Изследвания върху полските култури, 2005, Том II - 1
Field Crops Studies, 2005, Vol. II - 1

TECHNOLOGICAL ELEMENTS IN COTTON YIELD EARLINESS, YIELDING POTENTIAL ACHIEVEMENT AND REACTION TO HYDRIC STRESS OF COTTON GERMPLASM UNDER ECOLOGICALLY LIMITATIVE CONDITIONS FROM ROMANIA

Tudorina Nistor, Rodica Sturzu, Gh. Nistor, Sorina Morlogeanu
Agricultural Research and Development Station, Teleorman, Romania

Abstract

Nistor Tudorina, Rodica Sturzu, Gh. Nistor, Sorina Morlogeanu, 2005. Technological elements in cotton yield earliness, yielding potential achievement and reaction to hydric stress of cotton germplasm under ecologically limitative conditions from Romania

Under poor thermic regime, the cotton earliness optimization is a vital aim. Beside genetically conditioned cultivar earliness, technological measures, such as: sowing time, plant density, crop protection with photodegradable sheet, treatments of ripening stimulation, rapid harvesting from field, could contribute to the cotton yield earliness. The sowing in optimum time and a plant density of 160-220000 pl /ha, lead to the obtainment of some statistically ensured yield gains in comparison with the late sowing and lower plant density. The outrunning of sowing time by cotton crop protection with photodegradable sheet constitutes a guarantee of increasing of plant productivity and its earliness, yield gains being statistically very significant (64-246%) in comparison with unprotected control. The mechanization contributes to the rapid yield harvesting, its quality being superior, the registered losses being of 18.6–20.3 % at “0-1” type cultivars. The cotton germplasm reaction to hydric stress was positive, the early yield level being of 84-90% from the raw cotton total yield.

Key words: cotton, earliness, yield, mechanical harvesting, plant density, sowing time

INTRODUCTION

The placement of cotton area in Romania at the North limit of cropping zone is conditioned by the utilization of early germplasm, but especially, the application of some technological measures which should ensure some adequate conditions related to cultivars and the obtainment of early yield gains.

Beside cultivar earliness, genetically conditioned, technological measures as: sowing time, plant density, crop protection with photodegradable sheet, contribute to the raw cotton yield earliness by the increasing of early yield from total one (obtained from the open capsule till the first hoarfrost and 5-6 days after it).

Balan, I.M. (1974) and Carpinisan, T. (1984) show the importance of cotton sowing in optimum time, established by multiannual research, in the last decade of April.

Nicolov, G. (1980, 1984) shows that the establishment of uniform cotton field, with a density of 165-200000 pl/ha, leads to the obtainment of an early yield gain of 4.2-6.3 % as compared to the control density of 124,000pl/ha. According as the density increases over 200,000 pl/ha, the sterile plant percentage increases, too.

Boreno, A. (1991) communicates the testing of a new technological sequence (the

crop protection with photodegradable sheet), which leads to the appearance of some great early yield gains, of 144-160 % vs. unprotected control under favourable conditions from cotton in Spain.

In order to avoid the yield compromising in field, another important technological sequence is the mechanical harvesting.

Concerning the resistance or tolerance to drought of cultivars belonging to Gossypium hirsutum L. species, we underline the root system depth till 2-2.5 m, strongly laterally developed, with secondary ramifications till 1.2-1.5 m distance from the starting point. So, when the drought periods occur (July – August), the cotton plants have good resistance to hydric stress. The tolerance to drought and heat is given by other cotton peculiarities, too (pubescence, leaf turning around the main rib which contributes to a more reduced evapotranspiration (Bolteanu, 1993).

MATERIAL AND METHODS

The researches were performed at ARDS Teleorman, Brвnceni center, on a medium leached chernozem, well-supplied with nutrients, neutral pH and loamy-sand texture. During the researches (1988-2001), the favorability degree of years for cotton depending on the achieved yield level was different: 1989-unfavourable year; 1988, 1996, 1999 and 2001 middle favourable years; 1990, 1994, 1995 favourable years and 2000 very favourable year.

Table 1. Frequency of heat days during May-September, ARDS Teleorman, 1999-2001

Year	Month					Total days
	May	June	July	August	September	
No. of days with maximum air temperature > 30^0C						
1999	1 ($31,5^0$C)	21 ($30-33,7^0$C)	23 ($30-34,5^0$C)	17 ($30-39^0$C)	5 ($30-34,5^0$C)	67
2000	8 ($30-31^0$C)	17 ($30-38^0$C)	22 ($30-44^0$C)	23 ($30-39^0$C)	4 ($30-31,5^0$C)	57
2001	4 ($30-31^0$C)	7 ($30-39^0$C)	25 ($30-37^0$C)	25 ($30-38^0$C)	9 ($30-33^0$C)	70
No. of days with relative air humidity < 30%						
1999	9 (22-30%)	9 (20-30%)	6 (20-30%)	8 (22-30%)	10 (22-30%)	42
2000	2 (27-30%)	15 (26-30%)	18 (21-30%)	10 (24-30%)	1 (30%)	46
2001	5 (20-30%)	10 (25-30%)	8 (23-30%)	16 (22-30%)	12 (22-30%)	51

During 1999-2001, the frequency of heatedly days in May-September was of 57-70 and the air relative humidity smaller or equal with 30% registered during 42-51 days (Table 1). The experiments were performed as Latin rectangle and subdivided plots. Three sowing times, four densities, two ways of protection with photodegradable sheet

Concerning the germplasm reaction to hydric stress, 12 cotton cultivars and lines were tested. The data processing and interpretation were made by ANOVA (Ceapoiu, 1968).

RESULTS AND DISCUSSION

A cotton field sowed in optimum time, uniform as density, ensures the obtainment of an economical raw cotton yield. Additionally, some new technological measures (protection with photodegradable sheet, stimulation of ripening) and mechanical harvesting ensure the increasing of early share from total raw cotton yield, its quality being superior,

unaffected by rain and frost.

Figure 1 presents the results regarding the influence of sowing time on cotton yield ripening, with Adelin cultivar sowed in three times: early time (12th-15th April), optimum time (22nd- 25th April) and late time (1st-4th May). In all cases, the highest yields both early and total ones, are achieved in optimum sowing time, excepting 1995, when the highest early and total yields were obtained in early sowing time. On three years average, (1994-1996) the yield level was of 1845 kg/ha early yield and 2528 kg/ha raw cotton total yield in optimum sowing time and of 1594 kg/ha early yield and 2369 kg/ha total one in early sowing time.

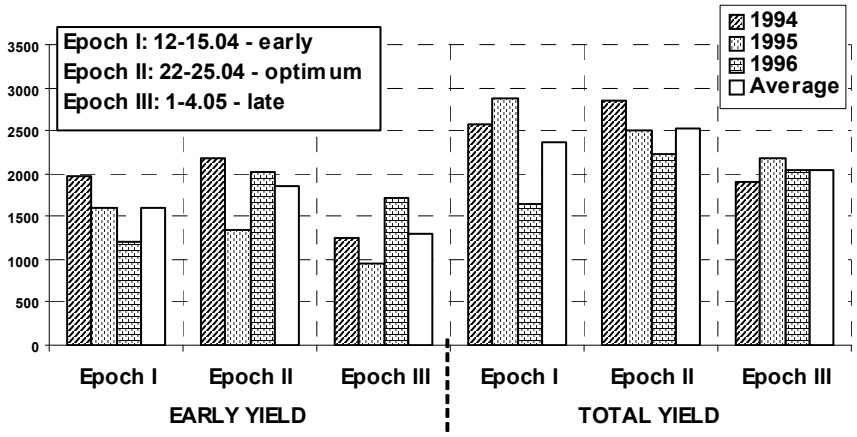

FIG. 1 INFLUENCE OF SOWING TIME ON COTTON YIELD PROCESSING - ADELIN CULTIVAR, A.R.D.S. TELEORMAN

The late sowing leads to the decreasing of both early and total raw cotton yield with early yield differences, statistically ensured, of 542-850 kg/ha.

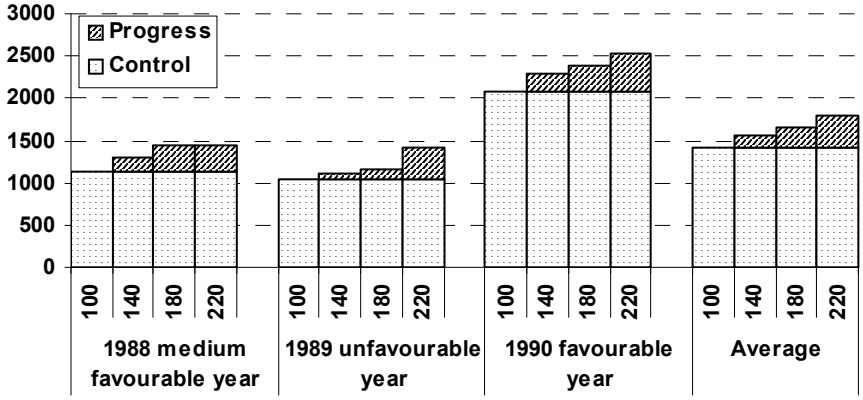

FIG. 2 INFLUENCE OF PLANT DENSITY ON RAW COTTON YIELD EARLINESS, A.R.D.S. TELEORMAN

The influence of sowing density on raw cotton yield earliness is presented in figure 2. As compared with the control density of 100000 pl/ha, the density increasing till 220000 pl/ha leads to the obtainment of some yield gains statistically ensured. On an average of these three testing years (1988-1990), the level of raw cotton early yield was of 1418-1793 kg/ha, increasing from the lowest to the highest sowing density. The yield gains obtained on a three years average were significant for the density of 140000 pl/ha (+147 kg/ha) and very significant for the densities of 180000 and 220000 pl/ha (+245 kg/ha and

375 kg/ha respectively) in comparison with control density of 100000 pl/ha.

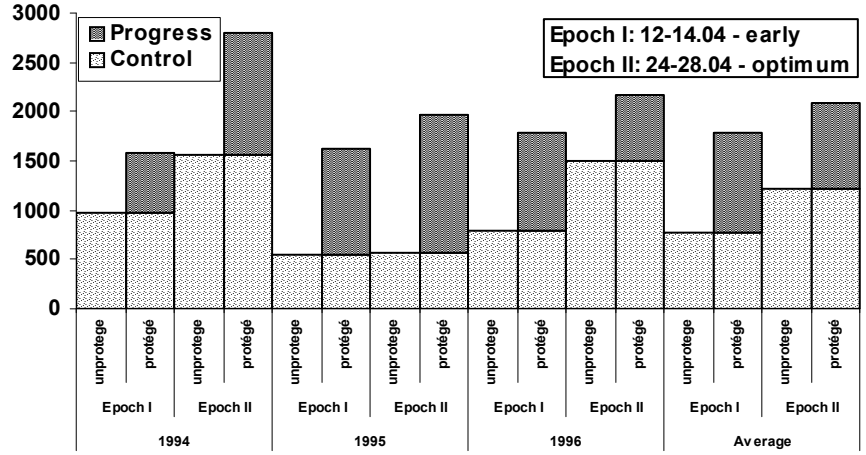

FIG. 3 INFLUENCE OF COTTON PROTECTION WITH PHOTODEGRADABLE SHEET ON RAW COTTON EARLY YIELD, A.R.D.S. TELEORMAN

The application of certain new technological measures led to the obtainment of some very good results regarding the level of early and even total raw cotton yield. So, the crop protection with photodegradable sheet compared with unprotected control, leads to the obtainment of some very significant early yield gains at both early and optimum sowing times: 621 kg/ha (64%) and 1241 kg/ha (80%) respectively in 1994; 1080 kg/ha (196%) and 1400 kg/ha (246%) respectively in 1995; 983 kg/ha (123%) and 673 kg/ha (45%) respectively in 1996. On a three years average, the yield gains vs. unprotected control were of 1004 kg/ha (1004%) in early sowing time and 872 kg/ha (72%) in optimum sowing time (Figure 3).

Table 2.1. Yields obtained by cotton cultivars and lines mechanically harvested, 1994-1996

Cultivar Line	Yield mechanically harvested (m_1)		Yield harvested from plant (m_2)		Yield harvested on the ground (m_3)		Total yield (m)	
	kg/ha	Diff.±	Kg/ha	Diff.±.	kg/ha	Diff.±.	kg/ha	Diff.±.
Brânceni control	1830	control	168	control	700	control	2698	control
Adelin	2160	+330	111	-57	384	-316	2655	-43
T-0575	2133	+303	143	-25	400	-316	2676	-12
T-08	2068	+256	123	-45	399	-300	2608	-90
LSD 5%		144		225		201		133
LSD 1%		218		386		305		208
LSD 0,1%		620		490		334		350

The rapid cotton harvesting leads to an adequate quality, being avoided the raw cotton degradation due to rainfall, hoarfrost, autumn frost (Tables 2.1; 2.2). The mechanical harvesting leads to the obtainment of 2608 – 2698 kg/ha and yield losses of 18-32% depending on cultivar.

The cotton germplasm reaction to the hydric and thermic stress from Brinceni, ARDS Teleorman was positive on a three years average (1999-2001), the average early yields (harvested till 30th September) being of 1700-1980 kg/ha, the weight of early yield from raw cotton total one being of 84-90% (Table 3).

Table 2.2. Yield mechanically harvested depending on cultivar and losses value (%) 1994-1996

Cultivar Line	% yield by mechanical harvesting (K_1)	% yield remained on plants (particles+whole capsule (K_2)	% yield remained on the ground after mechanical harvesting (K_3)	% losses $K_2+K_3/K_1+K_2+K_3x100$
Brânceni	67,9	5,2	25,9	32,1
Adelin	81,4	4,2	14,4	18,6
T-0575	79,7	5,3	15,0	20,3
T-08	80,0	4,7	15,3	20,0

$K_1 = m_1/m_2x100$; $K_2=m_2/mx100$; $K_3=m_3/mx100$
m = total quantity($m_1+m_2+m_3$);
m_1 = raw cotton quantity obtained by mechanical harvesting with 14HV-2,4A combine;
m_2 = raw cotton quantity remained on plant (particles+whole capsule);
m_3 = raw cotton quantity remained on the ground.

CONCLUSIONS

·During 1998-2001, the cotton has registered years with different favourability degrees for cultivation (1989 unfavourable year; 1988, 1996, 2001 middle favourable years; 1990, 1994, 1995 favourable years; 2000 very favourable year).

·Excepting, in 1995, the optimum sowing time of cotton could be considered 22nd-25th April period, with the highest yields of both early and total raw cotton no matter of cultivar. The late sowing (1st-4th May) leads to significant yield decreases no matter of cultivar.

·The plant density increasing from 160000 pl/ha till 220000 pl/ha leads to the obtainment of some statistically ensured yield gains. The plant density increasing up to 220000 pl/ha produces plant sterility.

·The utilization of photodegradable sheet to protect cotton field leads to the obtainment of some yield gains of 72 % in optimum sowing time and of 130% in early sowing time.

·The losses registered by mechanical harvesting were of 18.6-20.3% at “0-1” type cultivars.

·The germplasm reaction to hydric stress, registered during 1999-2001 was positive, the early yield level being of 1700-1980 kg/ha, representing 84-90% from total raw cotton yield.

REFERENCES

Brlan, I.M., 1974. Tehnologia culturii bumbacului. M.A.I.A., Redacюia revistelor agricole, Bucureєti, 21-22.

Bolteanu, G., 1993. Bumbacul. Fitotehnie, Ed. Ceres, Bucureєti, 2, 155-190.

Boreno, A., 1991. Cotton management for earliness in Spain. Plant Science, Sofia, XXVIII (2), 127-130.

Crrpinєan, T., 1984. Comunicrri privind cultura bumbacului. Instruire a cultivatorilor de bumbac, Brneasa.

Ceapoiu, N., 1968. Metode statistice aplicate on experienюele agricole єi biologice. Ed. Agro-Silvicr, Bucureєti.

Dimitrova, L.. 1986. Opredeliane na sroka za tretirrne na pamuka s preparati uskoriavrsci uzriavrneto. Rastenievrdni nauki, Plant Science, Sofia, XXVII (5), 56-62.

Nikolov, G., 1980. Izpitvrne na tesnoredove sgrsteni posevi pamuk pri nepolivni uslovia”, Rastenievrdni nauki, Plant Science, Sofia, XVII (1), 91-97.

Nikolov, G., 1984. Vlianie na nrprrvlenieto na redovete na poseva vrrhu razvitieto i dobiva na pamuka. Rastenievrdni nauki, Plant Science, Sofia, XXI (7), 65-71.

Table 3. Cotton germplasm reaction to hydric stress, ARDS Teleorman, Branceni center, 1999-2001

Cultivar Line	Cotton early yield																			
	1999					2000					2001					Average 1999-2001				
	kg/ha	Diff±	%	Sig nif	% from total yield	kg/ha	diff±	%	Sig nif	% from total yield	kg/ha	diff±	%	Sig nif	% from total yield	Kg/ha	diff±	%	Sig nif	% from total yield
Adelin	1780	+402	129	***	100	2208	-68	97		62	1660	+200	114	**	100	1883	+178	110		87
T-487	1718	+340	125	***	100	2638	+362	116	*	69	1583	+123	108	*	100	1980	+275	116	*	90
T-89	1696	+318	123	***	100	2221	-55	98	000	60	1550	+90	106		100	1822	+117	107		87
T-92	1416	+38	103		100	1771	-560	78	00	54	1560	+100	107		100	1582	-123	93		85
T-98	1620	+242	118	**	100	1815	-461	80	000	57	1595	+135	109	*	100	1677	-28	98		86
T-132	1838	+460	133	***	100	1680	-591	74	000	51	1581	+121	108	*	100	1700	-5	98		84
T-93	1793	+415	130	***	100	1452	-628	64		53	1495	+35	102		100	1580	-125	93		84
T-169	1678	+300	122	**	100	2398	+122	105		64	1562	+137	107	*	100	1879	+74	110		88
T-210	1984	+606	144	***	100	2083	-190	92		60	1538	+78	105		100	1868	+163	110		87
T-258	1691	+313	123	**	100	2202	-74	97		63	1626	+166	111	*	100	1840	+135	105		88
T-073	1893	+515	137	***	100	1955	-321	86		55	1581	+121	108	*	100	1810	+105	103		85
Brânceni	1378	Control	100		100	2276	Control	100		75	1460	control	100			1705	control	100		87
LSD 5 %		159	12				261	12				120	8				180	11		
LSD 1%		224	16				367	16				175	12				255	15		
LSD 0,1%		317	23				518	23				213	15				349	20		