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The use of local defoliants to enhance efficiency of defoliation in the condition of Uzbekistan

Shukhrat J. Teshaev, Fatulla J.Teshaev*

Cotton Selection,
Seed Production and Agrotechnology scientific research institute
111218, str. University 25, Tashkent, Uzbekistan
**Correspondence: email fathulla_1976@mail.ru*
ph. +998903483840, fax +998711421121

Absract

This study evaluated the effectiveness of local defoliants UzDEF, PoliDEF and FanDEF at various date (10-20%; 30-40 %; 50-60% of ripening of cotton bolls and after first harvest picked 70-80%) and norm and impact on lint yield in the condition of Uzbekistan. Upland cotton varieties Andijon-36, Bukhara-8, Khorezm-127 and Zarafshon were planted on second decade of Aprel each year of researches at the experimental stations of Bukhara, Khorezm and Samarkand regions. It should be pointed out, that while revealing the efficiency of local defoliants UzDEF, PoliDEF and FanDEF in different soil-climatic condition at boll ripening of 10-20%; 30-40%; 50-60% and after picking 70-80% of first harvest the best application time were at 30-40% and 50-60% bolls opening time.

Key words: cotton, defoliant, UzDEF, PoliDEF and FanDEF, boll ripening, falling of leaves.

Introduction

Upland cotton (*Gossypium hirsutum*L.) is the predominant crop in the agriculture system in Uzbekistan. It has played a major role in the country's economic development since the Soviet Union era (1926-1991). Uzbekistan is the world's seventh largest cotton producer with an annual raw cotton production of 3.5 million t in 2013 [1].

The growth and development as well as yield and quality of cotton, like many other plants, is directly related to the agrotechnological measures conducted in growing season.

It has been estimated that last years over 90% of the total Uzbekistan's cotton fields were treated with defoliants [2]. Defoliation is one of the major agrotechnological measure to get the higher yield and improve fiber quality. When determining the optimal time to defoliate cotton in Uzbekistan and a number of methods exist to determine crop maturity and readiness for defoliation.

It is known, that due to defoliation in plant happens some physiological and biochemical changes and decrease water provision of leaves as well as chlorofil and karotin syntheses. Consequency, decreases photosynthes intensivity and content of carbonats [3]. Abscission part of leaves forms with developing of seedlings, procedures with engaging of ferments oksidaza and piroxidasa enhance due to age of leaves [4]. This happens when number of cell increase in abscission part of leaves. If defoliation is done at optimal time and norm this natural procedures increase drop of leaves of cotton plant without damage to the quantity and quality of the yield [5].

Drop of cotton leaves carries out by destroying of hormons (auksin and etelen) balance. Defoliants cover auksin and don't allow to grow. The reason of drop of cotton leaves in this case increase of etelen compare to auksin [6].

Thus, for efficiency of defoliants there is relation with each soil-climatic condition, morpho-biological properties of varieties, agrotechnic measures to grow cotton as well as type of defoliants were studied at the beginning of previous century.

Defoliation allows producing an earlier harvest than if the cotton bolls matured naturally, but it can reduce the yield and deteriorate the fiber quality if the application is premature [7]. The efficacy of defoliation depends on properly agrotechnic measures in field and it can be achieved excellent efficiency by defoliation if there is enough stand densities in cotton field, fertilization, irrigation and other measures are done properly [8]. Determining the optimal time and norm for cotton defoliation is important to maximize yield and fiber quality while minimizing costs of inputs.

Since defoliation are broadly conducted in the cotton fields of Uzbekistan and significant part of defoliants are brought from abroad it is important to determine efficiency of local defoliant as well as study optimal time and norm of its application.

In this purpose, in 2012-2014 there were carried out the research to reveal an optimal norm and time of defoliation of new local Samara, UzDEF, PoliDEF and FanDEF defoliants (at the time of ripening 10-20%; 30-40 %; 50-60% and after first harvest picked 70-80%).

Material and methods

The researches were carried out at typical serosem soil of Bukhara and alluvial soils of Khorezm and Samarkand regions on upland cotton varieties Andijon-36, Bukhara-8, Khorezm-127 and Zarafshon. The researches were held on the basis of manual "Methods of Carrying out of Field Experiments" [9].

An efficiency of local defoliants UzDEF, PoliDEF and FanDEF were studied in different soil-climatic condition at various date of boll ripening 10-20%, 30-40%, 50-60% and after picking 70-80% of first harvest to reveal the best application time and norm.

Upland cotton varieties Andijon-36, Bukhara-8, Khorezm-127 and Zarafshon were planted on second decade of Aprel each year of researches at the experimental stations of Bukhara, Khorezm and Samarkand regions. The experimental design was a split plot with four replications of each of four defoliation timings. Each plot consisted of 12 rows, totalling 7.2 m wide by 30 m long. Conventional tillage was used as were standard cotton management practices for irrigation, fertilization and insect pest management. All agrotechnological measures were conducted at the same time and methods for entire field experimental plots, except defoliants type, norm and application date.

Defoliants were applied using a high clearance research sprayer. Before chemical defoliants were applied, crop maturity was assessed by measuring the percent bolls open on the plant. This value was calculated by first randomly selecting ten plants per plot and counting the total number of bolls per plant then dividing that number into the number of open bolls per plant. This measurement was repeated just prior to harvest.

Percent defoliation was measured 7 DAT and again at harvest using a visual rating system with zero equal to no defoliation and 100 equal to complete defoliation. The two center rows of each plot was harvested, weighed and ginned and lint yield and percent lint were determined.

Fiber quality measurements including color, leaf grade, micronaire, staple length, strength and uniformity were taken by the GOST. Mean values for each measurement were compared by analysis of variance (split plot with no pooled error) using the Agriculture Research Manager software.

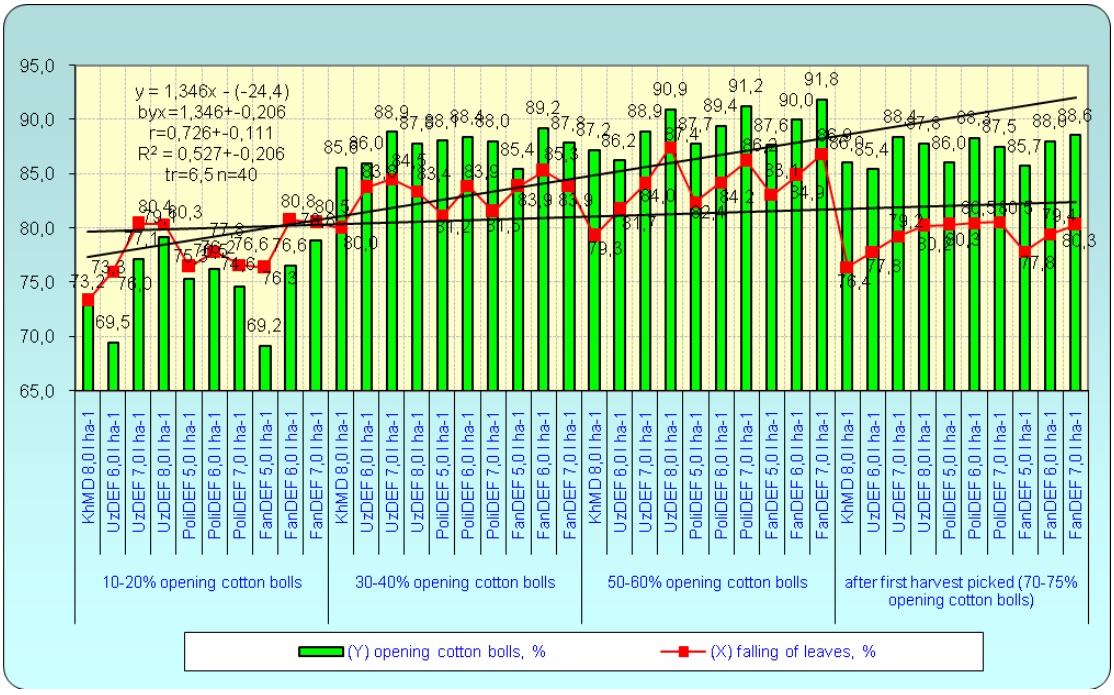
Results and discussion

It was determined that defoliation before the crop is mature may lead to reduced yields and fibre damage as well as low defoliation efficiency [10]. Defoliating too late can also result in poor fiber quality and increases cost of production. It is important to conduct a defoliation measures to pick up the cotton by the mashine. But in some countries defoliation are used to accelerate ripening of cotton bolls and provide ripening of bolls in same time.

Abdusattarov (2007) stated that optimal time of defoliation for upland cotton AN-Bayaut-2 variety is 35-40 days after of beginning ripening cotton bolls [11]. Gwathmey and Hayes (1997) pointed out that defoliation should be carried out when very young cotton bolls of upper branches are 30 days old and there will be no any damage to cotton yield and quality of fibre [12]. Our previous research revealed that the application of liquid KhMD at the norm 8,0 l ha^{-1} on Andijan-36 cotton variety cultivated in the condition of Tashkent region, Uzbekistan after 14 days the fallen leaves made up 80,0%, dehisced bolls made up 85,6% [13]. Some researchers revealed modern chemical defoliants increase fall of leaves, consolidate stay of matured bolls in branches and don't allow to regrowth of plants [14, 15]. Also, these chemicals positively influence mashin picking, boll diseases, damage of seeds and decrease of time of picking.

The use of thidiazuron defoliant at norm 100, 150 and 200 gram ha^{-1}, etrel defoliant 1,0 and 1,5 l ha^{-1}, and use of gramoksin defoliant after first harvest and use of etrel defoliant 1,5 l ha^{-1} had high number of bolls per plant [12]. These defoliants had no any negative influence to the seed and fibre qualities.

In our research highest results were taken from the variants used in UzDEF defoliant for 7,0 l ha^{-1}, PoliDEF and FanDEF for 6,0 l ha^{-1} doses at 30-40% boll opening, and UzDEF defoliant for 8,0 l ha^{-1}, PoliDEF and FanDEF for 7,0 l ha^{-1} doses at 50-60% boll opening without morpho-physiological properties of cotton these defoliants were more efficient than liquid KhMD defoliant.



1-picture. Correlation interrelation between falling of leaves and dehiscing of the bolls

The highest result with UzDEF defoliant were taken with application 7,0 l ha^{-1} dose and the fallen leaves made up 84,5%, dehisced bolls made up 88,9%. When PoliDEF defoliant was used in dose for 5.0-6.0-7,0 l ha^{-1}, the highest result were taken in the dose for 7,0 l ha^{-1} and fallen leaves made up 83,9%, dehiscing of the bolls made up 88,4%.

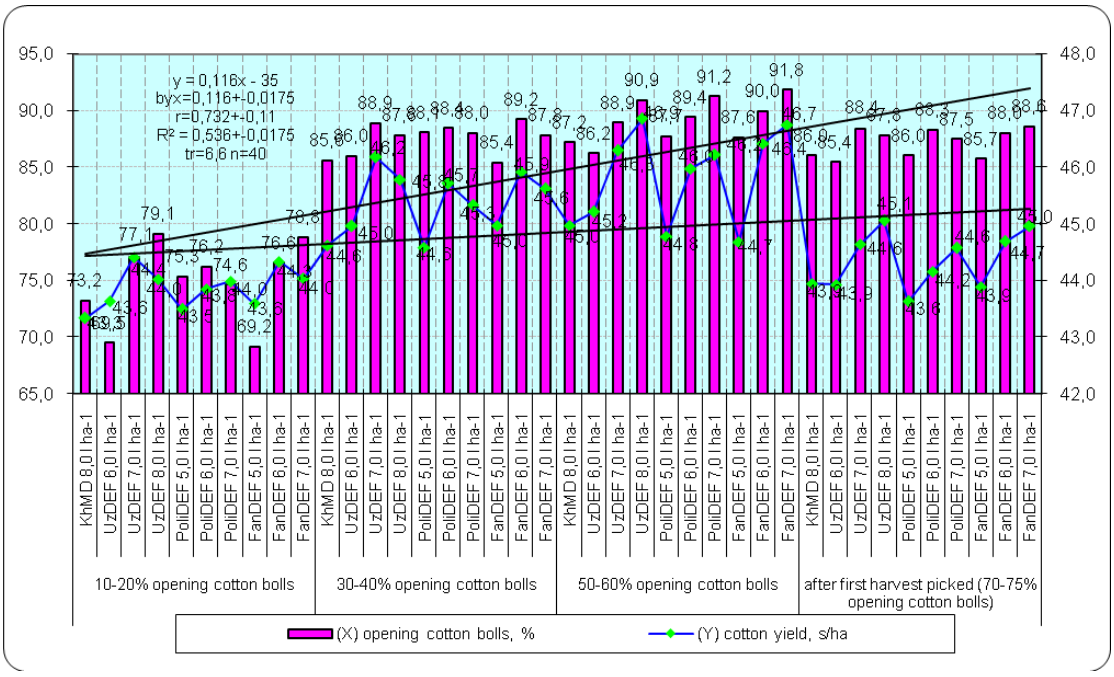
The researches with FanDEF defoliant doses 5,0-6,0-7,0 l ha^{-1} showed that the highest result was with application 7,0 l ha^{-1} and fallen leaves made up 85,3%, dehiscing of the bolls made up 89,2%. Defoliants were more efficient by using little higher norm when cotton bolls opened 50-60%. Because, at this time a moisture of soil and concentration of glucose in leaves will be decreased, and cotton leaves will be more thicker.

Cotton producer often face with challenges to spray defoliants in cotton grown in stress conditions [13]. Due to low moisture content in the soil and high air temperature cotton leaves fall in stress condition. Cotton grown in this condition has thicker leaves and utilization of defoliants to the leaves will be lower. To increase efficiency of defoliants it is recommended to use 10-20% additional norm of Dropp Leafless, Ginstar defoliants which have tidiazuron in its content.

In this mode both application of UzDEF defoliant 8.0 l ha^{-1}, PoliDEF and FanDEF defoliants 7.0 l ha^{-1} were efficient and fallen leaves made up 87,4-84,8-86,9%, opening of the bolls made up 90,9-91,2-91,8% respectively.

It is important to note that in both applications time there was noticed a correlation among falling of leaves and opening of the bolls. Thus, correlation coefficient r=0,903 ва R2=0,815, and its error level is equal Sr=0,177, regression among two indicator is byx=0,260, its error level is equalSbyx=0,051 (1-picture).

It was observed exactly this kind of rules and interrelation between the yield and dehiscing of the bolls. At the time of 30-40% dehiscing of the bolls the best defoliation norm was for UzDEF defoliant 7.0 l ha^{-1}, PoliDEF and FanDEF defoliants 6.0 l ha^{-1} and yield of the cotton was 46,2-45,4-46,2 sentner ha^{-1} respectively.



2-picture. Correlation between dehiscing of the boll and cotton yield

The best defoliation norm was for UzDEF defoliant 7.0 l ha^{-1}, PoliDEF and FanDEF defoliants 6.0 l ha^{-1} at the time of 50-60% dehiscing of the bolls and yield of the cotton was 46,9-45,9-46,9 sentner ha^{-1} respectively.

As pointed out there were revealed the correlation relations between dehiscing of the bolls and yield of the cotton and correlation coefficient was equal r=0, 795 ва

R2=0,631, and its error level was equal Sr=0,156, regression among two indicator is byx=0,146, its error level was equal Sbyx=0,0286 (2-picture).

Impact of defoliants to cotton yield, (2012-2014 y)

№	Name of defoliants	Norm L ha-1	Years			Cotton yield	Differences from control	1-harvest share	
			2012	2013	2014			Sentner ha-1	%
30-40% dehiscing of the bolls									
1	Control	-	36,0	47,0	47,5	43,5		31,5	72,5
2	Liquid ChMD	8,0	37,3	48,4	48,2	44,6	1,1	37,9	85,0
3	UzDEF	6,0	37,4	48,5	49,0	45,0	1,5	39,9	88,7
4	UzDEF	7,0	38,7	49,5	50,3	46,2	2,7	42,1	91,2
5	UzDEF	8,0	38,3	49,2	49,8	45,8	2,3	41,1	89,9
6	PoliDEF	5,0	37,0	47,9	48,8	44,6	1,1	39,3	88,1
7	PoliDEF	6,0	37,8	49,7	49,6	45,7	2,2	41,5	90,9
8	PoliDEF	7,0	37,6	49,1	49,2	45,3	1,8	41,0	90,6
9	FanDEF	5,0	37,4	48,7	48,8	45,0	1,5	39,8	88,6
10	FanDEF	6,0	38,9	49,4	49,4	45,9	2,4	41,9	91,3
11	FanDEF	7,0	38,4	49,2	49,2	45,6	2,1	41,1	90,2
50-60% dehiscing of the bolls									
1	Control	-	36,3	46,7	48,0	43,7		31,9	73,0
2	Liquid ChMD	8,0	37,8	48,8	48,3	45,0	1,3	38,3	85,2
3	UzDEF	6,0	37,6	48,6	49,4	45,2	1,5	40,8	90,2
4	UzDEF	7,0	39,5	49,7	49,7	46,3	2,6	42,8	92,6
5	UzDEF	8,0	39,7	49,9	51,0	46,9	3,2	43,7	93,1
6	PoliDEF	5,0	37,2	48,1	49,0	44,8	1,1	40,3	90,0
7	PoliDEF	6,0	38,3	49,3	50,3	46,0	2,3	42,0	91,4
8	PoliDEF	7,0	38,5	49,6	50,5	46,2	2,5	42,3	91,5
9	FanDEF	5,0	36,9	48,5	48,6	44,7	1,0	40,1	89,8
10	FanDEF	6,0	39,5	49,6	50,1	46,4	2,7	43,2	93,0
11	FanDEF	7,0	39,7	49,8	50,7	46,7	3,1	43,5	93,1

The efficient norm of defoliating and increase of cotton yield were at the time 30-40% or 50-60% opening cotton bolls for local defoliants UzDEF 7,0-8,0 l ha^{-1} and for PoliDEF and FanDEF was 6,0-7,0 l ha^{-1} in Tashkent, Samarkand, Bukhara and Khorazm regions for cultivating upland cotton varieties Andijan-36, Oqdaryo-8, Bukhara-8 and Khorazm-127.

Conclusion

According to the above mentioned results, for management an efficient artificial defoliation and to pick up cotton yield in short period for cultivating upland cotton varieties Andijan-36, Oqdarya-8, Bukhara-8, and Khorazm-127 it is recommended application of UzDEF defoliant 7,0 l ha^{-1} at the time of 30-40% opening cotton bolls, PoliDEF and FanDEF defoliants 6,0 l ha^{-1} at the time of 50-60% opening cotton bolls in the condition Tashkent, Samarkand, Bukhara and Khorazm region of Uzbekistan.

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