rotational Water Issues

During the land preparation period water issues are continuous. Depending on the progress of land preparation, water issues can be rescheduled using the computer programme.

When the land preparation is over, the actual stagger approximately is known. By updating the actual stagger in the programme, the maximum crop-water requirements can be computed.

During water issues for crop growth FCC are rotated with a frequency of 7 days interval.

The crop-water requirement varies with the growth stage of the crop. For rotational supply two methods can be used. One is changing the period of supply of a FC, while keeping the discharge FC constant. Other is the changing the discharge while keeping the period of supply contant, by fixing an ON and OFF time for each FC. The latter method is more practicable and can be described as farmer friendly, as only one time table has to be supplied to each farmer leader or the issue labourer. In adopting this 12 hr or 24 hr period can be used for convenience, below the FC level for farmer to share water. If there is excess water that can be redistributed among more permeable lots.

Therefore the latter method (with variable discharge and fixed time table) is adopted in the computer programme.

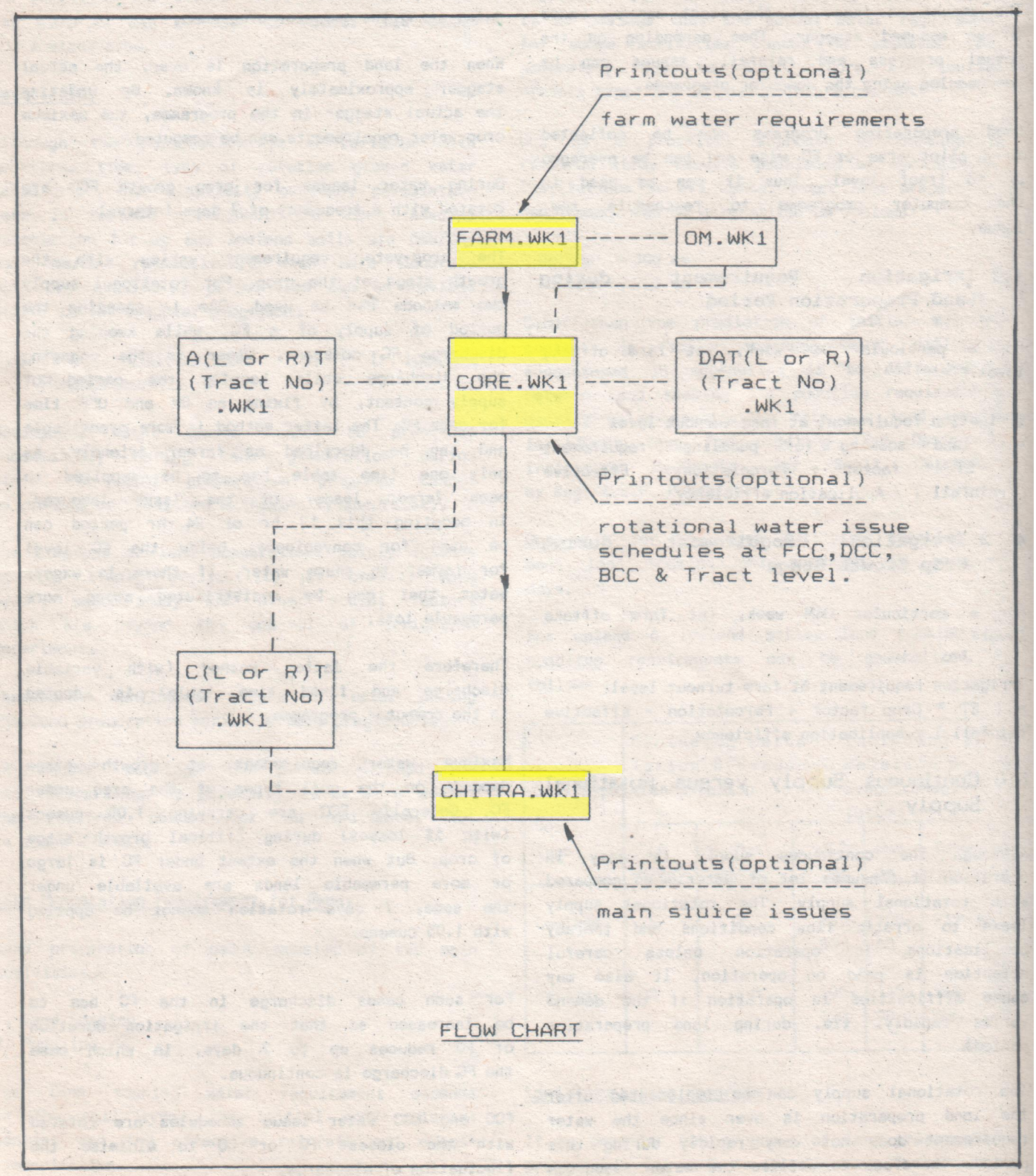
Maximum water requirement at growth stage depends on the soil types of the area under FC. Generally FCC are carrying 1.05 cusecs (with 5% losses) during critical growth stage of crop. But when the extent under FC is large or more permeable lands are available under the same, 7 days rotation cannot be applied with 1.05 cusecs.

For such cases discharge in the FC has to be increased so that the irrigation duration of FC reduces up to 7 days, in which case the FC discharge is continuous.

FCC and DCC water issue schedules are rotated with the closest FC or DC to minimise the fluctuation of discharge.

Schedules at FCC level are aggregated and corrected for losses in DCC to obtain the schedules at DC & BC level. From farm level to BC or DC level losses are incorporated into the discharge in terms of efficiency (i.e. turnout application eff 70% conveyance eff of FC=95%, DC=95%, BC=95%). Those efficiencies can be changed easily in the program if necessary.

Above process is executed automatically when the computer programme is running.



FLOW CHART

The DC & BC level discharges are aggregated to obtain the discharge at Tract level.

Since most of the time the main canals are kept at Full Supply Depth (FSD), losses are more or less constant. Finally water issue schedules at Tract level are combined with main canal losses to obtain the schedules at main sluice.

Detail description of the computer programmes are included in the later chapters.

6.0 Computer programmes for preparation of water issue schedules

6.1 General

Language used - Lotus-123 with macro-programming.

Seven types of spread sheets with three main spread sheets are used for programming.

Programming involved mainly for the following.

1. computation of crop water requirement at farm turnout level on weekly basis (l/s/ha)
2. computation of rotational water issue schedules for each FC
3. Aggregating FCC requirements to obtain DC, BC and Tract level water requirements.
4. Aggregating Tract water requirements to obtain sluice issues.

Aggregation, revision, updating, printing accessing of each spread sheets are executed using macro-programmes (automatically when the prompts are answered). Above process can be combing files, revision etc.) done manually also.

Following spread sheets are involved in preparation of water issue schedules.

Spread Sheet	Description
(1) FARM.WK1	The first file to be retrieved for preparation of water issue schedules. Water requirements at farm level for upland and lowland are calculated in the sheet . The maximum farm water requirements at growth stage, the O&M week No for scheduling is required and relevant Irrigation factors are saved in work sheet "OM" to be used later in sheet "CORE" Menu can be accessed by pressing <ALT><M>. Variables can be revised using the menu or manually. Programme CORE is accessed when AUTO is activated in the menu. No of Work Sheets 1
(2) OM.WK1	Crop-water requirements calculated in 'FARM' pertaining to the preparation of rotational schedules are saved in this work sheet. Later this data are used in work sheet CORE. OM work sheet is created or revised through "FARM". This can be revised even manually. No of Work Sheets 1

(3) DAT (L or R) Tract No.WK1

For each tract of LB and RB there is a seperate spread sheet with FC Nos Tracts, DC, BC details & upland, lowland acreages. These work sheets can be revised manually. Later these spread sheets are combined with program "CORE" to prepare rotational schedule for FCC.

(4) A (L or R) T Tract No.WK1

The rotational water issue schedules for FCC are aggregated tractwise to obtain water issue schedules for DCC, BCC and at Tract levelwhen this work sheet is combined with programme CORE.For each Tract there is a seperate spread sheet.

(5) CORE.WK1

Is the main programme for preparation of rotational water issue schedules. This programme can be assessed through "FARM" or seperately. This work sheet combines data from"OM" "DAT (L or R) Tract No", "A (L or R)T Tract No" to compute rotational schedules at FC,DC, & Tract levels. Then the total issues at tract level are saved in C (L or R) T (Tract No), to be used later in CHITRA for computation of sluice issues.

(6) C (L or R) T (Tract No).WK1

These spread sheets contain the water requirements per each day for a particular week at tract level. Contents in these spread sheets are automatically created through the programme CORE. Later these spread sheets are combined with programme CHITRA to compute water requirements at sluice level.

(7) CHITRA.WK1

This spread sheet computes water requirement at sluice (including main canal losses) using spread sheets C (L or R) T (Tract No). Menu is displayed when the programme is loaded. Menu can also be accessed seperately by pressing <ALT><M>. Programme FARM can be assessed through CHITRA.

A detailed description of these programs is presented in the following chapters.

6.2 Computer programme for Computation of Farm Water Requirement FARM.WK1

Lotus 123

Variables

1. Starting O&M week for land preparation (O&M week 1 = 1st week in Oct)
2. 3 staggers, duration = 1 week, spacing = 1 week (Stagger 1, Stagger 2, & Stagger 3)
3. Farm turnout application efficiency
4. Land soaking requirement
5. Puddling requirement
6. Percolation rate
7. Crop factors (for 3-3.5 & 4-4.5 months varieties)
8. Evapotranspiration & effective rainfall.

Revision of above factors in the spread sheet can be done by entering the new value when the curser is at the appropriate cell. The work sheet is globaly protected but the cells with variables are unprotected.

Most of the variables can be revised using the menu. The menu was created using macro programming. When ALT M is pressed the menu is displayed. Then on the pannel Yala, Maha, Stagger, Variety Auto, Print, Quit is displayed.

By using → ← keys and pressing Enter ↵ key when the required operation is highlighted, the macro programme can be executed.

If the farm water requirement is to be calculated for Maha season, highlight "Maha" and press the Enter key. Then on the pannel "starting O&M" is displayed. Then enter the starting O&M week of land preparation. ET (75% prob ET) for every O&M week is stored at the bottom of the spread sheet. Depending on the selected O&M week ET data are then copied to the appropriate rows of the calculation tables of upland and lowland respectively.

The starting O&M week for land preparation can be changed only up to 5 weeks beginning from Maha or Yala through macro. If the starting week is beyond the above limit copying of ET data to the appropriate row can easily be done manually using /C Range (Enter) cell.

After copying the ET values using the macro, the pannel menu is displayed again. Then the stagger or the paddy variety can be revised similarly. If a printout of results is needed "Print" in the menu has to be executed.

For upland & lowland soils maximum crop water requirements are stored in cell No. F 48 & G 48 respectively. Upland and lowland irrigation factors for a particular O&M week (stored in B 44) are stored in F 45 & G 45 respectively. When "Auto" is executed in the menu, macro programme waits for entering the particular O&M week for the scheduling is required. Then contents in F 44 to G 48 (Irrigation factors and max crop water requirements) are saved in spread sheet "OM" and programme CORE is retrieved.

Water issue factor or Irrigation factor is defined as below :

Water issue factors (for O&M week No n)

$$= \frac{\text{farm water requirement (l/s/ha) (for O\&M week No n)}}{\text{maximum water requirement during crop growth period}}$$

In the spread sheet "FARM" water issue factors for each O&M week is automatically calculated.

Since the effective rainfall is also a variable in the spread sheet it can be included as expected rainfall or the farm water requirements can be revised according to actual effective rainfall. (weekly).

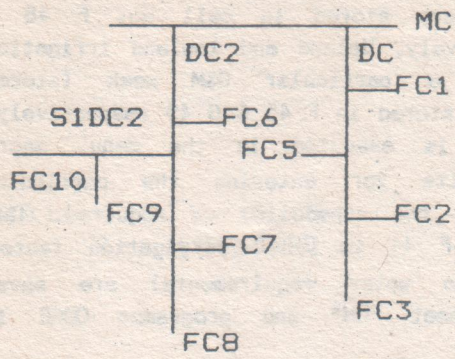
6.3 DAT (L or R) Tract No. WK1

This work sheet contains canal names (FC, SDC, DC, BC etc) and upland and lowland acrages under each FC.

For each tract there is a separate spread sheet of this type with above canal data.

The FCC & DCC are rotated with the closest FC or DC to minimize the fluctuation of discharges. For the same reason all the FCC & DCC are listed according to the chainage in the issue tree. Then the relevant upland & lowland acrages are listed in successive columns. These data files can be edited manually.

An example of a work sheet is shown below.



Issue Tree

	A	B	C
1	Tr,DC,FC	Upland	Lowland
2	$MC_1D_1F_1$	10	20
3	F5		40
4	F2	30	5
5	F3	5	20
6	D_2F_6	15	15
7	$S_1D_2F_9$	20	20
8	F10	10	15
9	D_2F_7	20	5
10	F8	12	13

Worksheet

When programme CORE is executed this work sheet combines with CORE to calculate schedules at FC level.

6.4 A (L or R) T Tract No. WK1

There are separate work sheets for each tract. This sheet computers rotational water issue schedules for DC, BC & Tract level when it is combined with programme CORE.

In this worksheet from Column A to T are empty. In column u efficiencies of the DC or BC are stored.

From Column V to AB cell formulae are stored in the appropriate rows where the DC SDC & BC are stored in the main CORE programme.

After the programme CORE is combined with DAT (L or R) Tract No. to obtain the schedules at DC, SDC, BC & Tract level. When it is combined using cell formula in Column V through AB & FC discharges in Column n to T in the previously combine files it computes schedules at DC, SDC, BC & Tr level.

This work sheet can be edited manually.

6.5 CORE.WK1

This is the most important programme for preparation of water issue schedules.

Column D to G & I are not displayed as those are not important for printing. First 3 columns are reserved for FC & DC Data (ie. FC or DC No, upland acreage & lowland acreage).

When this spread sheet combines with DAT (L or R) Tract No.WK1 data in DAT file are stored into the first 3 columns. Using this data and cell formula in column D to T is used to prepare schedule at FC level.

CORE programme can be accessed separately or through FARM.

When it is accessed through FARM data in FARM is stored in Sheet "OM". Then menu No 1 is displayed.

When the menu No. 1 is executed on the panel IFact, Crop, Go, Auto, Return are displayed.

Since CORE is accessed through FARM, "Auto" can be activated to use the stored Data in OM file to revise IFact and Crop automatically.

In the programme CORE these data are stored in cell No AC58 to AD61. Later these data are used in Column E to compute discharges in FCC.

Instead of using "Auto", for revision of contents in AC58 to AD61 "IFact" and "Crop" can be used in the menu.

After revising the Irrigation factors and max. crop water requirements, "GO" can be activated from the menu to access menu No. 2 in which the tract selection is done. Then on the pannel, LbTr1, LbTr2, RbTr1, RbTr2, RbTr5, Print, Quit, Sluice are displayed. Respective Tract No. can be activated to obtain the required schedule. When the schedule is calculated by activating "Print" in the menu, printout can be obtained.
After computing schedules for each tract, discharge at sluice level can be obtained by activating "sluice" in the menu and accessing work sheet CHITRA. It will take about 1 minute to compute water issue schedule for each tract. If the cultivation will not take place in certain canals, after computing the schedule respective acreages under particular canals can simply be erased in the spread sheet by using Range Erase Command to obtain the actual schedule.

In the column D of the CORE programme time taken for irrigation in each FC is calculated using the data in column B & C (Upland & Lowland areas).

Eg: Calculation of Total Time for Irrigation in FC.

FC No MC1, D1, F1 ,upland - 10 Acs, Lowland 20 Acs.

max crop-water requirement for upland = 1.82 l/s/ha
(stored in cell No AC61)
max crop-water requirement for lowland= 1.32 l/s/ha
(stored in cell No AD61)

FC discharge at Farm Level - 1 cusec

Time take t days = (10x1.82+20x1.32)x k conversion factor
= 4.46 days

Cell formula in D2

(B2 x .1 x AC61 + C2 x .1 x AD61)

which gives the same results

Column E

If the scheduling is done for the period other than for the max growth period,
discharge is FC
(when the total irrigation time for FC is less than 7 days)

$$Q = \frac{1.05\,[upa \times upIf \times upf + La \times LIf \times Lf]}{[upa \times upf + La \times Lf]}$$

upa - upland acrage
La - lowland acrage
upa - upland I fact
La - lowland I fact
upf - upland max farm water requirement
Lf - lowland max farm water requirement

When the total irrigation time for FC is greater than 7 days to reduce the time up to 7 days discharge in the FC is increased.

Suppose the increased discharge is i cusecs
by volume balancing

$$7 \times i = t \times Q$$

$$\therefore i = \frac{t \times Q}{7}$$

Column F to H are involved in adjustment of rotational time to 7 days when it exceeds 7 days & rounding off the time.

When the decimal part is between 0.6 to 0.2 ~ 0.5

When the decimal part is larger than 0.6 ~ 1

Column I to M

Depending on the adjusted rotational time for each FC, rotational time table is computed and the (gate on & off) time table is displayed.

Column N to T

Rotational time table is displayed in bar chart form for each day in the week starting from monday (monday = 1). For more details about cell formulate refer annexure.

Column u

Conveyance efficiencies of the DC, SDC & BC are stored

Column V to AB

Rotational time table for each DC, SDC BC, Tract is computed and displayed.

Cell formula varying for each Tract. These cell Formulas are included in "A (L or R) T Tract No" which combines later with "CORE".

6.6 CHITRA.WK1

This spread sheet combines tract water requirements daily on weekly basis to obtain the sluice issues. Since the FSD is maintained in the main canals, constant losses are included tractwise in the spread sheet. However, those losses can be edited easily.

This work sheet can be accessed through "CORE" or separately. The programme is provided with automatic macro. By pressing <ALT><M> also the menu can be accessed.

From "CHITRA", "FARM" also can be accessed.

Through the macro, adding up tract requirements to obtain RB & LB sluice issues, printing results and retrieving FARM can be executed. For the time being adding up to Phase I or KOISP is provided. Later it can be easily changed to obtain Phase II requirements also.

6.7 System Selection

6.7.1 Hard Dick System

The programmes in the annexure were prepared for a hard disk system.

Setting the system for everyday use.

First make a sub directory called "123" under the "ROOT" directory using "md" command. Then make another sub directory called "SCH" under the sub directory "123". Then copy all scheduling programmes to sub directory "SCH".

All system files of LOTUS-123 should be copied to sub directory "123" and change the drive settings in the LOTUS-123 to C: 123.

Advantages in using a hard disk system are fast in operation and large storage capacity to store data.

6.7.2 Floppy System

The MACROS in the programmes have to be changed to suit the floppy system as follows.

The set of characters "(ESC)123 SCH " in MACRO statements at following cell locations have to be deleted. (ref. the annexure for cell formulae)

Programme	Cell locations
FARM.WK1	AB16,AB17
CORE.WK1	AD8 to AH8 AH40 to AK7 AD10 to AH10 AD11 to AH11
CHITRA.WK1	S6,07,P7,09 P9,P11

END

1988/1989 MAHA

Effective Rain mm/day	0																		
stagger s1,s2,s3	20	60	20																
3-3.5 months veraity																			
Application Eff%	70																		
Crop factor LOWLAND	1	1	1	1.05	1.1	1.1	1.15	1.2	1.2	1.2	1.2	1.15	1.15	1.1	0.8				
Nett Soil sat req mm/day	5																		
Nett pudd req mm/day	2																		
Percolation mm/day	3																		
O&M week no	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ETP mm/day	5.2	5	4.7	4.3	4	3.7	3.5	3.4	3.5	3.6	3.7	3.9	4.2	4.4	4.6	4.9	5.1	5.2	5.4
gross FIR for stag 1	0.43	0.33	0.25	0.24	0.24	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.22	0	0	0	0
gross FIR for stag 2		1.29	0.96	0.72	0.71	0.70	0.68	0.68	0.71	0.72	0.73	0.76	0.77	0.80	0.80	0.68	0	0	0
gross FIR for stag 3			0.42	0.30	0.23	0.22	0.22	0.22	0.23	0.24	0.24	0.25	0.26	0.26	0.27	0.27	0.23	0	0
Total requirment l/s/ha	0.44	1.62	1.64	1.28	1.19	1.17	1.14	1.15	1.19	1.21	1.23	1.27	1.3	1.33	1.3	0.97	0.23	0	0
Water Issue Factor	0.33	1.22	1.23	0.96	0.89	0.88	0.86	0.86	0.89	0.91	0.92	0.95	0.98	1	0.98	0.73	0.17	0	0

UPLAND

Crop factor UPLAND	1	1	1	1.05	1.1	1.1	1.15	1.2	1.2	1.2	1.2	1.15	1.15	1.1	0.8				
Nett Soil sat req mm/day	8																		
Nett pudd req mm/day	3.5																		
Percolation mm/day	6																		
O&M week no	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ETP mm/day	5.2	5	4.7	4.3	4	3.7	3.5	3.4	3.5	3.6	3.7	3.9	4.2	4.4	4.6	4.9	5.1	5.2	5.4
gross FIR for stag 1	0.63	0.48	0.35	0.34	0.34	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.35	0.35	0.32	0	0	0	0
gross FIR for stag 2		1.88	1.41	1.02	1.01	1.00	0.97	0.98	1.01	1.02	1.03	1.06	1.07	1.09	1.09	0.98	0	0	0
gross FIR for stag 3			0.61	0.45	0.33	0.32	0.32	0.32	0.33	0.34	0.34	0.35	0.36	0.36	0.37	0.37	0.33	0	0
Total requirment l/s/ha	0.64	2.37	2.39	1.83	1.69	1.66	1.64	1.64	1.68	1.71	1.73	1.76	1.8	1.83	1.79	1.36	0.33	0	0
Water Issue Factor	0.35	1.3	1.31	1	0.92	0.91	0.9	0.9	0.92	0.93	0.95	0.96	0.98	1	0.98	0.74	0.18	0	0

Eng B.K.Jayasundera

25-May-89

01:47 PM

Results of FARM. WK$_1$

Tr,DC,FC	Upland acs	Lowland acs	Adjusted time	Open Days	Open Day	Open Time	Close day	Close Time	MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7	Ef	MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7
L,tr1s1,d1,f1		35	5	1	6am	6	6am	1.05	1.05	1.05	1.05	1.05	0	0	0.95	8.34	7.79	7.79	7.79	7.79	7.79	7.79
f9		30	4	6	6am	3	6am	1.05	1.05	0	0	0	1.05	1.05	0.95								
f8		32.5	4.5	3	6am	7	6pm	0	0	1.05	1.05	1.05	1.05	0.52	0.95								
f2	27.5		5	7	6pm	5	6pm	1.05	1.05	1.05	1.05	0.52	0	0.52	0.95								
f3	20		4	5	6pm	2	6pm	1.05	0.52	0	0	0.52	1.05	1.05	0.95								
f7		55	7	2	6pm	2	6pm	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.95								
f6		47.5	6.5	2	6pm	2	6am	1.05	0.52	1.05	1.05	1.05	1.05	1.05	0.95								
f4	25	12.5	6.5	2	6am	1	6pm	0.52	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
f5		52.5	7	1	6pm	1	6pm	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
d1,f1		50	7	1	6pm	1	6pm	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
f2		47.5	6.5	1	6pm	1	6am	0.52	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
f3		44	6	1	6am	7	6am	1.05	1.05	1.05	1.05	1.05	1.05	0	0.95								
f4		45	6	7	6am	6	6am	1.05	1.05	1.05	1.05	1.05	0	1.05	0.95								
f5		22.5	3	6	6am	2	6am	1.05	0	0	0	0	1.05	1.05	0.95	13.7	12.6	12.6	12.6	12.6	12.6	12.6
m,f11		47.5	6.5	2	6am	1	6pm	0.52	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
d2,f12		42.5	6	1	6pm	7	6pm	0.52	1.05	1.05	1.05	1.05	1.05	0.52	0.95	2.76	3.32	3.32	3.32	2.21	2.21	2.21
f13		42.5	6	7	6pm	6	6pm	1.05	1.05	1.05	1.05	1.05	0.52	0.52	0.95								
f14		40	5.5	6	6pm	5	6am	1.05	1.05	1.05	1.05	0	0.52	1.05	0.95								
d3,f15		30	4	5	6am	2	6am	1.05	0	0	0	1.05	1.05	1.05	0.95	4.97	4.42	4.42	4.42	5.53	5.53	5.53
f20		22.5	3	2	6am	5	6am	0	1.05	1.05	1.05	0	0	0	0.95								
f19		30	4	5	6am	2	6am	1.05	0	0	0	1.05	1.05	1.05	0.95								
f16		47.5	6.5	2	6am	1	6pm	0.52	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
f18		52.5	7	1	6pm	1	6pm	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
f17		52.5	7	1	6pm	1	6pm	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
m,f21		52.5	7	1	6pm	1	6pm	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.95								
d4,f22		52.5	7	1	6pm	1	6pm	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.95	4.97	5.53	5.53	4.97	4.42	4.42	4.42
f23		25	3.5	1	6pm	5	6am	0.52	1.05	1.05	1.05	0	0	0	0.95								
f29		12.5	2	5	6am	7	6am	0	0	0	0	1.05	1.05	0	0.95								
f28		25	3.5	7	6am	3	6pm	1.05	1.05	0.52	0	0	0	1.05	0.95								
f27		37.5	5	3	6pm	1	6pm	0.52	0	0.52	1.05	1.05	1.05	1.05	0.95								
f24		20	3	1	6pm	4	6pm	0.52	1.05	1.05	0.52	0	0	0	0.95								
f26		35	5	4	6pm	2	6pm	1.05	0.52	0	0.52	1.05	1.05	1.05	0.95								
f25		15	2	2	6pm	4	6pm	0	0.52	1.05	0.52	0	0	0	0.95								
d5,f30		30	4	4	6pm	1	6pm	0.52	0	0	0	0.52	1.05	1.05	0.95	2.21	2.21	2.21	2.76	3.32	3.32	2.21
f33		22.5	3	1	6pm	4	6pm	0.52	1.05	1.05	0.52	0	0	0	0.95								
f32		30	4	4	6pm	1	6pm	0.52	0	0	0.52	1.05	1.05	1.05	0.95								
f31		40	5.5	1	6pm	7	6am	0.52	1.05	1.05	1.05	1.05	1.05	0	0.95								
d6,f34		30	4	7	6am	4	6am	1.05	1.05	1.05	0	0	0	1.05	0.95	2.21	2.21	2.21	2.21	1.11	1.11	2.21
f35		27.5	4	4	6am	1	6am	0	0	0	1.05	1.05	1.05	1.05	0.95								
f36		30	4	1	6am	5	6am	1.05	1.05	1.05	1.05	0	0	0	0.95								
d7,f57	16	14	5	5	6am	3	6am	1.05	1.05	0	0	1.05	1.05	1.05	0.95	13.6	13.6	13.7	13.1	13.7	13.7	13.6
f56	15	5	3.5	3	6am	6	6pm	0	0	1.05	1.05	1.05	0.52	0	0.95								
f55	16.75	3.25	3.5	6	6pm	3	6am	1.05	1.05	0	0	0	0.52	1.05	0.95								
d7,s1d7,f54	19.25	5.75	4.5	3	6am	7	6pm	0	0	1.05	1.05	1.05	1.05	0.52	0.95	2.21	2.21	3.32	3.32	3.32	3.32	3.32
f51	28.25	1.75	5.5	7	6pm	6	6am	1.05	1.05	1.05	1.05	1.05	0	0.52	0.95								
f53	16.5	6	4	6	6am	3	6am	1.05	1.05	0	0	0	1.05	1.05	0.95								
f52	24	3.5	5	3	6am	1	6am	0	0	1.05	1.05	1.05	1.05	1.05	0.95								
d7,s2d7,f47	27.75	4.75	6	1	6am	7	6am	1.05	1.05	1.05	1.05	1.05	1.05	0	0.95	2.26	2.26	2.26	2.26	2.26	2.26	1.16
f50	33	9.5	7	7	6am	7	6am	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.95								
d7,f46	15		3	7	6am	3	6am	1.05	1.05	0	0	0	0	1.05	0.95								
d7,s3d7,f42	12.5		2.5	3	6am	5	6pm	0	0	1.05	1.05	0.52	0	0	0.95	2.21	2.21	2.76	2.21	2.21	2.21	2.21
f45	26.5	1	5	5	6pm	3	6pm	1.05	1.05	0.52	0	0.52	1.05	1.05	0.95								
f43	11	4	2.5	3	6pm	6	6am	0	0	0.52	1.05	1.05	0	0	0.95								
f44	17.75	9.75	4.5	6	6am	3	6pm	1.05	1.05	0.52	0	0	1.05	1.05	0.95								
d7,f41	24.5	5.5	5.5	3	6pm	2	6am	1.05	0	0.52	1.05	1.05	1.05	1.05	0.95								
f40	22.75	2.25	4.5	2	6am	6	6pm	0	1.05	1.05	1.05	1.05	0.52	0	0.95								
f39	22.5	15	6	6	6pm	5	6pm	1.05	1.05	1.05	1.05	0.52	0.52	1.05	0.95								
f38	21	16.5	6	5	6pm	4	6pm	1.05	1.05	1.05	0.52	0.52	1.05	1.05	0.95								
Total			0	4	6pm	4	6pm	0	0	0	0	0	0	0		46.1	46.0	46.1	45.5	45.0	45.0	44.9

Results of CORE. WK 1