Productivity and economic effect for cotton cultivated under different inter-row spaces and irrigation norms

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It was tested sown fields of cotton under irrigation and non irrigation regime at width of inter-row spaces respectively of 60 and 80 cm.

In terms of ***temperature*** years (Table 1)

- 2007 and 2011 were warm,
- 2008, 2009 and 2010 – moderate warm.

The ***rainfall sum*** for the period May – August characterized years (Table 2)

- 2007 and 2011 as dry,
- 2008 and 2009 as moderate, and
- 2010 – moderately humid.

Table 1. Sum of air temperatures (^oC) in the period of cotton vegetation (2007-2011).

Years	Period of cotton vegetation, months						Sum	
	IV	V	VI	VII	VIII	IX	IV-IX	VI-VIII
2007	351	579	693	825	753	527	3728	2271
2008	386	522	636	717	792	555	3608	2145
2009	357	569	648	751	725	571	3621	2124
2010	364	554	624	708	798	582	3628	2128
2011	535	538	645	722	743	558	3791	2160
1928-2007	343	519	622	720	711	561	3476	2053

Table 2. Sum of precipitations (*mm*) in the period of cotton vegetation (2008-2011)

Years	Period of cotton vegetation - months						Sum	
	IV	V	VI	VII	VIII	IX	IV-IX	VI-VIII
2007	19	53	39	0	62	128	301	101
2008	66	36	95	36	3	91	327	134
2009	17	16	14	89	35	58	229	138
2010	63	27	82	114	22	48	356	212
2011	46	46	31	24	58	50	225	113
1928-2007	45	63	65	52	41	34	300	158

The *soil type* was leached vertisols with humus horizon – 70-115 cm, with humus content of 1.8 – 3.5 %, clay minerals - 60 % and unproductive soil moisture is 18-20 %.

FMC for soil layers 0-50 cm is 34.2 %, 51-100 cm is 31.6 % and 101-200 cm – 28.7 %.

The average values of *productive moisture* for layer 0-60 cm was 96 mm, for 0-100 cm was 181 mm and 101-200 cm – 99 mm.

Irrigation with lower rates:

1). Non-irrigated variant – for standard.

2).Two irrigations of 600 mm/ha (total 1200 mm) at 75 % FMC in soil layer 0-40 cm – the first one at the blooming and the second – at the boll formations period;

3). Two irrigations of 450 mm/ha (total 900 mm) at 75 % FMC in soil layer 0-40 cm – the first one at the blooming stage and the second – at the boll formations period;

4). Single irrigation of 600 mm/ha at 75 % FMC in soil layer 0-40 cm in the interphase period blooming - boll formations;

Width of inter-row space:

1). Width of inter-row space 60 cm - standard.

2). Width of inter-row space 80 cm.

The tests were conducted at an irrigation regime by sprinkling on Vega variety, in two crops rotation (durum wheat - cotton), at fertilization rate of N - 180 kg/ha, P_2O_5 - 100 kg/ha and crops density of 170 000 plants per 1 ha.

RESULTS AND DISCUSSIONS

The highest september yield from non irrigated variant was realized average of 2042 kg/ha (98.98 %) then total yield. Decrease of irrigation norm from 1200 m^3/ha with 25 % and 50 % at cotton field not bring about to adequate change in yields – the drop in this case is with 319 kg/ha (89.4%) and 163 kg/ ha (94.6 %).

- During the dry years (2007 and 2011) the earliness of the irrigated variants was within the limits of 79.3 – 84.9 % of the total yield amount. For moderate years (2008 and 2009) this percentage was within 72.7 – 82.7 %, and for humid 2010 year– 60.8-69.1 %. For the non-irrigated controls this ratio was respectively 91.2 %, 85.1 % and 74.7 %. Average for the period 2007-2011 the earliness of the irrigated variants was within the limits of 82.6 – 84 % and 83.7- 100 % for non-irrigated control - Table 4.

Table 3. Seed cotton yields under different inter row spaces

Inter-row spaces		Total yields by years – kg/ha					Average		
		2007	2008	2009	2010	2011	kg/ha	%	±D
60 cm		2246	3153	2355	2660	2472	2574	100	-
80 cm		2560	3220	2441	2743	2612	1719	106	138
GD	5 %	90	142	30	80	94	112	4.7	112
	1 %	124	197	41	108	130	135	6.0	135
	.1 %	172	274	56	146	158	161	6.9	161

With optimized of water factor by different years the yields varied from 2205 BGN/ha to 3780 BGN/ha, in such at an average of five years period under irrigation the cotton yields increased with 28.5 – 45.5 %. The variant with irrigation norm 1200 mm realized average with 941 kg/ha more then non irrigated variant.

During the moderately humid years (2002-2003) the yield increase was with an average of 34.5 % or 930 kg/ha more than the variant with two irrigations of 400 m^3/ha performed at the cotton bud formation and blooming stages.

From the other variants was obtained 21.7 – 25.0 % higher yield as compared to the non-irrigated control.

Table 4. Seed cotton yields under different irrigation regimes

Norms of irrigation		Yields by years – kg/ha					Average		
		2007	2008	2009	2010	2011	Kg/ha	%	±D
No irrigat.		1975	1863	1989	2515	1972	2063	100	-
1200 mm		2890	3780	2648	2873	2833	3004	146	941
900 mm		2434	3633	2577	2854	2730	2846	138	783
600 mm		2205	3469	2379	2563	2633	2650	129	587
GD	5 %	110	201	43	113	112	288	4.3	288
	1 %	152	279	58	153	153	386	5.6	386
	.1 %	211	388	78	207	206	430	6.3	430

The irrigation effect was smallest in the humid years. Given in percentage of the non-irrigated control, the yield increase was from 9.0 to 27.9 %.

The cotton grown under inter-row space of 80 cm show better yields then crops under inter-row space 60 cm (Table 2 and 3).

Different of cotton-yields in comparison of cotton grown under inter-row space 80 cm and irrigated norm 1200 mm, 900 and 600 mm was higher than these grown under irrigation and inter-row space 60 cm with 8.68, 6.35 and 3.14 %. Net income from variants with irrigated norms from 1200 and 900 mm was with 161 and 115 BGN/ha more then the same variants planted in 60 cm inter-row space – Table 3 and 4. At

Table 5. Seed cotton yields under different irrigation norms and different inter-row

Norms of irrigation	Average for 60 cm inter-row space			Average for 80 cm inter-row s,ace		
	Kg/ha	%	±D	Kg/ha	%	±D
No irrigation	2062	100	-	2064	100.1	2
1200 mm	2880	139.7	818	3130	151.8	1068
900 mm	2758	133.8	696	2933	142.2	871
600 mm	2609	126.5	517	2691	130.5	620
GD 5 %	*	*	*	218	10.6	218

- At the variants of 600 mm irrigation water results show identical net income.
- The effect of 1000 m^3 irrigation water per 1 ha, expressed in additional yield of kilograms of cotton, obtained with additional yield of kilograms of cotton obtained as a result of the irrigation depends on the year rainfall and temperature.
- This effect was greatest for the dry and warm years and varied from 586 to 1163 kg/ha.

Table 6. Economic indexes on irrigated variants

Irrigated norms mm	Total output BGN/ha	Costs of production BGN/ha	Net production BGN/ha	Net income BGN/ha	Effect of 1000 water m3 kg/ha	Net profit of 1000 m3 BGN/ha
Inter-row space 60 cm						
Wheth-owt	2681	1857.5	823.5	-	-	-
1200	3744	2417.5	1326.5	503	682	886.6
900	3585	2327.5	1257.5	434	868	1128.4
600	3445	2237.5	1240.5	384	862	1120.6

Table 7. Economic indexes on irrigated variants

Irrigated norms mm	Total output BGN/ha	Costs of production BGN/ha	Net production BGN/ha	Net income BGN/ha	Effect of 1000 M^3 water; kg/ha	Net profit of 1000 m3 BGN/ha
Inter-row space 80 cm						
without	2682	1857.5	824.5	1	-	-
1200	3905	2417.5	1487.5	664	890	1157.0
900	3700	2327.5	1372.5	549	967	1257.1
600	3445	2237.5	1207.5	384	1033	1342.9

CONCLUSIONS

Under conditions of regulated water deficit, the highest effect was provided by irrigation regime of 75 % FMC in soil layer 0-40 cm, which was realized in two irrigations with irrigation rate of 600 mm. Average for 5 years with this irrigation regime the total cotton yield increased with 941 kg/ha or with 45.5 %, in comparison with non irrigated variant.

The cotton grown under inter-row space of 80 cm show better yields then crops under inter-row space 60 cm. Different of cotton-yields in comparison of cotton grown under inter-row space 80 cm and irrigated norm 1200 mm, 900 and 600 mm was higher than these grown under irrigation and inter-row space 60 cm with 8.68, 6.35 and 3.14 %.

Additionally total production from irrigation variants was 517 – 818 kg/ha for inter-row space 60cm and 620 – 1060 kg/ha for variants at inter-row space 80 cm.

Decrease of irrigating norm of 1200 mm with 25 and 50 % brought to go down of total output according with 159 – 229 BGN/ha for inter-row space 60 cm and 205 – 460 BGN/ha inter-row space 80 cm.

World records

Rainfalls

Charapundzhi, India

for 4 days – 3 721,10 мм; for 31 days – 9 299,96 мм; for 365 days - 26 461,21 мм

Dray

Dry valleys, Antarctica – from several scores thousand years to several millions years without rainfalls!

Arika, desert Atacama, Chile – 0,8 мм. The most dray town on all the world.

Assuan, Sahara, Egypt – 1,5 мм. The most dray town in Africa.


Thank You!