PARTICIPATORY IRRIGATION MANAGEMENT IN KIRINDI OYA IRRIGATION AND SETTLEMENT PROJECT

Wijesundara. Mudiyanselage. Gunawardana. Banda. Giragama[1]

ABSTRACT

The Kirindi Oya Irrigation and Settlement Project (KOISP) located in the southeast quadrant of Sri Lanka was completed in 1986 and during the same year, water issues commenced. The KOISP consists the old Ellegala Irrigation System (EIS) Project area (4,090 ha) and New Irrigation System (NIS) area (5,340 ha). Water management in this project is performed in four levels: main canal handled by the Irrigation Department (ID), secondary canal by Distributary Channel Organization (DCO), tertiary canals by Farmer Organizations (FOs) and field level canals by individual farmers. Up to 1990, the old EIS and the NIS were managed as two separate entities. During 1990, these were formed into a single Project Management Committee (PMC) and the ID with the assistance of IWMI prepared the seasonal operational plans for both seasons with much consultation and communication between and among the stakeholders. The drainage flow to the sea from the EIS and NIS has reduced considerably due to this water management practice. The successful completion of 1999 *yala* cultivation was due to the participatory irrigation management system offered by the officers, DCO leaders and FO representatives. Due to high participation of the EIS the farmers got less number of dry days and they reported that more than 71% adequate water delivery was available in all crop growing stages. Further they obtained high yields ranging from 3.9 to 7.7 ton/ha. The farmers in the RB of NIS reported 24% and 10% adequate water supply in booting stage and flowering stage respectively and they obtained less yields ranging from 0.6 to 3.2 ton/ha.

1. INTRODUCTION

Sri Lanka a tropical country, which lies between 6^0 and 10^0 N latitude and between 80^0 - 82^0 E longitude has an extent of about 65,610 square kilometers. It is an island in the Indian Ocean, and a predominantly rural, agro based economy with few industries and with a limited population. Integrated Water Resources Management was not a pressing issue. Demand for water in every economic sphere is increasing with an unhealthy competition resulting in an unregulated exploitation and threatening the degradation of

1- Research Fellow and Head/Irrigation Water Management and Agrarian Relations Division
Hector Kobbekaduwa Agrarian Research and Training Institute
P.O. Box 1522, Colombo 7, Sri Lanka. Email: hartiiar@sltnet.lk, gbgiragama@yahoo.com

quantity and quality and depletion of a resource. With the transformation of the agrarian society into an urban society, the main issue that the water sector is faced with is to meet the growing sectoral water demands such as domestic, industrial, irrigation agriculture and hydropower.

The overall objective of the National Water Resource Management Policy is to encourage integrated water resources development and management, to ensure that the national water resources are conserved and efficiently and equitably allocated among all stakeholders to meet socio economic and environmental need of the present and future generation (Draft National Water Resource Management Policy, 2006).

Based on water resources issues and management needs, the recommendation of the institution responsible for water resource management areas should be declared. Comprehensive sustainable water resource management plans need to be formulated through identification of distinctive characteristics specific to different zones and areas.

National Water Resource Management Policy (2006) states that the system of water allocation will be based on a participatory decision making process, represented by all stakeholders with technical input on optimal operation for meeting anticipated seasonal and multi- seasonal water demands for various regions and sectors, and the environment. It also states that the allocation of water among different users will be in accordance with the water resource management plans prepared for the each river basin region, river basin or aquifer.

In Sri Lanka, the southeast quadrant received less rainfall than other dry zone areas and the Kirindi Oya is located in this quadrant. The upper part of the Kirindi Oya basin is mountainous with a fewer number of settlements. The lower part consists mainly of agricultural lands under major, medium and minor irrigation systems and rain-fed farming systems. KOISP is in Tissamaharama Electorate, Lunugamwehera Divisional Secretary Division Hambantota District. This basin is narrow and extends from Bandarawela at 1900 m. MSL to a distance of 120 Km. to the sea at Kirinda.

The total drainage area is 1,178 sq. kms. And the catchment area at Kirindi Oya reservoir site is 909 sq. kms. Thin forests and scrub jungle are found between 600 m to 1,900m. elevations, which comprise 19% of the catchment. The catchment terrain can be divided into a steep section from 1,900 m MSL to 180 m MSL and thereafter a flat plain extending 50 Kilometers from Wellawaya to the dam site at Lunugamwehera. Presently this area receives less than 1,500 mm of annual rainfall which is not favourable for rain fed agriculture.

In late 1980's, after bidding adieu to their relatives in their home towns, more than 5,000 families aimed from various parts of the country to settle under KOISP with great expectations of a comfortable life. However, these expectations became a distant dream as the inflow to the Lunugamwehera Reservoir was far below the expected level, high percolation rates of soils in the command area persisted and cultivation of traditional paddy in lands were suitable only for other food crops.

Various other solutions were proposed for the water shortage problem of the farmers who were settled under the new system of KOISP and they endured great difficulties during last two decades.

The Kirindi Oya Irrigation and Settlement Project (KOISP) includes the old Ellegala Irrigation System (EIS) Project area (4,090 ha) and New Irrigation System (NIS) area (5,340 ha). The main component of KOISP was Lunugamwehera reservoir and the main two canals which were completed in 1986 and water issues commenced from 1986 Y*ala* season (April to August). Annual rainfall was 1,152 mm and it spread during Y*ala* season (380 mm) and *Maha* season (September to March - 810 mm). Reference Crop potential evapotranspiration is 2,000 mm. Average inflow to Lunugamwehera reservoir was 392, 315, 290 and 279 MCM during the years of 1977, 1986, 1994 and 2000 respectively (IWMI 2001). It showed that the inflow reduced from 392 to 279 MCM during 1977 -1999 period. Hence, water scarcity was the main problem here.

Water management in this project was performed in four levels. Those are the main canal handled by the Irrigation Department (ID), secondary canal by Distributary Channel Organization (DCO), tertiary canals by Farmer Organizations (FOs) and field level by individual farmers. From the commencement of the KOISP in 1986 and until 1990, the old EIS and the NIS were managed as two separate entities by the Irrigation Department (ID) without much consultation and communication between and among the stakeholders. Prior to 1991, seasonal allocation decisions in Kirindi Oya were generally taken in a Project Management Committee (PMC) meeting presided over by the Government Agent (GA). Under the Integrated Management of Major Irrigation Systems (INMAS) programme, farmers were grouped on the basis of hydrologically based organizations. These organizations select farmer representatives who sit with officials from relevant agencies, including the ID, on joint management committees that make seasonal allocation decisions and resolve various problems. The top-level joint committee is the PMC and is chaired by the Project Manager from the Irrigation Management Division (IMD). The INMAS advocates the establishment of a pyramidal committee structure operating on three tiers; FOs, DCOs, and the PMC. In the case of Kirindi Oya, a single PMC was constituted in 1990 by combining the PMCs of the old EIS and NIS. In light of participatory irrigation system management, PMC is the legitimate decision making body for seasonal allocations (IWMI 2001).

After the formation of a single Project Management Committee (PMC) in 1990, the ID with the assistance of IWMI prepared seasonal operational plans for both *yala* and *maha* seasons, taking into account the storage in Lunugamwehera reservoir and the five EIS tanks at the time of planning (generally November 1), expected 75% percent probable inflow to reservoir and the zoning of the NIS with priority order to receive water and commence the *Maha* cultivation in stage level. This zoning procedure was necessary because of the inadequate water inflow into the Lunugamwehera reservoir.

According to PMC decision the water allocation in 1999 to new area of left bank (LB), right bank (RB) and old area was 39.996, 57.320 and 57.19 MCM respectively. The drainage flow to sea from the EIS and NIS has considerably reduced due to this water management practice. Farmers became more disciplined in receiving water and using it effectively due to the higher management effort of DCO leaders and field channel representatives. The re-use of drainage water has considerably increased due to this method during both 1999 and 2000 *Yala*. The successful completion of 1999 *Yala* was due to participatory irrigation management of lower level of ID field officers, DCO leaders and FO representatives.

The KOISP planned to augment irrigation water supplies for the existing irrigation systems of Ellegala and Badagiriya which cover 4,500 ha. Besides, the project intended to provide irrigation facilities through the Right Bank and the Left Bank Main Canals from the newly constructed Lunugamvehera reservoir for an additional area of 8,400 ha. (IWMI 1995). The annual projected paddy production for KOISP was set at 44,000 mt. During 1993 the actual production amounted to 41,000 mt. (IWMI 1995).

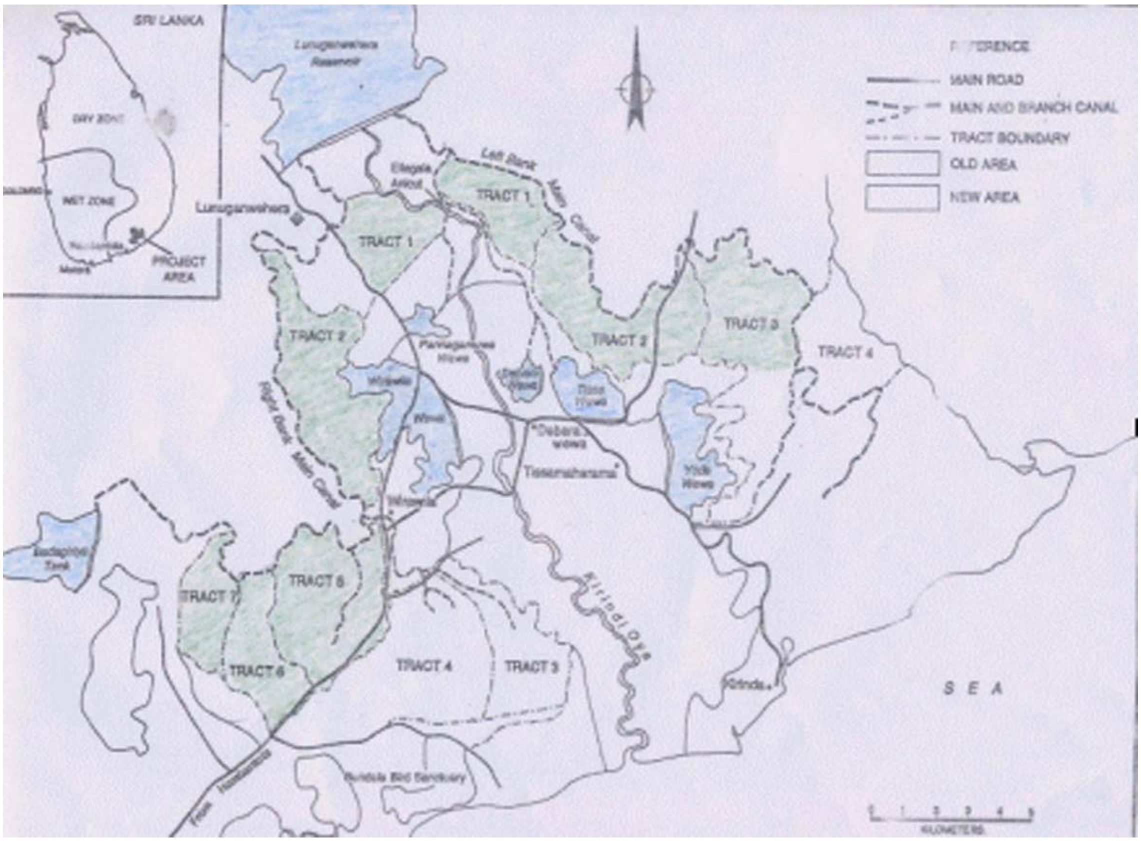


Figure 1. Map of KOISP

The rural Deevelopment society dominates among the extraneously- initial organizations in both NIA and OIA. However, the OIA as the more stabilized community reported higher settler membership as well as awareness of the organizations. (Gamage et at 1988). Many organizations in the OIA were more established with higher membership. In the NIA settler organizations have not established themselves as yet, their emergence uptro Yala 1986 indicates that systematic development of a community sense was underway in NIA (Gamage et at 1988).

PADDY PRODUCTION

Paddy yield in the old area at 6.5 mt/ha in 1985/86, this was 6% below the national average 96.8 mt/ha). Hoowever and new irrigated area yield was 2.4 mt/ha in yala 1986.

METHODOLOGY

DATA COLLECTION

Several methods were adopted for colleting the required data for this paper**.** Reservoir outflow data and meteorological data were collected from the Department of Irrigation and secondary data are presently available. The drainage data of command area and time series of monthly inflow data to Lunugamwehera reservoir were obtained from the IWMI database which were mentioned in HARTI publications and data for other information collected at the IWMI/HARTI collaborative study in 2003. The minutes of the PMCs and IWMI publications were perused to find out the decisions made at different stages of planning during and before the crop growing season. The author collected some field data and information from DCO leaders agencies involved in operating and managing the system and farmers. Additional information was ascertained through a questionnaire which was pre-tested and refined. The questionnaire survey conducted in year 2003 with a sample of 220 households in 11 villages of in Kirindi Oya Basin. The farmers' answers to the questionnaire were analyzed and the results of the farmers perceptions and their views were discussed with the system-operating agency to authenticate the veracity of the farmers responses.

Relationship between monthly rainfall and inflow of the KOISP was analyzed using simple regression analysis. Data used for the analysis compare of 1991, 1992, 1997, 1998 and 1999 years.

RESULTS

Based on the questionnaire survey in Kirindi Oya Basin, male and female population is indicated in the Table 1. This shows that the male population is 52.3% and female population is 47.7%. According to that, more male population in both age groups and that is a positive situation considering heavy labour requirements for agriculture.

Table 1: Number and percentage of households classified by age and sex

Unit	Age range	Male		Female	
		No.	%	No.	%
Kirindi Oya Basin	<18 Years	172	49.6	175	50.4
	Years 18<	371	53.6	321	46.4
	Total	543	52.3	496	47.7

Survey data 2003

Distribution of family members according to their marital status is shown in Table 2. Married percent age is 63.4%, and this can be construed that their mental conditions are helpful for participatory activities. Percentage of unmarried is 31.4% in the sample. This poses a drawback for participatory activities and agricultural production.

Table 2: Distribution of family members according to their marital status

(Age 18 years and above)

Marital status	**No.**	**%**
Unmarried	222	31.4
Married	449	63.4
Divorced	4	0.6
Widowed	30	4.2
Other	3	0.4
Total	708	100

Survey data 2003

The people of Kirindi Oya have to travel a distance of about 0.6 km to draw water during the season. Mean distance travel for water during off season in the Kirindi Oya, according to descriptive statistical analysis is 0.02 –8 km. Table 5 shows the average distance (km) traveled by the households who do not own drinking water source to fetch during the off season.

WATER FOR BATHING

Survey data of year 2003 indicates among the households not having own source for bathing, the average distance traveled to bathe within season is about 0.816 km. This is a considerable distance.

Average distance traveled to bathe by households not having own source for bathing during the off season is high (1.917km) in Kirindi Oya. This is fairly a very long distance to travel. The time spent for this may badly affect the time allocation for agricultural purposes.

Seasonal variation of rainfall and inflow is indicated in Fig 2. It shows similar pattern of change both during rain fall and inflow. During the months of January, February, March and December, the difference between two lines are high. Hence relationship between these two parameters will be discussed in next section for Maha and Yala seasons.

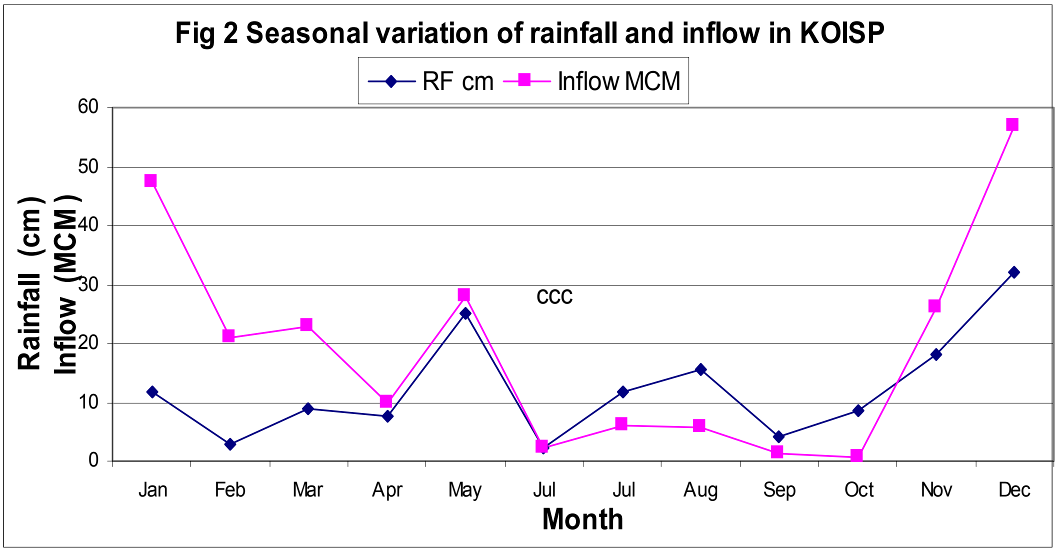


Figure 3: shows relationship of rainfall (mm) and inflow (MCM) during *Maha* season. Relationship between monthly rainfall and inflow of the KOISP was analyzed using simple regression analysis. It shows the inflow (IF in MCM) and rainfall (RF in mm) by the following equation (N = 24, R = 0.6104).

IF = 3.617 + 0.150097RF----------------------- (1)

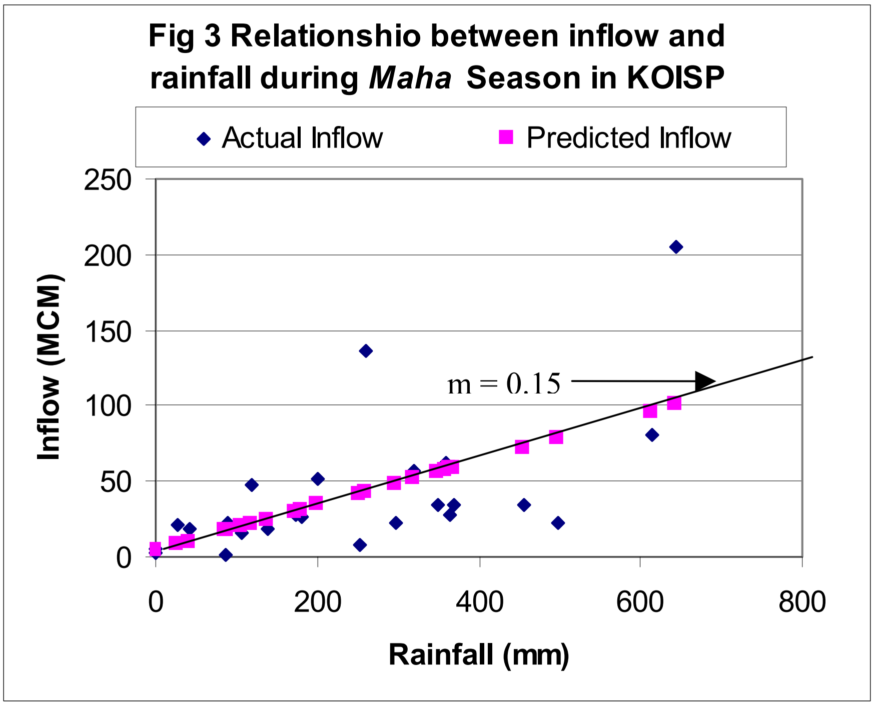
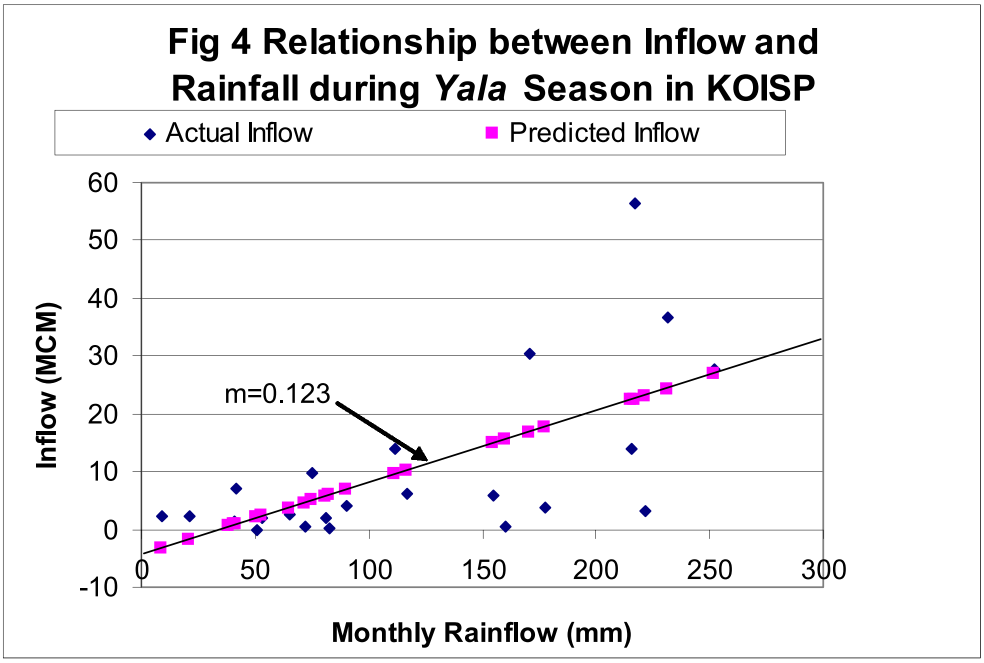


Figure 4: shows the relationship of rainfall (mm) and inflow (MCM) during *yala* season. Relationship between monthly rainfall and inflow of the KOISP was analyzed using simple regression analysis. It shows the Inflow (IF in MCM) and rainfall (RF in mm) by following equation (N=24, R= 0.6495)

IF = -4.399 +0.123196RF----------------------- (2)



Changes in performance due to changes in water-delivery strategies

According to Table 3 head, middle and tail end of the channel in the EIS reached nearly similar percentage of farmers. But in other two schemes (LB and RB) the farmer distribution was different along the field channels. Also there are 46% of tenant farmers in EIS but no any such farmers in other schemes.

Table 3: Breakdown of the surveyed farmers according to the schemes, location with respect to the field channel, tenure system and soil type of the farm

General information	Composition (number) of sample farmers							
	LB		RB		Old EIS		Total	
Total number of farmers	31		50		76		157	
Location with respect to the field channel	N	%	N	%	N	%	N	%
Head	6	19	21	42	24	32	51	33
Middle	13	42	12	24	24	32	49	31
Tail	12	39	17	34	28	36	57	36
Tenure system Owner	26	84	48	96	31	41	105	67
Lessee	5	16	2	4	10	13	17	11
	0	0	0	0	35	46	35	22
Soil type Can retain standing water	21	68	28	56	60	79	109	69
Cannot retain standing water	10	32	22	44	16	21	48	31

Source IWMI 2001

WATER DELIVERY: FARMERS PERCEPTION

Almost all the sample farmers were aware of the decision taken at the PMC meetings on the water delivery schedule (Table 4). It is estimated that the LB and RB farmers have experienced significant delays in water delivery from the agreed date of water delivery. It was also observed that the non-land-owner farmers have reported a significantly higher delay in the commencement date of water delivery, than the land owner farmers.

According to Table 8 the highest percentage of water is received by EIS. If shows the understanding and participation of EIS farmers on participatory water distribution. But in other two schemes (LB and RB) the water distribution percentages were lower than that of EIS in all four stages after LP stage.

Table 4: Farmers knowledge of water delivery

Factor	Distribution among systems			
	LB	RB	EIS	KOISP
Farmers knowledge on the PMC decision on the water delivery schedule (%)	94	86	93	91
Delay in water delivery (average number of days between agreed and actual water delivery)	14	9	0	6
Continuous mode of water supply				
LP stage (%)	100	92	100	97
NS stage (%)	35	32	89	60
TS stage (%)	6	6	51	28
BS stage (%)	6	0	37	19
FMS stage (%)	3	0	31	16

Source IWMI 2001 LP- Land preparation; NS – Nursery stage; TS – Tillering stage; BS – Booting stage; FMS – Flowering and milking stage

CROPPING INTENSITIES OF LUNUGAMWEHERA SCHEME

The cropping intensities of Lunugamwehera Scheme is given in the Table 5. It shows cropping intensity increases after 1990 especially in the new area. Due to less rainfall some years 97/99 and 200/201 low cropping intensities indicated in NIS.

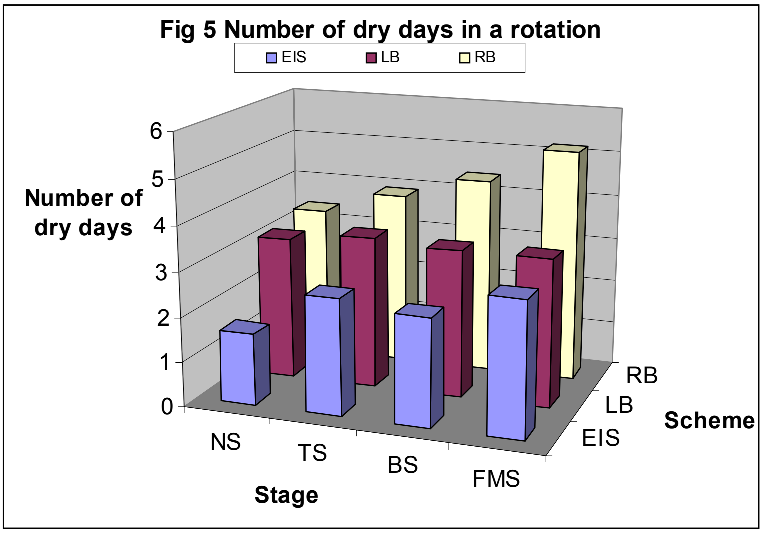
Table 5. Cropping Intensities of Lunugamwehera Scheme

Year	Old Area Cropping Intensity	New Area Cropping Intensity
87/88	2	1.25
88/89	2	1.14
89/90	2	0.45
90/91	2	0.85
91/92	2	0.98
92/93	1.6	0.94
93/04	2	0.81
94/95	2	1.63
95/96	1.7	2
96/97	2	2
97/98	2	1
98/99	2	0.74
99/00	2	2
00/01	1.38	0.74

Source: Irrigation Department 2004 Weheragala Reservoir Project

NUMBER OF DRY IN A ROTATION

The average number of dry days in a rotation is high in the RB and the very low in the EIS. Number of dry days in booting, flowering and milking stages in the RB was higher than the other two schemes. The Fig 5 shows lower number of dry days in EIS old area. That is also due to their participatory irrigation management.



LP- Land preparation; NS – Nursery stage; TS – Tillering stage; BS – Booting stage; FMS – Flowering and milking stage

PADDY YIELD IN KOISP

Paddy yield in the study area indicated in the Annex Fig 1. It shows high yield in the old area than other two areas. More farmers in the old area got more than 6 t/ha and most other farmers in the area got more than 3.75 t/ha. But most of the farmers of LB and RB received less than 1.37t/ha. This is mainly due to bad water supply for the crop.

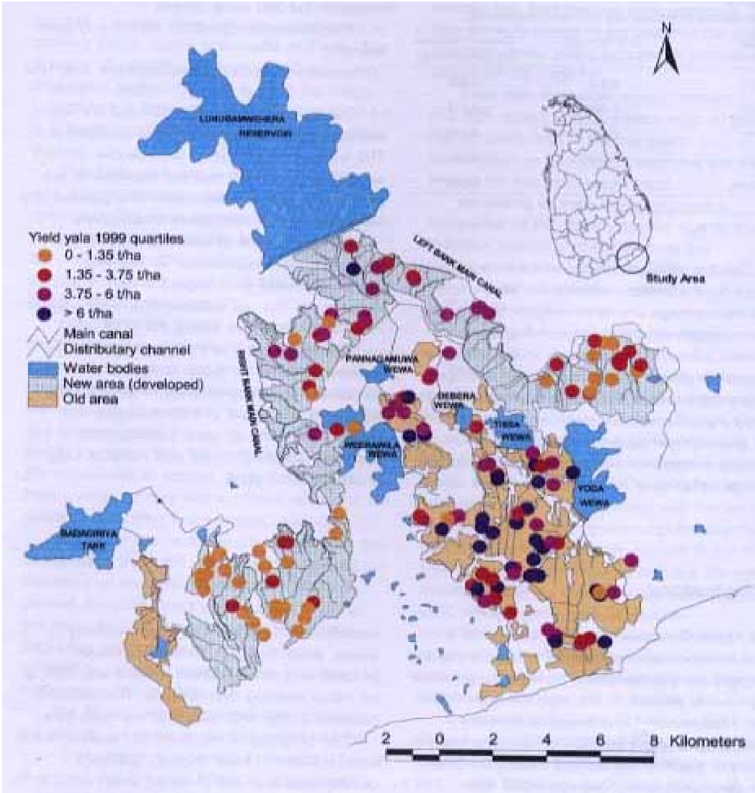
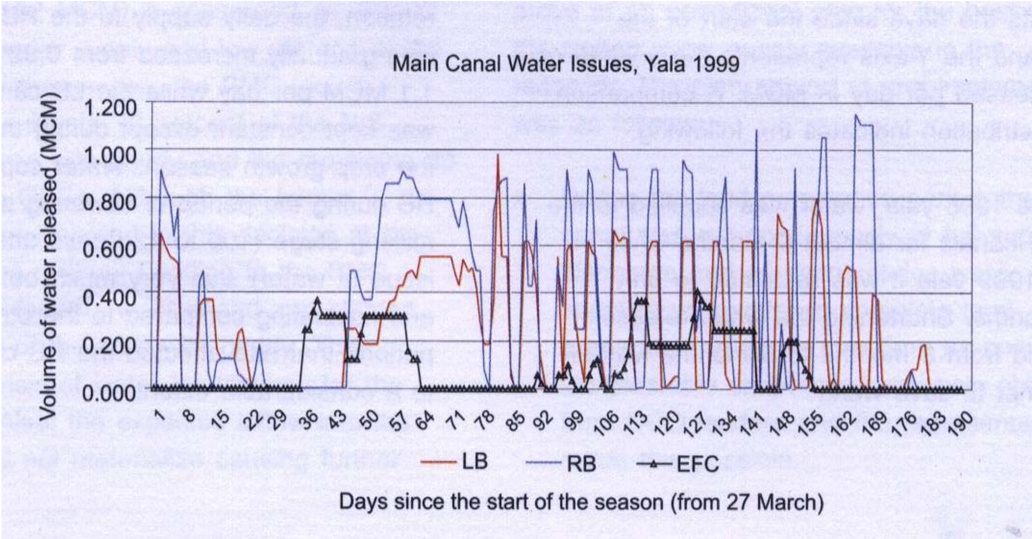


Fig 6 Spatial distribution of yield in the 1999 *Yala*: Kirindioya irrigation and settlement project

Source: Sakthivadivel, R, et al 2001

CONCLUSIONS

Due to high participation of EIS the farmers get less number of dry days and they reported that they received more than 71% adequate water delivery in all crop growing stages and a high yield ranging from 3.9 to 7.7 ton/ha. Due to less participation and other reasons the farmers in the RB of NIS reported 36%, 24% and 10% adequate water supply in tillering stage, booting stage and flowering stage respectively and obtained less yields ranging from 0.6 to 3.2 ton/ha. Due to less participation and other reasons the farmers in the LB of NIS reported 42%, 45%, 42% and 39% adequate water supply in nursery stage, tillering stage, booting stage and flowering stage respectively and obtained less yields from 1.8 to 4.8 ton/ha. This shows that the participatory irrigation management is important to optimum utilization of water resources and to gain high yield and income.



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