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Effect of defoliants and fertilizers on yield and quality of upland cotton (*Gossypium hirsutum* L.)

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ABSTRACT : Cotton yield and fibre quality were significantly enhanced by various doses of defoliants application and different norm of fertilisers. The results of the study indicated that application of Avguron-extra defoliant at 0.25 l/ha increased seed cotton yield and fibre quality traits. It was concluded that to produce higher cotton yield with best fibre quality of new upland cotton variety Bukhara 2 defoliant Avguron-extra 0.25 l/ha should be applied with mineral fertilization $N_{250}Ð_{175}Ê_{125}$ kg/ha in soil climatic condition of Tashkent region, Uzbekistan.

Key words: Cotton variety, cotton yield, defoliant norm, fibre quality, mineral fertiliser

Defoliation can facilitate early ripening of cotton and increases the yield as well as improves fibre quality. It has been estimated that last years over 90 per cent of the total Uzbekistan's cotton fields were treated with defoliants.In order to conduct an effective defoliation, it is important to consider the biological development of cotton in a field, also plant density, irrigation norm, nutritional condition are important factors to provide efficiency of defoliation.Many new cotton varieties are being introduced to agricultural production and it is clear that those varieties requires specific agrotechnological approaches as well as defoliation measures.

Defoliation allows to produce an earlier harvest than if the cotton bolls matured naturally, but it can reduce the yield and deteriorate the fibre quality, if the application is premature (Snipes and Baskin, 2004; Sindarov, 2007). There is also, increasing interest in the use of mineral fertilisers to produce an adequate crop yield in cotton farms of Uzbekistan.

The objectives of this research was to determine the effect of different defolians(KhMD; Sadaf; Drop ultra and Avguron-extra)and mineral fertilisers to the yield and fibre quality traits of new upland cotton variety Bukhara 2 in the typical serosem soil condition of Tashkent region.

MATERIALS AND METHODS

Field researches were carried out at Central Experimental field, Scientific Research Institute during 2009-2011 on an irrigated cotton at the Central Experimental Station of Uzbekistan Cotton Research Institute. The experimental design was constructed as 8 treatments, including one control and 7 combinations of defoliants and three different norm of fertilisation ($N_{150}Ð_{100}Ê_{75}$kg/ha; $N_{200}Ð_{140}Ê_{100}$kg/ha and $N_{250}Ð_{175}Ê_{125}$kg/ha), with 3 replications across 72 experimental plots in a randomized complete block design. Each plot contains 8 rows 60 sm width and 10 m long. During the growing season all agrotechological measures were exactly same for all plots except defoliation and fertilization norm on appropriate plots.

The seeds of (*Gossypium hirsutum* L.) Bukhara 2 were taken from Republican Seed Control Station located in Tashkent region. Sowing was done in early April of all experiment years after addition of adequate phosphorous and potassium fertilisers. Irrigations were scheduled when soil water in the root zone was depleted to specific fractions of FC, *e.g.*, for each of 3 main plant growth periods (squaring, flowering and maturation).

RESULTS AND DISCUSSION

In cotton production, good fertilization and defoliation management ensures proper availability of nutrients for high quality yield and early ripening. Michelotto *et al.,* (2013) revealed that the early defoliation negatively affected all components of agronomic traits, on the contrary using defoliants on timely manner and recommended dose were improved the yield and fibre quality. Prior to start defoliation process, were analysed biological condition of cotton, during experimental years. Height of main stem was on the average 67.0-96.5-98.2 sm, green leaves 35.1-36.2-36.6, bolls 7.4-9.7-12.3, percentage of ripened bolls were 46.2-47.0-48.4 when optimal irrigation mode were (70–70–60% of FC) of, and fertilization $N_{150}Ð_{100}Ê_{75}$ kg/ha. The plant growth and development gradually enhanced with increasing norm of mineral fertilisers. Teshaev(2007) found optimal defoliation norm to the cotton plant stimulates comprehensive physiological processes in plant tissue which caused to utilise enough amount of nutrients and increased the seed weight.

As depicted in Table 1, analysis of variance indicated that cotton yield was significantly affected by defoliant application along with different fertilization norm.All the treatments showed better performance as compared to control.The higher cotton yield was observed at application Avguron extra 0.25 l/ha when associated with mineral fertiliser $N_{250}Ð_{175}Ê_{125}$ kg/ha. Significantly higher seed cottonyield was recorded with other treatments Avguron-extra and Sadaf defoliants.

According to researches of Sindarov (2008) upland cotton variety S 6524 was grown by irrigation mode 1-3-1 and application defoliation Sardor 7.0 l/ha norm ensured high quality of cotton, and increased oil and protein content of seed. Awan *et al.,* (2012) reported that defoliant application can accelerate boll maturity and crop can be harvested considerable earlier than without defoliation.

In the experiments mineral fertiliser increase significantly affected the traits *i.e.* bolls/ plant, boll weight, cotton yield and some fibre quality traits (Table 1 and 2).The result was also confirmed that without sufficient mineral fertilizers plants could not achieve optimum growth and yield and also the defoliation efficiency might be less effective.Defoliation norm and chemical fertilisers aid impacted significantly on fibre length and fibre fineness Table 2.

Defoliant types and fertilization norm also had a positive impact on various fibre quality characteristics. There were non significant differences for fibre fineness quality among the whole treatments but other fibre quality indicators like fibre strength and fibre elongation significantly improved by optimal defoliation and fertilization norm (Table 2). Similar results have been reported by Sindarov (2008), Teshaev (2007).

For the first picking percentage showed consirable differences among the treatments, defoliant Avguron extra was more efficient than the other defoliants, but second picking percentage resulted in significant increase in control and KhMD as compared to other treatments Avguron extra defoliants could increase first picking percentage as well as cotton fibre quality.

It can be seen that in Table 2, there were significant differences for fibre sort and fibre fineness in all treatment of defoliation depending fertilization norm. Also, percentages of fibre belong to the high sorts, also increased with increase of fertilization norm. The result of this study confirm to Sindarov (2007) reported that defoliation norm has the positive impact on the fibre strength, staple length and length uniformity. For fibre reflectance there were non significant differences. Significant differences were found among the treatments for fibre uniformity, fibre strength and slightly increased by increasing of fertilization norm.

Therefore, information about determining the optimal defoliation norm is useful for cotton producers. From this study, it was observed that optimal defoliation norms was 0.25 l/ha Avguron extra. Mineral fertilization and defoliant material can be applied and this

Table 1. Cotton yields during 2006 to 2008

	Defoliants	Defoliation norm, l/ha	(Cotton yields, q/ha) 2006	2007	2008	**Average**	Difference
$N_{150}Đ_{100}Ê_{75}$kg/ha							
1	Control	-	41.2	30.7	39.5	**37.1**	
2	KhMD	10.0	41.5	31.2	39.5	**37.4**	0.3
3	Sadaf	7.0	42.6	32.0	40.3	**38.3**	1.2
4	Sadaf	8.0	42.4	31.8	40.1	**38.1**	1.0
5	Dropp-ultra	0.5	42.1	32.4	40.7	**38.4**	1.3
6	Avguron-extra	0.15	43.5	32.6	40.9	**39.0**	1.9
7	Avguron-extra	0.20	43.1	32.5	40.8	**38.8**	1.7
8	Avguron-extra	0.25	42.8	32.4	40.7	**38.6**	1.5
$N_{200}Đ_{140}Ê_{100}$kg/ha							
9	Control	-	44.4	34.6	41.8	**40.3**	-
10	KhMD	10.0	44.9	34.6	41.9	**40.5**	0.2
11	Sadaf	7.0	45.4	35.2	42.5	**41.0**	0.7
12	Sadaf	8.0	46.2	35.4	42.7	**41.4**	1.1
13	Dropp-ultra	0.5	45.8	36.0	43.3	**41.7**	1.4
14	Avguron-extra	0.15	46.3	36.1	43.4	**41.9**	1.6
15	Avguron-extra	0.20	46.9	36.4	43.7	**42.3**	2.0
16	Avguron-extra	0.25	46.7	35.9	43.2	**41.9**	1.6
$N_{250}Đ_{175}Ê_{125}$kg/ha							
17	Control	-	44.6	34.5	42.0	**40.4**	-
18	KhMD	10.0	45.0	35.4	42.7	**41.0**	0.6
19	Sadaf	7.0	45.4	35.8	43.1	**41.4**	1.0
20	Sadaf	8.0	46.2	36.0	43.3	**41.8**	1.4
21	Dropp-ultra	0.5	45.8	36.3	43.6	**41.9**	1.5
22	Avguron-extra	0.15	46.5	36.1	43.4	**42.0**	1.6
23	Avguron-extra	0.20	46.8	36.3	43.6	**42.2**	1.8
24	Avguron-extra	0.25	47.0	36.8	43.8	**42.5**	2.1

2006-yearSD_{05}= 0,68 q/ha**; 2007-yearSD_{05}= 0,97** q/ha**; 2008-yearSD_{05}= 0,98** q/ha

material did not had and detrimental effect on cotton yield and quality. Field studies have shown that defoliation applications made significantly early to mature cotton bolls.Some authors have declared that defoliation at too high an application rate can actually reduce the total number of fruiting sites, and therefore, lint yields (Abdusattarov, 2007). This is particularly true in situations where early and mid season fruit retention is good, which exerts some measure of control of vegetative growth. Plant growth measurements used in assessing relative vigor and fruit retention measurements can pay off unneeded or excessive applications and potential negative impacts.

Although there appeared to be a significant positive effect between defoliation and the mineral fertilization norm of cotton plant during growing season. The study has revealed that it may be possible to predict, with fair accuracy, the susceptibility of a cotton field to chemical defoliation by making an assay of the norm of mineral fertilisers. In summarizing the research that the most consistent improvements in yields in Experimental station studies have been with applications of Avguron extra (0.25 l/ ha); and the most effective fertilization application rates have been $N_{250}Đ_{175}Ê_{125}$kg/ha, with rates adjusted based upon relative plant vigor. The findings showed that optimal defoliant and fertilization norm caused 10-15 days early boll ripening as compare to control.

CONCLUSIONS

Highest norm of defoliants should be applied to provide efficiency of defoliants when leaf area is also high. Most effective application

Table 2. Cotton fibre quality parameters (2008 year)

	Fibre output (%)		Fibre sort		Fibre strength (ã/êã)		Fibre length (ì/òåêñ)		Fibre fineness		Fibre uniformity index, (ãê/òåêñ)	
	I	II	I	II	I	II	I	II	I	II	I	II
$N_{150}Ð_{100}Ê_{75}$kg/ha												
1 Control	37.3	37.2	I	II	4.4	4.3	178	172	1.9	1.9	24.7	25.0
2 KhMD	37.3	37.0	I	II	4.4	4.1	178	170	1.9	1.8	24.7	24.1
3 Sadaf	37.7	37.4	I	I	4.5	4.3	179	174	2.0	1.9	25.1	24.7
4 Sadaf	37.4	37.0	I	I	4.4	4.2	178	173	1.9	1.9	24.7	24.3
5 Dropp-ultra	37.8	37.2	I	I	4.4	4.3	176	174	1.9	1.9	25.0	24.7
6 Avguron-extra	38.7	37.5	I	I	4.5	4.3	179	175	2.0	2.0	25.1	24.6
7 Avguron-extra	38.7	37.3	I	I	4.4	4.3	178	174	2.0	1.9	24.7	24.7
8 Avguron-extra	38.7	37.0	I	I	4.4	4.2	175	173	2.0	1.9	25.1	24.3
$N_{200}Ð_{140}Ê_{100}$kg/ha												
9 Control	38.1	37.9	I	II	4.4	4.3	178	173	1.9	1.9	24.7	24.9
10 KhMD	38.2	37.2	I	II	4.4	4.2	177	171	1.9	1.9	24.9	24.6
11 Sadaf	38.4	37.4	I	I	4.3	4.3	176	172	2.0	1.9	24.4	25.0
12 Sadaf	38.7	37.6	I	I	4.5	4.3	180	174	2.0	1.9	25.0	24.7
13 Dropp-ultra	38.8	37.5	I	I	4.5	4.3	180	174	2.1	1.9	25.0	24.7
14 Avguron-extra	38.8	37.7	I	I	4.5	4.3	178	175	2.1	1.9	25.3	24.6
15 Avguron-extra	39.0	37.8	I	I	4.5	4.4	181	176	2.1	2.0	24.9	25.0
16 Avguron-extra	38.4	37.6	I	I	4.5	4.3	178	175	2.0	1.9	25.3	24.6
$N_{250}Ð_{175}Ê_{125}$kg/ha												
17 Control	38.2	37.7	I	II	4.4	4.3	179	174	2.0	1.9	24.6	24.7
18 KhMD	38.2	37.0	I	II	4.4	4.1	179	172	2.0	1.9	24.6	23.8
19 Sadaf	38.2	37.3	I	I	4.5	4.3	180	173	2.0	1.9	25.0	24.9
20 Sadaf	38.7	37.5	I	I	4.5	4.3	181	174	2.0	1.9	24.9	24.7
21 Dropp-ultra	38.7	37.5	I	I	4.6	4.4	180	174	2.1	1.9	25.6	25.3
22 Avguron-extra	38.7	37.0	I	I	4.6	4.2	180	172	2.0	1.9	25.6	24.4
23 Avguron-extra	38.7	37.5	I	I	4.5	4.4	180	173	2.0	1.9	25.0	25.4
24 Avguron-extra	39.3	37.7	I	I	4.5	4.4	181	174	2.1	1.9	24.9	25.3

rates of defoliants were Avguron extra (0.25 l/ha) in new upland cotton variety Bukhara 2 depending on agrotechnology during vegetation period and fertilization norm should be $N_{250}Ð_{175}Ê_{125}$ kg/ha at plant density 90-100 thousand/ha.

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