All India Co-ordinated Cotton Improvement Project,
Mahatma Phule Krishi Vidyapeeth,
Rahuri- 413 722,
Dist. Ahmednagar (Maharashtra), India

Studies on Photosynthetic Efficiency in *G. hirsutum* Cotton Hybrids

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Head, Dept. of Agril. Botany & Sr. Cotton Breeder

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INTRODUCTION

- **The productivity of cotton in Maharashtra is 310 kg per ha in terms of lint which is very low.**
- **The low productivity of cotton is mainly attributed to cultivation of cotton under rainfed condition. The major coverage of the Maharashtra State is under rainfed condition which is subjected to irratic and uneven distribution of rainfall.**
- **Also limited use of fertilizers and its high price contributes to the low productivity.**
- **To fulfill the increasing needs of clothing, special attention needs to be given to increase the yield per unit area of cotton.**

- **In general, the hybrids are high yielders over straight varieties.**
- **It is a fact that all the hybrids do not possess all favourable yield contributing characters.**
- **Few attempts made to identify the physiological parameters which contribute towards yield directly or indirectly.**
- **The important physiological attributes such as photosynthetic rate, transpiration rate, instantaneous water use efficiency, partitioning of total dry matter and photosynthetic efficiency are important parameters while attempting to improve the yield by selection.**

Therefore, present investigation was undertaken to study photosynthetic efficiency in different hybrids of cotton (*Gossypium hirsutum* L.).

Experimental details:

Location : **Cotton Improvement Project, MPKV, Rahuri**
Year : **2010**
Design : **R.B.D**
Replications : **3**

Ten hybrids : **RHH-707, RHH-523, RHH-216, RHH-202, RHH-516, RHH-622, RHH-520, Phule-492, NHH-44 and Ankur-651.**

Observations recorded:

Growth and yield attributes

Plant height, leaf area, number of sympodial branches per plant, total dry matter and seed cotton yield per plant and per ha.

Physiological observations

Periodical mean photosynthetic rate (µmol $m^{-2}s^{-1}$), periodical mean transpiration rate (µmol $m^{-2}s^{-1}$), periodical mean stomatal conductance (mol $m^{-2}s^{-1}$), and periodical mean photosynthetically active radiation (µmol $m^{-2}s^{-1}$) were recorded at 60 and 120 days after sowing (DAS), Instantaneous water use efficiency, total chlorophyll content

Results:

Significant differences were observed amongst the hybrids for mean values of plant height, sympodial branches per plant, leaf area, total dry matter and seed cotton yield per plant and per ha.

The observations on various growth characters were recorded periodically at 60, 120 DAS and at harvest.

Table 1. Yield components in different cotton hybrids recorded at 60, 120 DAS and at harvest.

Sr. No.	Treatment	Plant height			Number of sympodia per plant			leaf area (dm^2) per plant		
		60 DAS	120 DAS	At harvest	60 DAS	120 DAS	At harvest	60 DAS	120 DAS	At harvest
1	RHH-707	65.50	118.13	139.50	14.78	20.83	30.16	51.13	58.86	55.76
2	RHH-523	55.53	116.63	142.10	13.00	19.16	27.33	41.03	54.13	52.80
3	RHH-216	54.70	125.03	123.60	14.00	18.17	25.00	56.33	63.80	59.10
4	RHH-202	56.40	127.70	150.36	14.16	20.17	29.16	56.96	74.13	57.13
5	RHH-516	72.00	139.46	153.13	15.33	21.00	33.66	61.83	76.76	65.83
6	RHH-622	64.56	137.76	144.20	13.06	20.83	29.83	59.76	73.66	63.16
7	RHH-520	60.63	134.26	141.80	12.66	18.16	28.16	53.00	71.10	60.86
8	Phule-492(c)	72.20	132.73	149.53	14.83	20.50	31.33	54.20	63.96	57.96
9	NHH-44(c)	74.43	134.20	158.16	16.00	22.83	34.38	64.16	80.76	70.23
10	Ankur-651(c)	71.03	127.46	136.23	14.33	19.33	28.16	57.33	75.46	61.73
Mean		64.70	129.64	143.86	14.22	20.10	29.72	55.57	69.26	60.46
SE ±		2.79	3.85	2.89	0.90	1.20	1.05	1.88	2.20	1.75
C.D. at 5%		8.29	11.44	8.58	N.S.	N.S.	3.12	5.59	6.54	5.21

Contd...

Sr. No.	Treatment	Mean total dry matter (g/plant)			Seed cotton yield	
		60 DAS	120 DAS	At harvest	Per plant (g)	Per ha (kg)
1	RHH-707	82.46	210.63	278.26	145.53	1560.00
2	RHH-523	82.36	177.93	241.86	134.86	1353.50
3	RHH-216	84.63	160.70	228.13	131.26	1328.66
4	RHH-202	77.36	193.50	260.13	140.43	1452.00
5	RHH-516	124.83	257.30	339.56	191.60	1784.33
6	RHH-622	101.83	217.96	290.66	142.93	1529.66
7	RHH-520	94.10	180.43	239.00	133.60	1375.00
8	Phule-492(c)	109.63	230.36	307.20	196.20	1648.66
9	NHH-44(c)	125.80	281.60	369.13	223.16	1985.66
10	Ankur-651(c)	110.76	222.36	288.03	175.15	1552.33
Mean		99.38	216.28	284.20	161.48	1556.98
SE ±		2.49	3.16	3.57	4.716	57.43
C.D. at 5%		7.39	9.39	10.59	14.01	170.55

Table 2. Physiological properties of different *Gossypium hirsutum* hybrids at 60 and 120 DAS

Sr. No.	Treatment	Photosynthesis rate (µmol/m²/ sec.)		Mean transpiration rate (µmol/m²/ sec.)		Mean stomatal conductance (mol/ m²/sec.)	
		60 DAS	120 DAS	60 DAS	120 DAS	60 DAS	120 DAS
1	RHH-707	23.10	24.50	0.59	1.76	1.18	0.02
2	RHH-523	18.40	21.00	1.41*	2.21	0.41	0.31
3	RHH-216	16.93	17.96	1.65*	2.97*	0.34	0.29
4	RHH-202	20.40	22.96	1.18*	1.11	0.80	0.20
5	RHH-516	25.13	26.83	0.49	1.46	1.36	0.09
6	RHH-622	21.40	23.96	0.61	1.81	1.20	0.08
7	RHH-520	20.20	21.70	1.10*	2.54*	0.87	0.21
8	Phule-492(c)	24.06	25.50	0.42	1.27	1.25	0.13
9	NHH-44(c)	27.16	29.50	0.36	1.05	1.53	0.07
10	Ankur-651(c)	22.10	26.10	0.81	2.22	1.05	0.10
Mean		21.89	24.00	0.86	1.84	0.99	0.15
SE ±		1.28	0.98	0.04	0.06	0.06	0.04
C.D. at 5%		3.82	2.91	0.12	0.17	0.16	0.11

Contd...

Sr. No.	Treatment	Mean instanteneous water use efficiency		Mean Photosynthetically active radiation (µmol/m²/sec.)		Total chlorophyll content (mg/ g)	
		60 DAS	120 DAS	60 DAS	120 DAS	60 DAS	120 DAS
1	RHH-707	39.46	14.17	758.00	794.83	0.92	2.26
2	RHH-523	13.07	9.59	743.33	658.06	0.60	1.75
3	RHH-216	10.21	6.10	660.33	550.53	0.54	1.68
4	RHH-202	17.26	21.07	1193.33	664.53	0.67	2.15
5	RHH-516	52.73	17.96	1640.33	954.96	0.98	2.37
6	RHH-622	35.05	13.08	1283.33	665.20	0.85	2.36
7	RHH-520	18.44	8.62	1318.66	681.83	1.18	2.09
8	Phule-492(c)	58.29	20.25	1535.33	914.43	0.90	1.98
9	NHH-44(c)	66.20	26.20	1742.66	987.66	1.38	2.45
10	Ankur-651(c)	26.39	12.00	1420.00	736.40	1.36	2.12
Mean		33.71	14.90	1229.53	760	0.94	2.12
SE ±		2.94	0.66	185.32	65.30	0.01	0.01
C.D. at 5%		8.75	1.95	550.38	193.93	0.04	0.03

Conclusion:

The cotton hybrids NHH-44, Phule-492, RHH-516, RHH-707 and Ankur-651 were observed to be photosynthetically more efficient thereby resulting into higher yield.

The higher plant height, leaf area, photosynthesis rate, PAR, stomatal conductance, total dry matter and number of sympodia are the desirable characters for developing the ideotypes and obtaining the higher seed cotton yield in the cotton.

Thank You