

IGAD- IWRM- WATER DIALOGUE FORUM: WATER FOR REGIONAL  
COOPERATION

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**Effect of Land Inundation Period on Spate Irrigated  
Sorghum Yield in Gash Delta, Sudan**

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Presented by:

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- Gash delta is a fan shaped area stretching over 100 Km from Kassala town in the south to Hadalia in the north.
- Located between Latitudes  $15^{\circ} 30''$  and  $16^{\circ} 30''$  N and Longitudes  $35^{\circ} 50''$  and  $36^{\circ} 30''$  E .
- The total area of the scheme is 315 thousand hectares (ha)
- 168 thousand ha are equipped for irrigation.
- The actually irrigated area is about 105 thousand ha.
- Annual rain fall is about 260 mm in the south and 160 mm in the north.
- Temperature ranges from  $42^{\circ}$  C in may to  $16^{\circ}$ C in January.
- The land is divided by embankments into long parallel strips (known as misga) of width 500 m to 800 m and length 5.0 to 10.0 km.

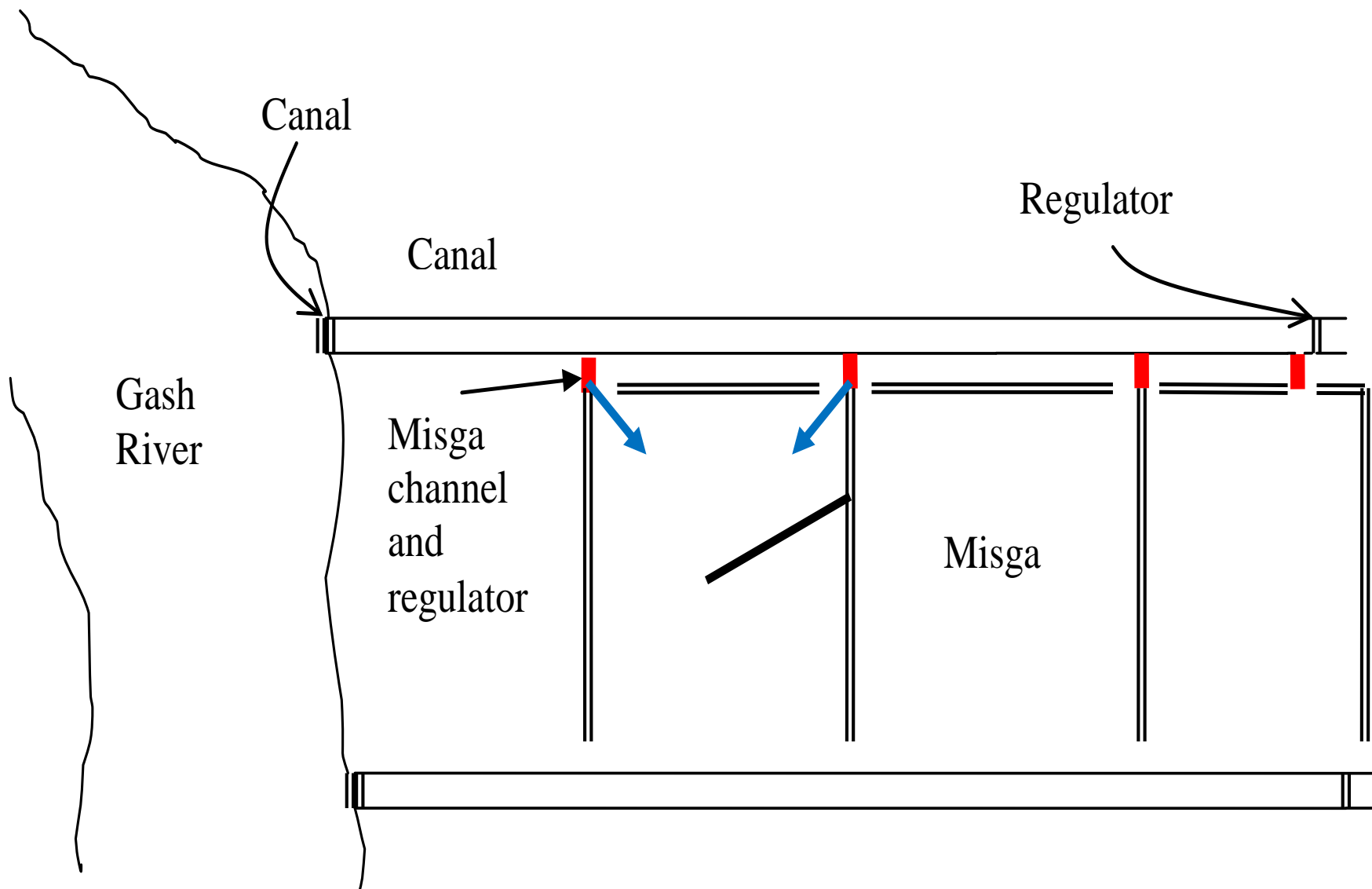


# Irrigation Network

- The river annual discharge varies from 1.2 to 0.65 km<sup>3</sup> per year.
- Water is diverted from the river into six main canals.
- Off-takes of small truncated channel known as misga channel from canal at selected points, flows into the misga land strip.
- No further control- except for occasional diagonal bunds.
- water is left to run into the field for 3– 4 weeks to cover an area between 400– 1000 ha







# Methodology

## A misga with:

- two off-takes,
- an area of 630 hectares,
- a length of 7640 m,
- a width of 800 m with
- two spurs dividing the misga into three sections:
  - upstream
  - intermediate and
  - downstream section

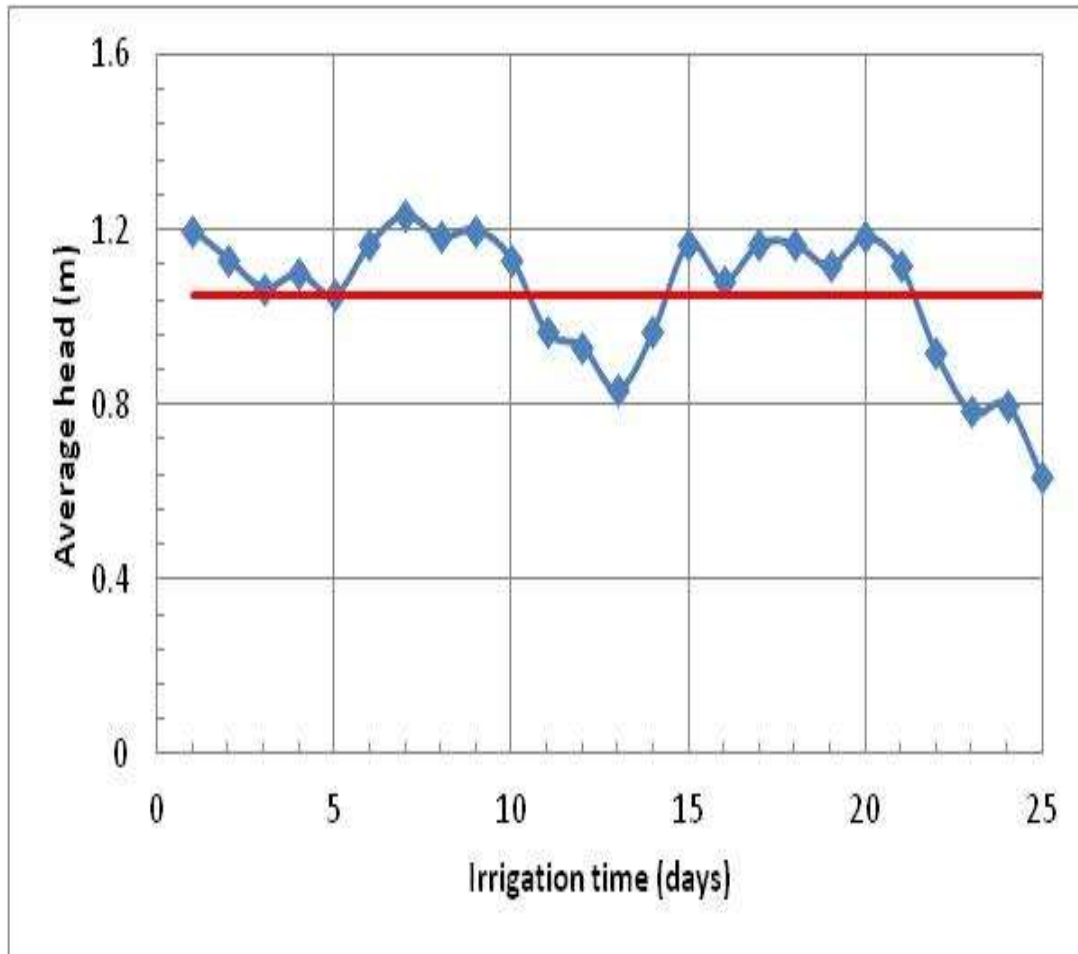
**was selected.**



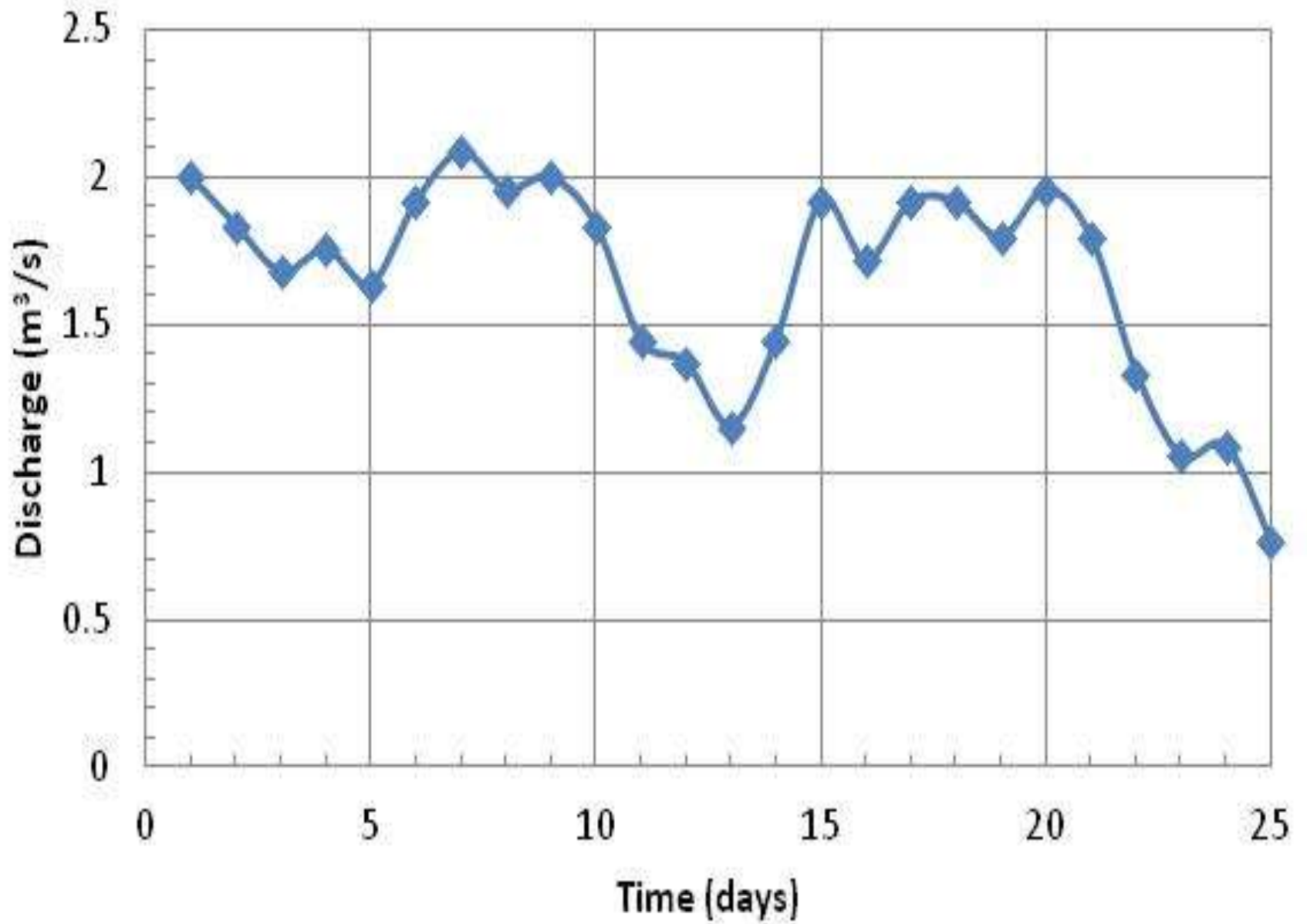
# Methodology...

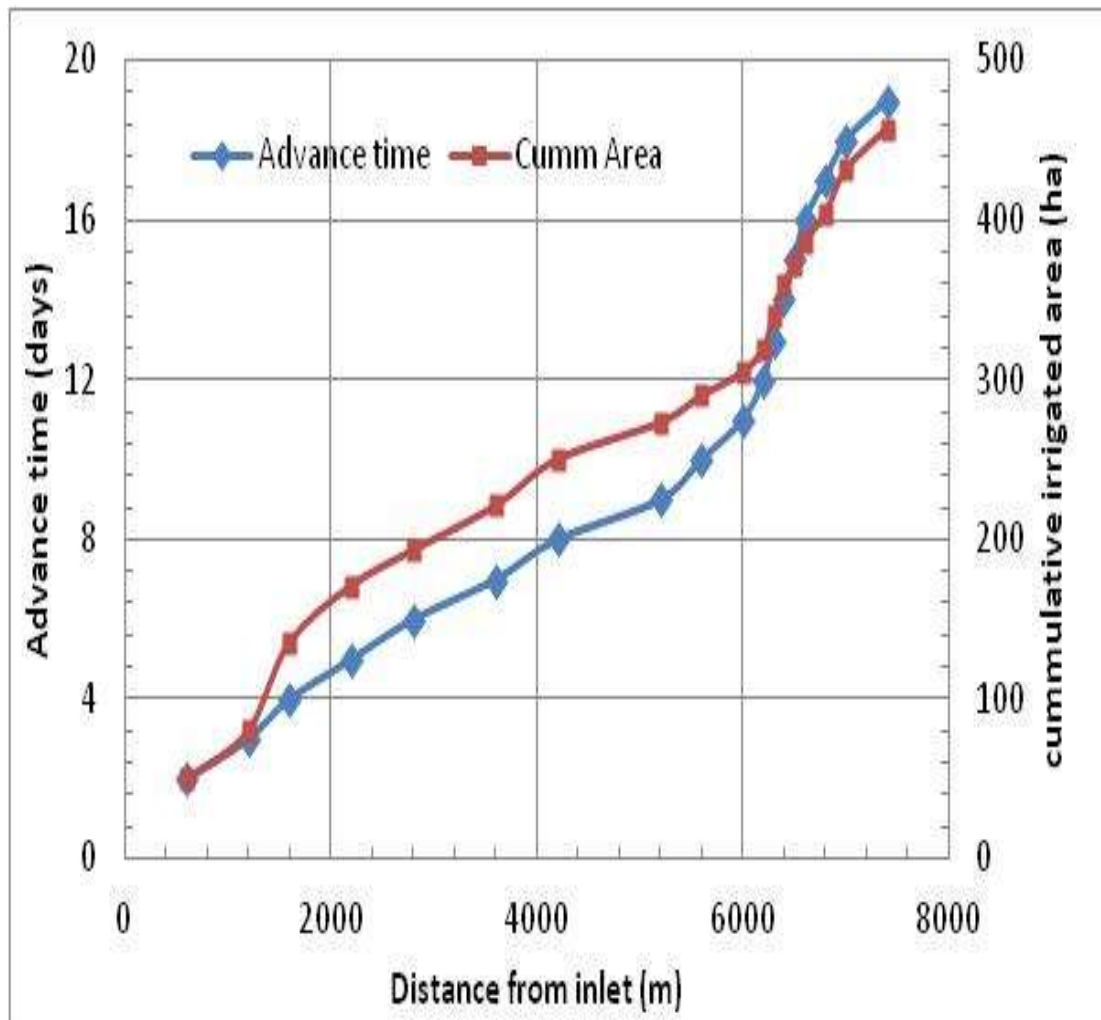
- The two misga channels were opened for 25 days.
- Depth of water over the stop logs was measured three times every day
- Discharge was calculated using a weir equation calibrated for the stop logs.
- Advance of water (map) over the surface- and hence infiltration opportunity time- was registered.
- After closing the misga, nine points were selected in upstream (25 days of inundation), intermediate (15 days of inundation) and downstream locations (10 days of inundation); three in each location where the wetting front was determined.
- Crop water requirement was calculated.
- Crop yield samples were taken at the three sites.

# Results and Discussion



- The head over the stop-logs 0.6 to 1.3 m with an average of 1.05 m.
- Discharge from both misga channels was close to the design values .
- The total volume of water from both misga channels was  $3.58 (10^6) \text{ m}^3$





- Advance was slow towards the end of the irrigation period.
- Advancing front reached 7400 metre which was about 97% of the total misga length.

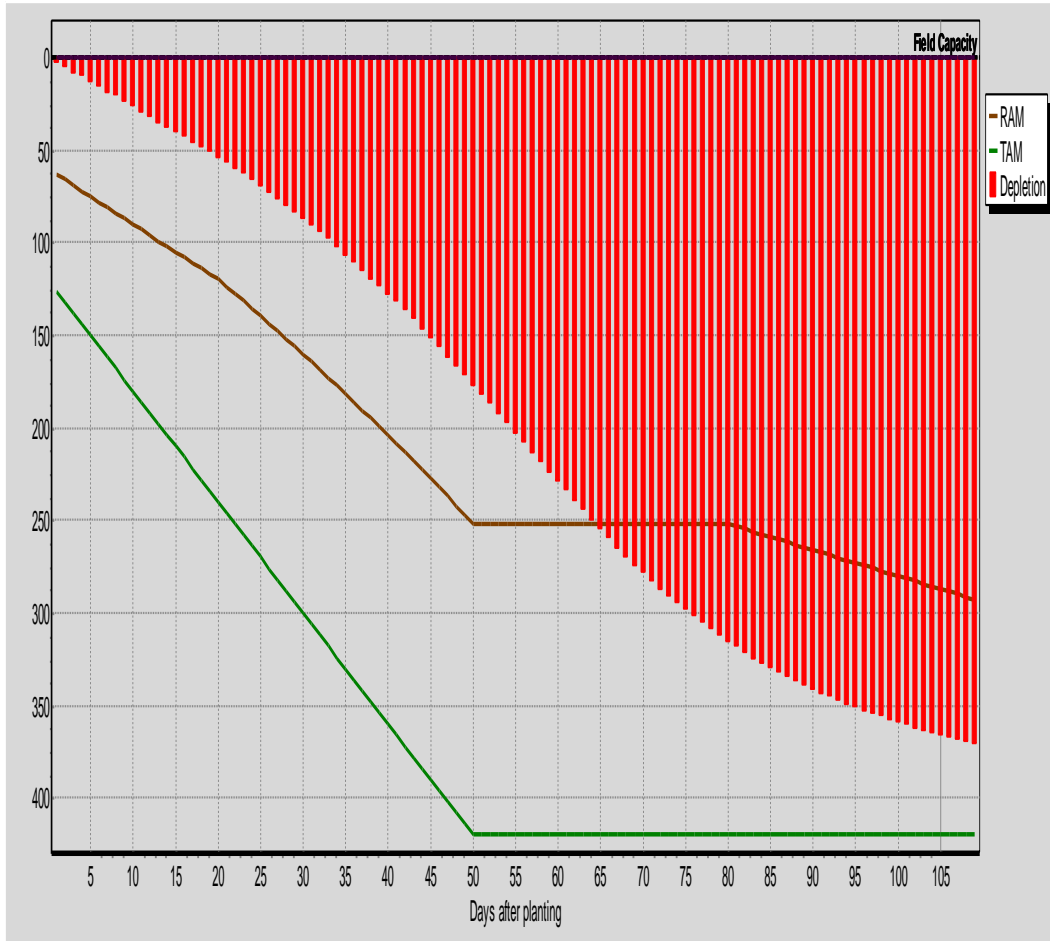
- **Total inundated area was 457 ha resembling about 73% of the misga area.**
- **Non-uniform coverage behaviour of the irrigation practice.**
- **More than 27% of the misga area was not irrigated.**
- **About 48% of the misga irrigated area was inundated.**
- **Only seven days and about 70% was inundated during the first half of the irrigation period.**
- **Only 30% of the inundated area was covered during the next 15 days.**

## **The mean wetting front (downward percolation) reached:**

- 2.7 m, upstream
- 2.07 m, middle
- 1.43 m, downstream



# Crop Water Requirement

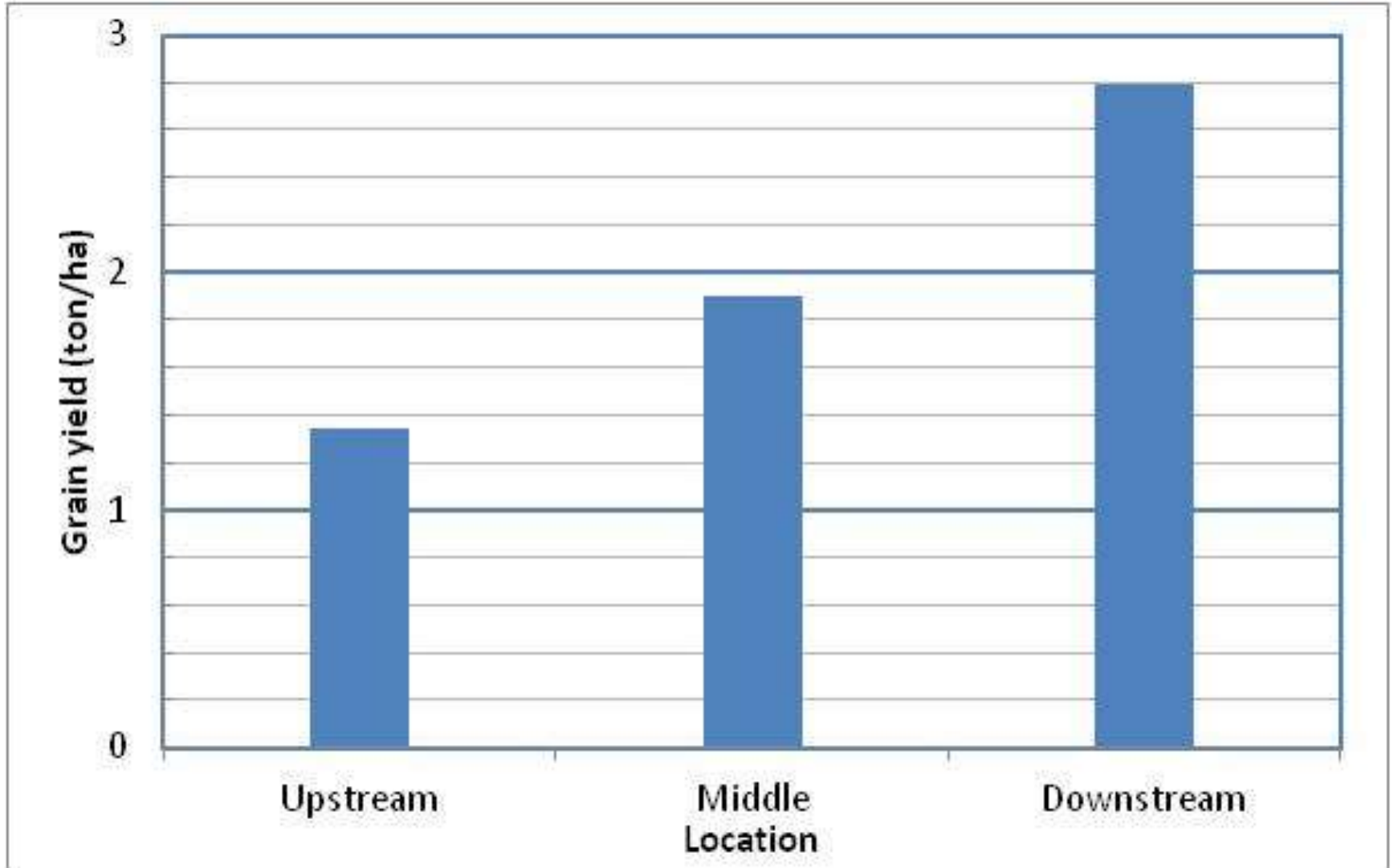


- For a root depth of 1.4 m, depletion exceeds the readily available moisture (RAM) during the maturity stage; a state which will improve the grain yield.
- irrigation requirement was 444 mm

# Lost Water

- The water lost was:
  - ✓ 50% at the misga head and
  - ✓ 22% at the misga middle section.
- Sorghum crop requires physiological moisture stress for maturity.
- Abundant moisture in the root zone during the cool season, causes failure to produce good grain yield.

# Grain Yield



## Grain yield, irrigation water and water productivity

<b>Site</b>	<b>Yield (ton/ha)</b>	<b>Water (mm)</b>	<b>Productivity (kg/mm)</b>
Upstream	1.34	663.60	2.02
Middle	1.90	542.01	3.51
Downstream	2.79	412.80	6.76

# Statistical Analysis

## Multiple Comparisons

yield  
LSD

		Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
(I) site	(J) site				Lower Bound	Upper Bound
upstream	middle	-2.35714	1.42976	.117	-5.3610	.6467
	downstream	-6.07143'	1.42976	.000	-9.0752	-3.0676
middle	upstream	2.35714	1.42976	.117	-.6467	5.3610
	downstream	-3.71429'	1.42976	.018	-6.7181	-.7105
downstream	upstream	6.07143'	1.42976	.000	3.0676	9.0752
	middle	3.71429'	1.42976	.018	.7105	6.7181

\*. The mean difference is significant at the 0.05 level.

# Conclusion and Recommendations

## ➤ Conclusion:

The current spate irrigation method resulted in significant loss of yield due to excessive water which could have otherwise been used to irrigate more area in the same misga or used elsewhere.

## ➤ Recommendations:

- ✓ Extension of misga channel and
- ✓ Operation method to evenly distribute water at the required depth will result in:
  - significant rise of yield,
  - improve the food security in the region and
  - generate better income for the farmers.





*...Thanks for your Attention ...*