

Studies on water use in chickpea (*Cicer arietinum* L.) in the Gangetic alluvial zone of West Bengal



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Introduction

- ❖ **Chickpea one of the most important pulse crops in India as well as West Bengal**
- ❖ **In new Alluvial Zone of West Bengal chickpea is grown after harvesting of *kharif* rice during post rainy season usually under rainfed condition**
- ❖ **Its yield depends on date of sowing and moisture availability during the growing period**

Objectives

- **To assess the growth and yield of chickpea crop under different irrigation regimes and dates of sowing**
- **To monitor water uptake by chickpea at different stages of growth**
- **To find out optimum water uptake by chickpea for maximum seed yield and biomass yield**

Methodology

- **Study period - Post monsoon of 2005-06 and 2006-07**
- **Study area – ‘C’ Block Farm, BCKV, West Bengal**
- **Treatment - Main plot - Date of sowing**
 - D1- 20th November**
 - D2 - 6th December**
 - Sub plot – Irrigation regime**
 - I₀ - No irrigation**
 - I_b - Irrigation at branching**
 - I_{bf} – Irrigation at branching and pre-flowering**
 - I_{bp} – Irrigation at branching and pod formation**
- **Design - Split plot**
- **Replication No.- 4**

Table-1 Sowing date and irrigation level on plant height (cm)

DOS	2005-06				2006-07			
	D1	D2	Mean		D1	D2	Mean	
I _o	38.17	33.83	36.00		41.23	40.20	40.72	
I _b	44.97	40.40	42.69		47.23	46.03	46.63	
I _{bf}	56.77	45.67	51.22		58.47	45.97	52.22	
I _{bp}	56.53	41.41	48.97		50.93	46.44	48.69	
Mean	49.11	40.33			49.47	44.66		
	D	I	D X I	I X D	D	I	D X I	I X D
S.Em (±)	1.66	1.60	2.57	2.27	0.90	1.27	1.80	1.80
C.D.(5%)	7.46	4.77	NS	NS	4.07	3.79	5.66	5.36

- Early sowing recorded the maximum plant height
- Two irrigations at branching and pre-flowering increased plant height

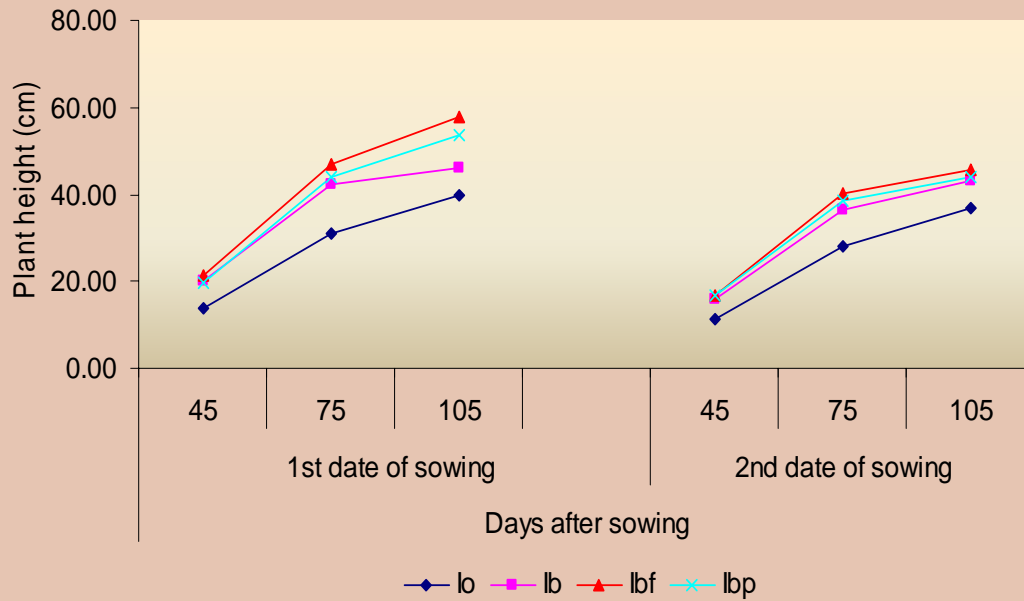


Fig. 1 Effect of date of sowing and irrigation regime on plant height

Fig. 2 Effect of date of sowing and irrigation regime on dry matter accumulation

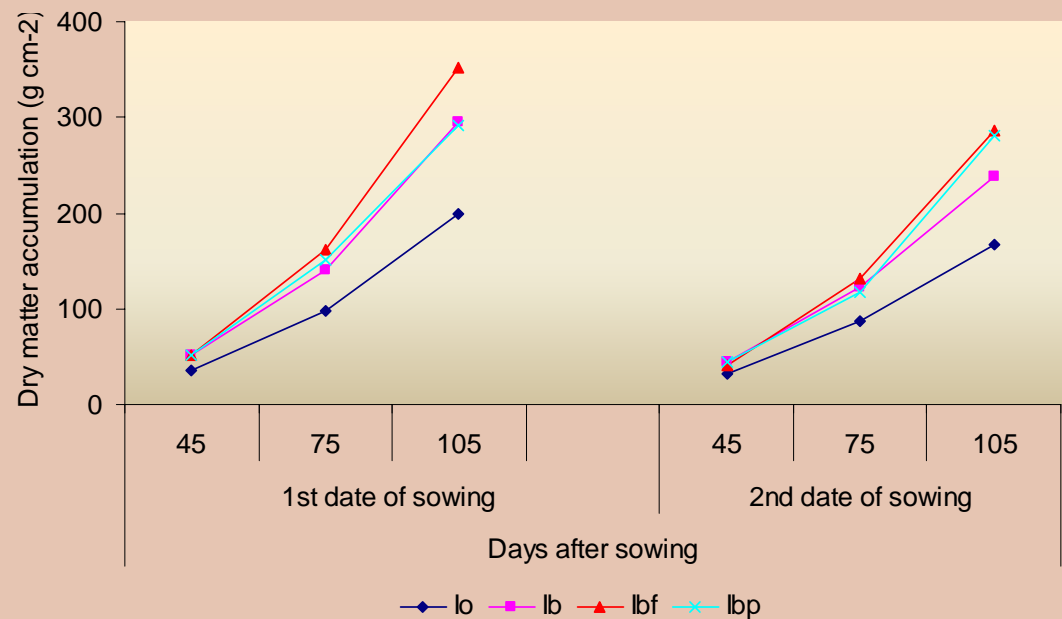


Table-2 Sowing date and irrigation on dry matter accumulation (g m⁻²)

DOS	2005-06				2006-07			
Irrigation	D1	D2	Mean	D1	D2	Mean		
I _o	243.17	197.00	220.08	263.41	220.90	242.16		
I _b	385.43	336.97	361.20	435.18	328.20	381.69		
I _{bf}	457.13	404.38	430.75	478.27	367.96	423.11		
I _{bp}	454.78	369.17	411.97	448.92	346.67	397.79		
Mean	385.13	326.88		406.44	315.93			
	D	I	D X I	I X D	D	I	D X I	I X D
S.Em (±)	6.38	6.00	9.73	8.48	8.82	8.64	13.77	12.22
C.D.(5%)	28.72	17.82	NS	NS	39.67	25.67	44.18	36.30

- **Early sowing recorded maximum dry matter accumulation**
- **Two irrigations at branching and pre-flowering increase DMA**

Table-3 Date of sowing and irrigation level on pods plant⁻¹

DOS	2005-06				2006-07			
	D1		D2		D1		D2	
I_o	22.43	21.49	21.96	21.57	20.86	21.22		
I_b	40.97	29.07	35.02	40.63	32.67	36.65		
I_{bf}	39.78	32.64	36.21	35.13	25.93	30.53		
I_{bp}	47.50	39.62	43.56	42.19	32.10	37.14		
Mean	37.67	30.71		34.88	27.89			
	D	I	D X I	I X D	D	I	D X I	I X D
S.Em (±)	1.00	1.33	1.91	1.88	1.19	1.30	1.99	1.83
C.D.(5%)	4.50	3.94	NS	NS	5.36	3.85	NS	NS

- **Early sowing increases pods per plant**
- **Maximum pods per plant recorded with two irrigations at branching and pod formation**

Table- 4 Date of sowing and irrigation level on seeds pod⁻¹

DOS	2005-06				2006-07			
Irrigation	D1	D2	Mean		D1	D2	Mean	
I_o	1.58	1.31	1.45		1.48	1.40	1.44	
I_b	1.75	1.44	1.59		1.80	1.63	1.72	
I_{bf}	1.84	1.56	1.70		1.56	1.49	1.52	
I_{bp}	1.92	1.63	1.78		1.92	1.63	1.78	
Mean	1.77	1.48			1.69	1.54		
	D	I	D X I	I X D	D	I	D X I	I X D
S.Em (±)	0.04	0.06	0.08	0.08	0.03	0.04	0.06	0.06
C.D.(5%)	0.18	0.16	NS	NS	0.14	0.13	NS	NS

- **Maximum seeds per pod recorded with early sowing**
- **Two irrigations at branching and pod formation increases seeds per pod**

Table-5 Date of sowing and irrigation level on test weight (g)

DOS	2005-06				2006-07					
	Irrigation		D1	D2	Mean	Irrigation		D1	D2	Mean
I_o			135.20	112.69	124.11			150.20	141.02	145.61
I_b			142.61	122.10	132.36			180.68	156.57	168.62
I_{bf}			160.90	131.80	146.35			157.33	153.10	155.22
I_{bp}			190.45	137.95	164.20			177.65	166.28	171.97
Mean			157.37	126.13				166.47	154.24	
	D	I	D X I	I X D	D	I	D X I	I X D		
S.Em (\pm)	0.04	0.06	0.08	0.08	0.03	0.04	0.06	0.06		
C.D.(5%)	0.18	0.16	NS	NS	0.14	0.13	NS	NS		

- **Maximum test weight recorded with early sowing**
- **Two irrigations at branching and pod formation increases test weight**

Table-6 Date of sowing and irrigation regime on seed yield (kg ha⁻¹)

DOS	2005-06				2006-07			
	Irrigation		D1	D2	Mean	D1	D2	Mean
I _o	1023.3		834.3	928.8	1044.1	748.3	896.2	
I _b	1457.3		1357.0	1407.1	1658.6	1175.3	1416.9	
I _{bf}	1602.5		1588.7	1595.6	1439.3	1026.6	1233.0	
I _{bp}	1813.7		1671.6	1742.7	1628.2	1205.0	1416.6	
Mean	1474.2		1362.9		1442.5	1038.8		
	D	I	D X I	I X D	D	I	D X I	I X D
S.Em (±)	21.2	26.2	38.5	37.2	35.3	34.9	55.4	49.3
C.D.(5%)	95.5	78.1	NS	NS	158.8	103.7	NS	NS

- **Maximum seed yield recorded with early sowing**
- **Two irrigations at branching and pod formation increases seed yield**

Table-7 Date of sowing and irrigation regime stalk yield (kg ha⁻¹)

DOS	2005-06				2006-07			
	D1	D2	Mean		D1	D2	Mean	
I _o	1408.3	1150.0	1279.1		1590.0	1456.5	1523.2	
I _b	2403.3	2012.6	2208.0		2693.1	2106.5	2399.9	
I _{bf}	3064.0	2500.6	2782.3		3343.3	2655.5	2999.4	
I _{bp}	2734.0	2020.0	2377.0		2861.0	2261.7	2561.3	
Mean	2402.4	1920.8			2621.8	2120.1		
	D	I	D X I	I X D	D	I	D X I	I X D
S.Em (±)	62.1	50.8	87.9	71.9	60.6	76.4	111.5	108.1
C.D.(5%)	280	151	285	214	273	227	NS	NS

- **Maximum stalk yield recorded with early sowing**
- **Two irrigations at branching and pre-flowering increases stalk yield**

Table-8 Consumptive water use (CWU) rate (mm day⁻¹)

Treatment	Sowing to branching		Branching to flowering		Flowering to pod formation		Pod formation to maturity		Over all CWU (mm)	
	05-06	06-07	05-06	06-07	05-06	06-07	05-06	06-07	05-06	06-07
DOS										
D1	0.76	0.83	0.97	1.33	1.24	1.42	1.20	1.68	141.38	175.83
D2	0.74	0.79	0.91	1.34	1.50	1.63	1.16	1.80	143.32	179.27
Irrigation										
I _o	0.75	0.81	0.84	1.20	1.19	1.34	0.89	1.58	114.45	158.71
I _b	0.76	0.82	1.00	1.36	1.33	1.54	1.05	1.72	135.40	177.00
I _{bf}	0.75	0.82	0.94	1.40	1.62	1.72	1.31	1.81	157.96	190.35
I _{bp}	0.75	0.80	0.99	1.38	1.35	1.51	1.48	1.85	161.59	184.14

- ▶ Early vegetative stage - higher moisture use with earlier sowing
- ▶ Reproductive stage - higher moisture use with late sowing
- ▶ Rainfed crop recorded lowest moisture use
- ▶ Flowering to pod formation - I_{bf} irrigation recorded maximum moisture use
- ▶ Pod formation to maturity - I_{bp} irrigation recorded maximum moisture use

Luxuriant water use

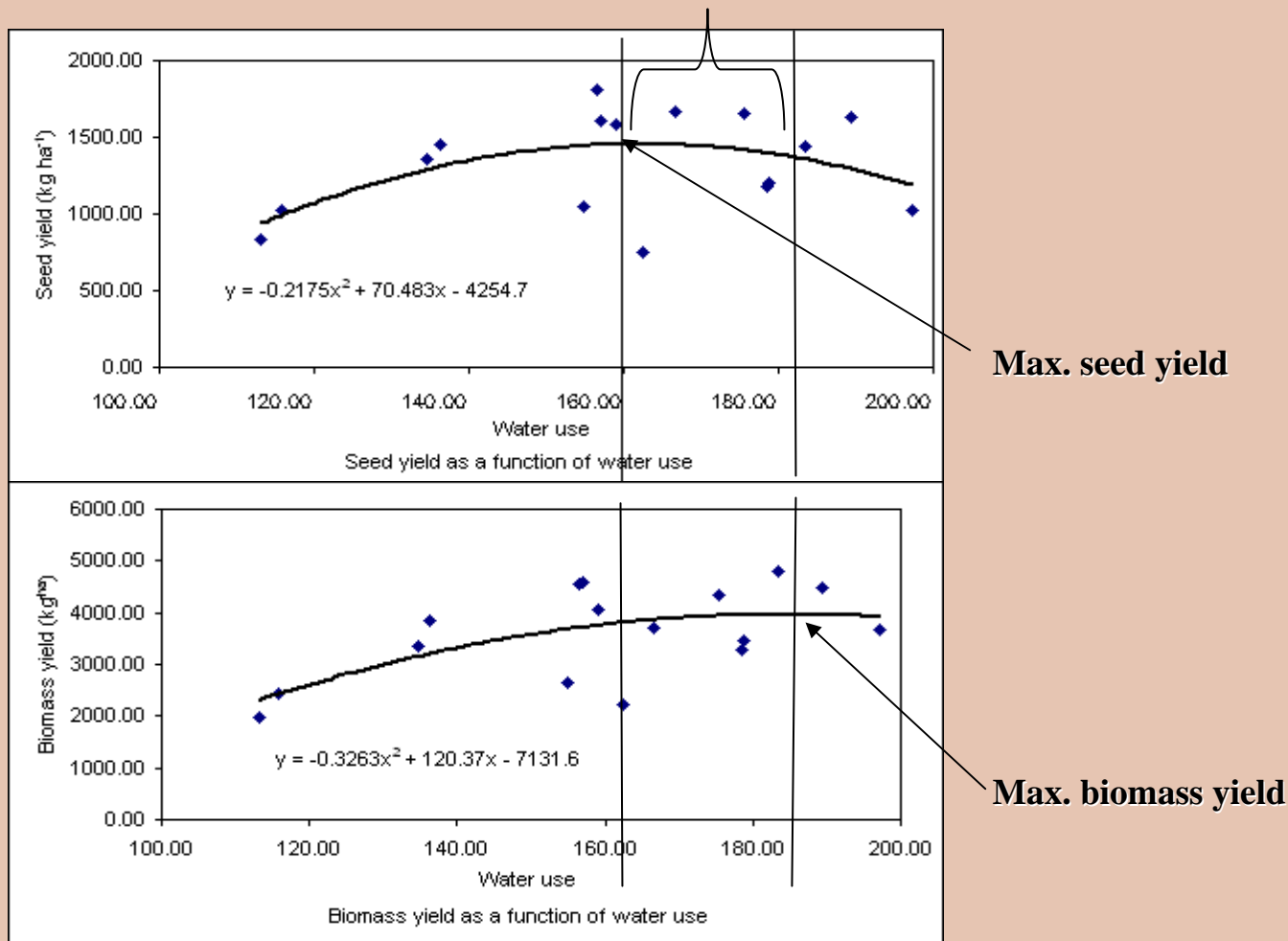


Fig. 3 Seed yield and biomass yield of chickpea in relation to water use

Conclusion

- ❖ **Best sowing time of chickpea in new Alluvial zone of West Bengal is mid November**
- ❖ **Two irrigations at branching and pod formation found best for obtaining maximum grain yield. Seasonal Consumptive use = 162.59 mm for higher seed yield**
- ❖ **Excess irrigation or rainfall leads to luxuriant water use and higher biomass production**



Thank you