CAN THE YALA CULTIVATION IN KAUDULLA BE MADE A SUCCESS

by

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Abstract:

Kaudulla irrigation reservoir faces water shortage in many Yala seasons, although it is fed by Mahaweli waters. Mahaweli water distribution to Kaudulla reservoir is very complicated. However timely supply of water to Kaudulla during the North-East monsoon will ensure the cultivation in full extent in Yala season. The main advantage of Kaudulla reservoir is that it has a large storage capacity, which is over and above the required capacity for a full yala. The aim of this work is to analyse the reservoir operation data during the recent past and recommend a feasible operation plan to meet the water shortage during Yala season. It is proposed to fill the reservoir at the end of January in each year to solve the water deficiency during Yala seasons.

1.0 Introduction:

Kaudulla reservoir, situated in Medirigiriya Divisional Secretary's area, is maintained by the Irrigation Department and is coming under the system 'D' of Mahaweli network. This reservoir has a gross catchment area of 97 square miles and Gal oya and Aluth oya are the two main streams, feeding the reservoir. However Minneriya - Kantale Yoda Ela(MKYE), situated right across the catchment of Kaudulla diverts the runoff to Kantale reservoir leaving only 35 square miles of net catchment to Kaudulla.

At the intersection point of MKYE - Gal oya and MKYE - Aluth oya gated regulators have been provided to control flood water. Gal oya regulator is used as diversion gate to distribute Mahaweli water to Kaudulla and Kantale tanks. There are standing orders prepared by the Irrigation Department with regard to operation of these gates and of distribution of Mahaweli waters among Kaudulla and Kantale.

The seasonal water allocation to each Mahaweli system is decided by the Water Management Panel (WMP) of Mahaweli Authority with the consultation of Irrigation Department and Ceylon Electricity Board in advance. However the distribution ultimately depend upon the actual rainfall in the upper catchment of the Mahaweli river.

Usually, Kaudulla receives Mahaweli water during the North-East monsoon period in November, December and January. Feeding Kaudulla in other months are difficult in a normal year, because it depends on so many other factors; mainly

i. Water availability at Minneriya tank and

ii. Water availability at Elahera diversion anicut.

Kaudulla reservoir is probably the most complicated reservoir in Polonnaruwa district with regards to reservoir operations. Reasons are,

i. All the flood waters from Minneriya tank are discharged in to Kaudulla tank.

ii. Priority is given to Kantale reservoir in diverting the catchment inflow of Gal oya and Aluth oya. This means that water is allowed to flow to Kaudulla, only when it is not required at Kantale. and

iii. Kaudulla tank receives Mahaweli water though Minneriya tank. To issue Mahaweli water to Kaudulla the capacity of Minneriya reservoir should reach at least 70,000 ac.ft..

Fig. 1 & 2 show the location map and Mahaweli network in Polonnaruwa district.

2.0 History and background

The abandoned Kaudulla tank was restored in 1959 by the Irrigation Department to a capacity of 47000 ac.ft. Under phase 1 of the projects, Irrigation facilities were provided to 4644 acs. of

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paddy lands. This area of command was fed by a single sluice which issued water to spill tail channel and picked up at a point 2 miles below the bund, where the main canal starts. Command area allotments were of the size 3 acres of paddy land and 2 acres of highland for homestead for each farmer.

In 1967, under phase ii of construction, the capacity of the tank was increased to 104,000 ac.ft by raising the bund and introducing a redial gated spillway. Irrigation facilities were provided to 5912 acs. of new land by a new sluice located at LB end of the bund. This new sluice was placed 5 ft. above the other and termed as "High level sluice" while naming the previous one as "Low lever sluice". The construction of canal system continued for a very long time finally completing the project in 1983. Land alienation was done by allotting each farmer a two acre block of paddy and one acre of highland.

The records available show that since 1985, all the Maha seasons were successfully cultivated after diversion of the Mahaweli river to Polonnaruwa district. However Yala cultivation was only a 50% success during this period.

Partial success in Yala cultivation is due to both technical and social problems. However, a solution has to be found to the problem in the present social environment.

3.0 Irrigable area

According to the original Blocking Out Plan (BOP), it can be seen that an extensive reservation area had been made available for future development, mainly for pasture lands, community centers, earth borrow areas etc. However, the situation is entirely different at present as all reservations, including canal and road reservations have been encroached by farmers. Those lands too have been converted to paddy lands. Some of them have obtained deeds for those lands and some are having annual permits, while the others have no proof of ownership.

Although the specified acreage according to the original BOP is 10556 acres, unauthorized lands were gradually added to the irrigable extent, since inception in 1984. A survey conducted in 1990 found that the area under command is now stands at 12270 acres. However in addition to this acreage, there are some more lands in the tail end of irrigable area, which are being cultivated from drainage waters of Kaudulla. This additional acreage is well beyond 1500 acres, according to a rough assessment, and therefore the irrigable extent under Kaudulla tank can be safely estimated as 14,000 acres.

4.0 Water Requirement for Yala Season.

4.1 Past Cultivation records:

It is seen from the above tabulation that the success in Yala is about 50% during the past 10 years and following factors attributed to the low success rate in addition to the water shortage..

i. Addition of unauthorized new lands to irrigable extent.

ii Human influenced wastages by damaging channel bunds and structures and utilizing more water than required.

iii Human interference with system channels in order to feed unauthorized lands cultivated under drainage channels.

4.2 Quantity of Water used in past successful Yala seasons:

Available cultivation data shows that full extent was successfully cultivated during Yala seasons in 1986, 1990, 1991, 1993 and 1994. However, during 1993 there was a water crisis and about 5% of the crop died.

The inflow - outflow data for the above 5 years are analyzed and shown in Table 2.

Usually, sluice gates are operated only in the morning around 7.00 am. and canal water level is read from the gauge, once steady flow condition is achieved. In the calculations, it is assumed that once the gate opening is changed, that discharge rate will be maintained for the next 24 hours.

From the above analysis, it is seen that during a dry season like 1994 Yala, where inflow from rainfall is insignificant, about 81,000 ac.ft of active storage has been required for a successful Yala season, whereas in a wet year like 1990, about 62,000 ac.ft of active storage is required. 1993 Yala was not very successful, because about 5% crop died due to shortage of water. In addition, the yield in the tail end paddy lots were decreased, although the harvesting was done.

4.3 Assessment of inflow from rainfall

For the calculations of inflow due to rain, the following water balance equation is adopted indirectly.

Table 1- Past Cultivation Records

Season	Acreage Cultivated		Remarks
	Paddy	Ofc	
1985 Yala	4642	-	-
1986 Yala	10556	-	Full extent
1987 Yala	4000	-	-
1988 Yala	5500	-	-
1989 Yala	5648	175	Ofc are Moong,Cowpee & Vegetable
1990 Yala	12000	-	-
1991 Yala	12000	-	-
1992 Yala	5000	1250	Ofc are Moong, Cowpee & Vegetable
1993 Yale	12000	-	-
1994 Yala	12000	-	-
1995 Yala	12000	-	-

Table 2 – Table Showing Processed Data of Inflow – Outflow

Season	First Date of Water Issue	Last Date of Water Issue	Tank Capacity at first Date of Water Issue	Tank Capacity at last Date of Water Issue	Sluice Issue		Water Used from the tank as per Sluice Issue	Storage Reduction of the tank as per tank Guage	Inflow from MKYE + Agalawatta Oya	Rainfall During the Season	Inflow from Rainfalls	Remarks
					L/L	H/L						
			Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	m.m.	Ac.ft.	
86 Yala	11-04-86	31-08-86	101,300	32,666	37,418	23,240	60,658	69,604	5,500	166.5	4,334	——
90 Yala	22-04-90	25-08-90	97,400	42,000	24,646	30,952	55,598	62,400	——	487.7	16,942	——
91 Yala	20-04-91	28-08-91	96,200	28,200	25,712	32,450	58,162	67,400	——	50.3	816	——
93 Yala	03-05-93	14-09-93	60,275	11,525	23,280	29,084	52,364	51,525	——	253.2	3,877	5% crop failure
94 Yala	16-04-94	20-08-94	102,800	21,000	31,584	37,008	68,592	81,495	——	26.5	00	——

Inflow due to rainfall = change in storage in the tank + sluice issue + spillage - other diversions

5.0 Commencement of Yala season

The commencing date of Yala cultivation plays a vital role in the efficiency of water use. If the Yala can be commenced within first week of April, substantial amount of water can be saved by completing the season before August. However, the general practice of the Kaudulla farmers is to commence the Yala after the New Year festival. Some of the reasons for this are beyond the control of Irrigation officials and they are listed below.

i. Because of the late cultivators in the proceeding Maha season one or two water issues have to be given even after the scheduled last date of water issue in Maha, which may continue till end of March.

ii. Selling the product of Maha cultivation season take time.

iii. Having sold the Maha product farmers have money with them so that they tend to spend part of that money to purchase things and enjoy the New Year.

iv. As farmers do not clear the canals soon after harvesting, the water issues in field canals have to be delayed.

v. Many farmers want to enjoy the New Year cultural event as such they are not prepared to work before New Year.

Considering all these factors the suggested Yala season commences after the New Year festival. Three days can be given to farmers to clear their field channels and prepare liyadda bunds to receive water, so that for preparation of cultivation calendar, first date of water issue may be taken as April 20th, but the sluice can be opened one day ahead so as to reach water to tail end in time.

Since the water is scares in Yala, it is always preffered to use short term variety of paddy. Maximum 30 day period can be allowed for land preparation and sowing. As the water supply can be stopped two weeks before maturity 85 days of rotational water issue is sufficient for 3 - 3 1/2 month variety paddy. It is assumed that maximum 25 days of land preparation and sowing for 3 1/2 months variety of paddy.

6.0 Water loss from the tank during close season

The water loss due to evaporation and percolation is considerable from the end of Maha season to the commencement of Yala season. The water loss in different seasons estimated from the Capacity reduction of the reservoir from April 1st to April 20th are shown in Table 3. Water balance method is used to estimate losses

There was a practice of giving water in two main canals, two days on April 13th and 14th for bathing and other domestic purposes of farmer families on the occasion of Sinhala and Hindu New Year festival. This quantity adds to the natural loss during this period. Losses also largely depend on prevailing water spread area of the tank during this period.

Considering all these factors 3000 ac.ft of water loss from April 1-20 is more realistic during an average year.

7.0 Forecast for next 5 years

Table 4 shows summary of Table 2

From the Table 4, mean value of Yala water requirement is approximately estimated as 70,000 ac.ft (1993 Yala is omitted). This is the active storage required for full Yala cultivation taking into account the illegal cultivation too.

The total storage available in the tank should be 70,000 ac.ft + inactive storage.

Dead storage at High Level (H/L) sluice sill = 11,000 ac.ft
Dead storage at Low Level (L/L) sluice sill = 4500 ac.ft

However the capacity of the tank at minimum driving head of H/L sluice = 17500 ac.ft The same for L/L sluice is 8000 ac.ft. With the above data, it may be taken that 87500 ac.ft of minimum storage is required for a full Yala cultivation. By staggering H/L and L/L issues this 87500 requirement can be further reduced.

It is very difficult to get the consent of the farmers in L/L command area for staggering of sluice issue. However in a water shortage situation it may be possible to get them to agree to maximum 10 day staggering. Hence two curves of tank depletion with 5 day and 10 day staggering are plotted.

The three curves shown in Fig. 3 are,

i. H/L and L/L starts simultaneously
ii. H/L starts 5 day ahead of L/L and
iii. H/L starts 10 days ahead of L/L

Table 3 - Waters Losses from the tank from April 1 to 20

Season	Commencement of Water issue for Yala	Water Issued Rainfall & other	Inflow due to in the tank Ac.ft.	Capacity Reduced Ac.ft.	Losses Ac. ft.	Remarks
86 Yala	10 - 04 -1986	5422	3922	3000	4500	-
90 Yala	22 - 04 - 1990	798	28860	-	-	Capacity rose by 20000 ac. ft. Acurate estimation of Losses difficult
91 Yala	20 - 04 - 1991	1040	1200	3000	3160	-
93 Yala	03 - 05 - 1993	-	-	1575	1575	No issues for domestic purposes
94 Yala	18 - 04 - 1991	-	Accurate estimation difficult	-	-	Tank Spilling

Table 4 - Water Storage Efficiency Factor

Season	Total Sluic issue Ac. ft.	Tank Storage Reduction Ac.ft.	Factor Storage Reduction + Actual Issue	Remarks
86 Yale	60658	69604	1.14	-
90 Yala	55598	62400	1.12	-
91 Yala	58162	67400	1.16	-
93 Yala	52364	51525	0.98	5% Crop failed
94 Yala	68592	81495	1.19	-

It is assumed that water issue commences on 20th April and continue for 30 day period for land preparation and sowing. Thereafter rotational issue starts and water is issued on rotation for further 85 days.

The curves in Fig 3 indicates that if the sluice issue staggered by 5 days 85,000 ac.ft is sufficient for full Yala. (2500 ac.ft. is in excess above the minimum inactive storage 17500 ac.ft)

8.0 Date at which tank to befilled up for a full Yala cultivation:

The factor, storage reduction/Actual sluice issue is varing from 0.98 to 1.19 for different seasons of Yala, as per Table 4. However the 0.98 value in 1993 is not realistic as there was a crop failure. The average of other values gave 1.15. This means that to make use of 1 unit of water in the field 1.15 units should be available in the tank.

Now to decide the date at which tank to be brought to FSL capacity (104,000 ac.ft) to ensure 85000 ac.ft on 20th April following analysis is done. Anticipated water requirement during February and march is computed based on previous records.

Table 5 shows the computations.

Using the mean values of capacity reduction, the curve in Fig 4 is plotted.

The curve gives the 104,000 ac.ft value on 31st January. It means that if the tank is brought to full supply capacity on 31st January by getting Mahaweli water, 100% Yala cultivation in the proceeding year is almost certain.

9.0 Observations andconclusions

i To bring the Kaudulla tank to FSL on 31st January by getting Mahaweli water in time.

ii April 20th is a suitable date to commence Yala cultivation.

iii Successful Yala can be done with 85,000 ac.ft of water, if high level issue commences 5 days ahead of low level issues.

iv Estimated water loss from 1st to 20th April is 3000 ac.ft

v Short term varieties of paddy are recommended for Yala season

10.0 References:

This study is based on the records maintained in the Irrigation Engineer's office Kaudulla.

Note 11.0

: 3-3 1/2 month paddy variety is cultivated30 days given for land preparation and sowing 85 days rotation issues given for growth period.

1 - H/L & L/L starts simultaneously
2 - H/L starts 5 days ahead of L/L
3 - H/L starst 10 days ahead of L/L

Table 5 - Capacity reduction during February & March

Year	Sluice Issue x 1.15			Remarks
	Feb. 1 - 15	Feb. 15 - 28	March 1 - 31	
1986	3864	6168	4631	
1987	5359	4397	4243	
1988	-	-	-	Data not reliable
1989	5202	4034	8216	
1990	4648	5707	5445	
1991	4537	6513	5100	
1992	5370	6110	5574	
1993	5604	4422	4981	
1994	-	-	6235	Excess water released to spill tail channel in February
Mean Value	4940	5344	5553	

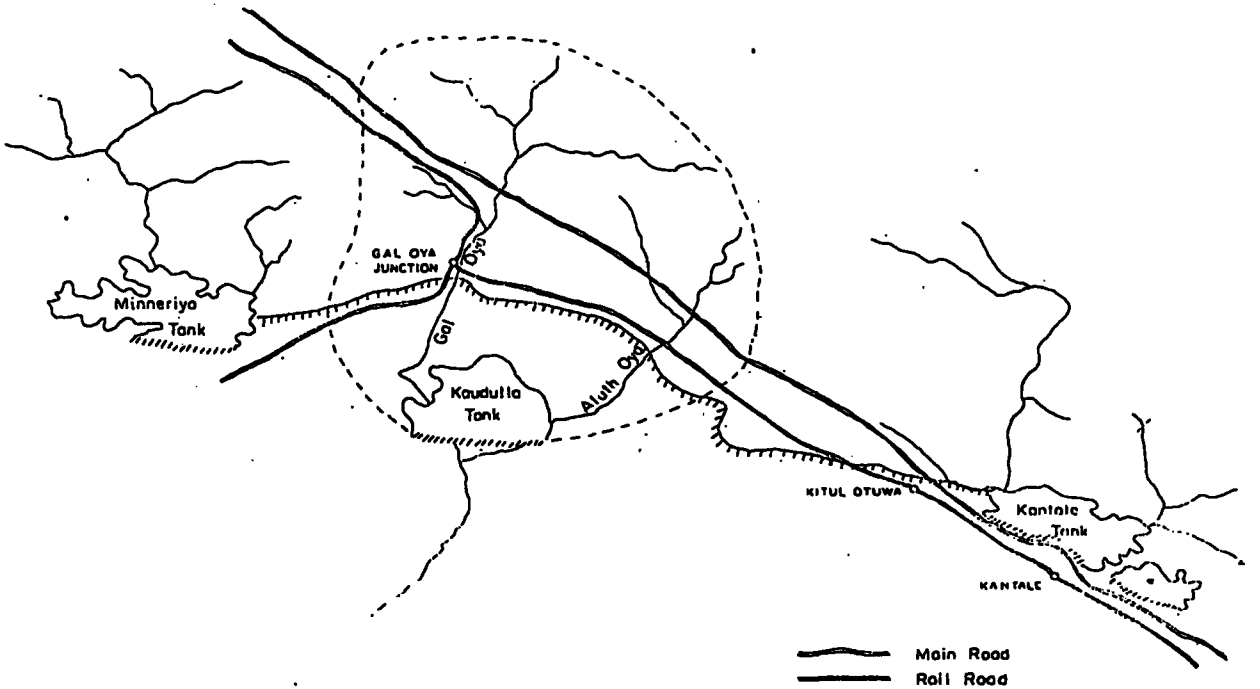
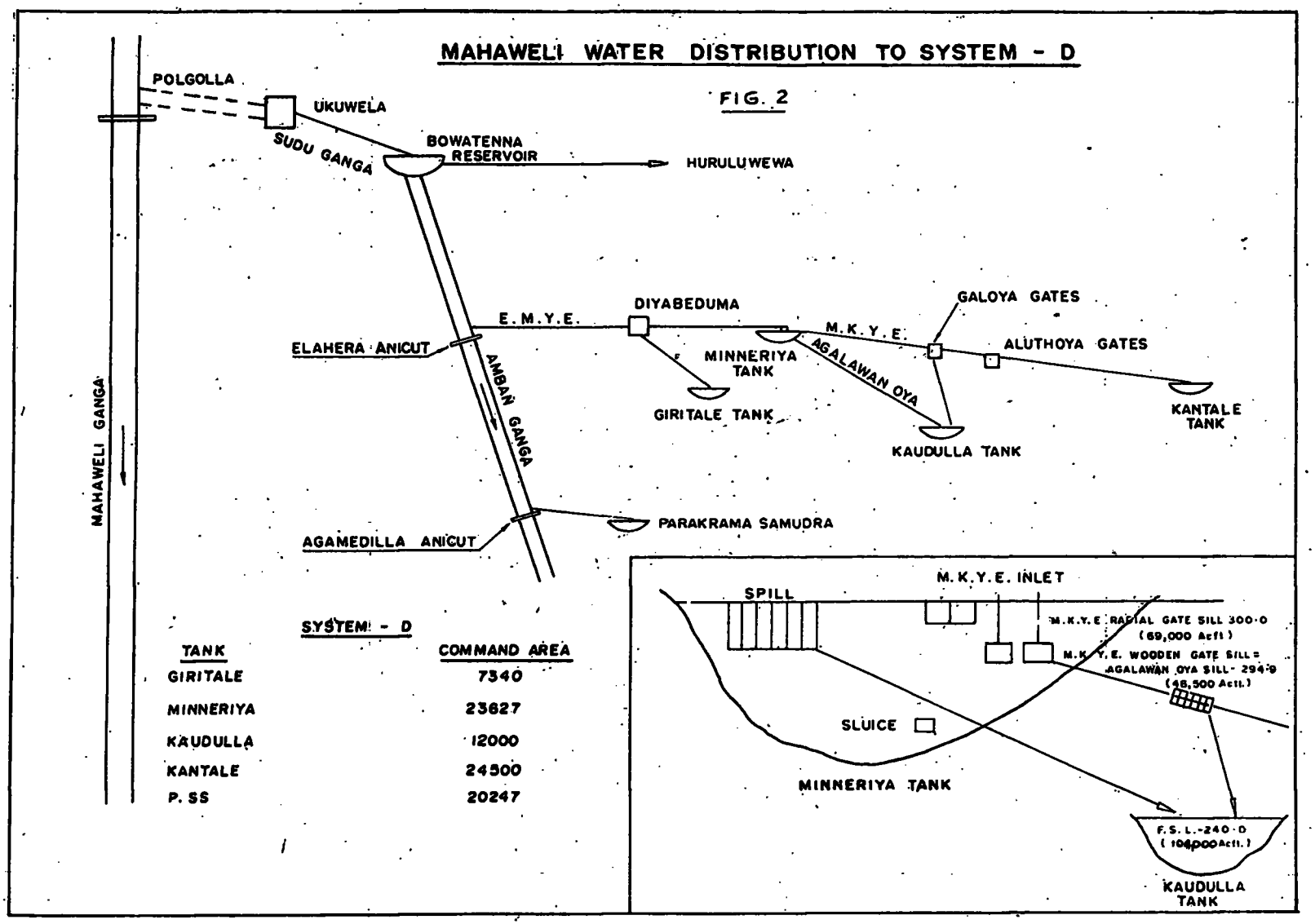


FIG. 1

LOCATION MAP SHOWING CATCHMENT BOUNDARY OF KAUDULLA TANK

MAHAWELI WATER DISTRIBUTION TO SYSTEM - D

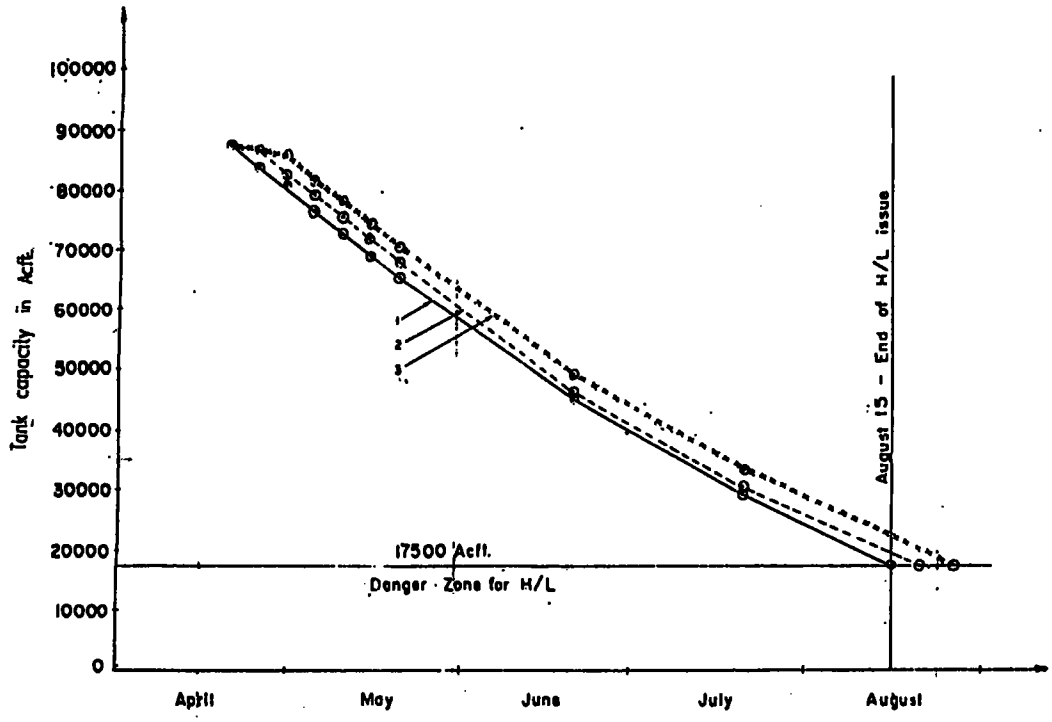
FIG. 2



SYSTEM - D

TANK	COMMAND AREA
GIRITALE	7340
MINNERIYA	23627
KAUDULLA	12000
KANTALE	24500
P. SS	20247

TANK DEPLETION CUFIVES
FOR YALA SEASON - KAUDULLA TANK



DURATION

H/L Water Issue starts on 20th April

Duration	H/L & L/L starts simultaneously	H/L starts 5 days early	H/L starts 10 days early
20-Apr	87500	87500	87500
25-Apr	83810	86480	86480
30-Apr	80120	82790	85460
5-May	76430	79100	81770
10-May	72740	75410	78090
15-May	69050	71720	74390
20-May	65360	68030	70700
20-Jun	45360	46380	49050
20-Jul	29360	30080	33050
15-Aug	17560		
20-Aug		17530	
25-Aug			17550

NOTE: 3 - 31/2 month paddy variety is cultivated.
30 days given for land preparation and sowing
85 days rotation issues given for growth period.

1 - H/L & L/L starts simultaneously

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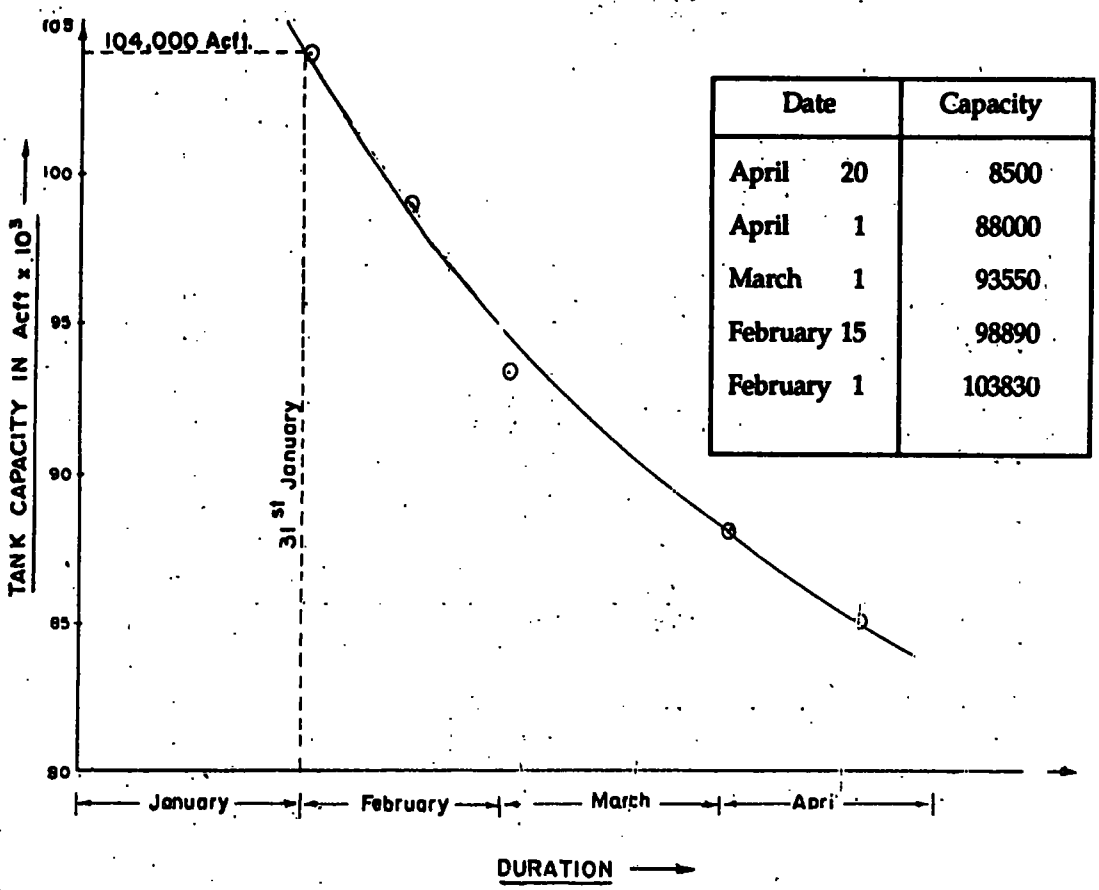

Date	Capacity
April 20	8500
April 1	88000
March 1	93550
February 15	98890
February 1	103830

TankDepletion Curve January ToAppril
Fig 4