academicJournals

Vol. 12(33), pp. 5117-5130, 14 August, 2013
DOI: 10.5897/AJB11.1785
ISSN 1684-5315 ©2013 Academic Journals
http://www.academicjournals.org/AJB

African Journal of Biotechnology

Full Length Research Paper

An evaluation of some mutant cotton (*Gossypium hirsutum* L.) varieties from Azerbaijan in Southeast Anatolian region of Turkey

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Accepted 2 October, 2012

The aim of this study was to determine seed cotton yield, yield components and fiber technological properties of four mutant cotton varieties from Azerbaijan (Agdas-3, Agdas-6, Agdas-7 and Agdas-17) and three local standard varieties (Maras-92, Sayar-314 and Stoneville-453) belonging to *Gossypium hirsutum* L. The study was carried out at the experimental field of Koruklu Agricultural Research Station in Sanliurfa Province (Akcakale-Harran Plain) in the South-east Anatolian Region of Turkey. The trial was established in randomized block design with four replications in four years (2001 to 2004). In the study, plant height, monopodia, number of sympodia and boll, weight of seed cotton per boll, ginning outturn, 100 seed weight, seed cotton yield, earliness ratio, fiber length, fiber fineness, strength and uniformity were investigated. According to the results of four years' trials, the varieties, in all investigated characters except fiber fineness, strength and uniformity and year x variety interactions for plant height, number of bolls per plant, seed cotton yield and first harvest ratio, were found to be significant. The highest sympodial number was taken from Agdas-3 variety (13.79), the highest number of boll per plant was taken from Agdas-17 (15.41) and the highest seed cotton weight per boll was taken from Agdas-7 (5.54 g). All Agdas varieties had less ginning outturn than local standard varieties. The highest seed cotton yield was obtained from Agdas-17 (3654.2 kg ha^{-1}), followed by Agdas-3 (3593.8 kg ha^{-1}). All Agdas varieties had more seed cotton yield than standards except Agdas-7. Among Azerbaijan varieties, Agdas-3 was the earliest maturing variety with 81.3% of first harvest ratio. All investigated varieties were similar to each other in fiber technological properties. In conclusion, it can be said that among Azerbaijan varieties, Agdas-17 and Agdas-3 had higher seed cotton yield than local standard varieties, and they are the most hopeful varieties for Southeast Anatolian Region.

Key words: Cotton, *Gossypium hirsutum* L., seed cotton yield and fiber technological properties.

INTRODUCTION

Increase in world population and high living standards are raising demand of natural fibers, particularly cotton lint. Cotton is an important fiber crop in the world. Its seed is an important raw material in oil and forage industries due to the high percentage of the seed oil and protein.

Cotton sowing area is about 33.9 million ha., and cotton lint production is 25.5 million tonnes in the world (Anonymous, 2012). Approximately, 80% of the world production is supplied by 8 countries such as China, India, USA, Pakistan, Brazil, Uzbekistan, CFA and Turkey. Turkey has 542 000 ha. sowing area, 2 580 000 tonnes of cotton seed, 954 600 tonnes of cotton lint and 1760 kg ha^{-1} lint yield (Anonymous, 2011).

In Turkey, cotton is grown on a large scale in Southeast Anatolian, Mediterranean and Aegean Regions. Cotton sowing areas were 313.9 thousand ha in Southeast

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Anatolian Region, 129.9 thousand ha in Mediterranean Region and 96.7 thousand ha in Aegean Region (Anonymous, 2011). In recent years, South east Anatolian Region has become the most important cotton production region of Turkey in terms of sowing extent and production quantity. 53.6% of total domestic cotton production has been supplied from this region. It has been estimated that cotton sowing areas will increase much in parallel to increasing of irrigated fields.

Production increase in Southeast Anatolian Region resulted from incease in sowing area and yield per unit area. In recent years, lint yield in this region has risen to the lint yield level of the other cotton growing regions due to use of higher yield, quality cultivars and increasing of irrigated area.

Yield, yield components and fiber technological traits in cotton can vary depending on the genotypic structure of cultivar, environmental conditions and growing techniques (Murray and Verhalen, 1970; Meredith and Bridge, 1973; Meredith, 1990; Brown, 1991).

Begum and Hossain (2011) evaluated twelve advanced cotton genotypes with a standard variety at Central Cotton Research, Training and Seed Multiplication Farm, Sreepur, Gazipur, Bangladesh during 2006 to 2007. They reported that significant differences among the genotypes were observed for different characters. The genotypes, SR-05 and SR-12, produced the highest cotton seed yield (2634.73 and 2632.59 kg ha^{-1}). The genotypes, SR-05 (56.03 g) and CB-9 (56.57 g), produced the highest average weight of cotton seed per ten bolls.

Ashokkumar and Ravikesavan (2011) conducted a field experiment to find out the morphological diversity and performance per se of yield component traits, yield, and a fiber quality traits of eleven cotton genotypes (*Gossypium hirsutum* L.) during 2005 to 2006. Significant differences were recorded for all the fourteen traits observed. Researchers reported that the cultivar, MCU 12, produced maximum yield (95.33 g plant $^{-1}$) due to more number of sympodia (24.11 plant $^{-1}$), number of bolls (25.17 plant $^{-1}$), boll weight (4.20 g), ginning outturn (35.43%), lint index (6.12 g) and seed index (10.44 g).

Long et al. (2010) conducted two field experiments to asses the fiber quality and yarn performance of Australian bred cotton (five *G. hirsutum* L. and one *G. barbadense* L.) genotypes. The strongest yarns were produced using genotypes with the longest and finest fiber. They noticed that *G. hirsutum* L. breeding lines CHQX12B and CHQX377 each had micronaire values of 4.4; but CHQX377 spun stronger yarns due to its finer and more mature fiber.

Karademir et al. (2010) carried out the study from 2007 to 2008 on cotton growing season at Southeastern Anatolia Research Institute in Diyarbakir, Turkey, in order to determine the relationship between yield, fiber length and other fiber related traits in advanced cotton strains, derived from a cotton breeding program. In the study, nine advanced cotton strains and two check varieties were used as plant materials. Researchers reported that the advanced cotton strains had significant differences in terms of the investigated characteristics when compared to the check varieties. The highest cotton seed yield (4087.0 kg ha^{-1}) and fiber yield (1632.2 kg ha^{-1}) were obtained from 'SET-34' cotton strain which had acceptable fiber quality properties.

Singh et al. (2008) conducted a field experiment in Bathinda, Punjab, India, during the spring- summer season of 2005 to 2006 to evaluate the feasibility of growing cotton genotypes in the spring-summer season. Researchers revealed that the highest number of monopodial branches (2.8 per plant) was observed in PIL-8, whereas the highest number of sympodial branches (29.4) and total numbers of boll per plant (33.2) were found in LH-2074.

Mahmood et al. (2007) tested new candidate varieties/strains of cotton (*G. hirsutum* L.) from different research stations/institutes for their yield performance. They reported that cotton seed yield of VH-142 was the highest with 5417 kg ha^{-1} having 52.1 bolls per plant with maximum value, as compared to the other lines. DNH-57 and NIAB-999 remained second and third with 5234 and 5095 kg ha^{-1} cotton seed yield, respectively. BH-160 and CRIS-467 were found to be second and third highest boll bearing varieties with an average of 51.0 and 40.2 bolls plant $^{-1}$, respectively.

Copur (2006) carried out a study during 2000 and 2001 growing season in Sanliurfa Province, Southeastern Anatolia Region of Turkey, to determine the yield, yield components and fiber technological traits of some cotton (*G. hirsutum* L.) cultivars. Fifteen cotton cultivars were used to determine the higher yielding cultivars. They noticed that cotton seed yields varied between 1884 and 4322 kg ha $^{-1}$ and statistical significant differences were determined among cultivars in all the observed characters. Also, they reported that Stoneville-453 was the highest yielding cultivar just ahead of Sayar-314 under irrigated conditions in Southeastern Anatolia Region of Turkey.

Begum et al. (2005) investigated performances of one advanced line encoded SR-05 with three other existing Cotton Development Board (CDB) varieties namely CB-1, CB-5 and CB-9 at four SDB research stations of Bangladesh during 2004 to 2005. They reported that significant variations among the line and varieties were observed for number of vegetative branches per plant, nod number of first fruiting branches, days to first flowering, days to first boll split and cotton seed weight per boll. Although, they also noticed that primary fruiting branches, secondary fruiting branches, number of bolls per plant, plant height at harvest, and cotton seed yield did not show any significant differences.

Hanif et al. (2005) evaluated the performance of 15 candidate cotton genotypes against that of three commercial cultivars in Multan, Pakistan, during 2003 to 2004. CIM-496 (4629 kg ha^{-1}), CIM-506 (4622 kg ha^{-1}),

IR-CIM-448 (4294 kg ha^{-1}), BH-160 (4184 kg ha^{-1}) and MNH-700 (4072 kg ha^{-1}) had higher yields than commercial cultivars [CIM-473 (3782 kg ha^{-1}), CIM-499 (3687 kg ha^{-1}) and FH-1000 (3352 kg ha^{-1})]. CIM-707 produced the tallest plants (159 cm). CIM-506, BH-160 and CIM-496 recorded the highest number of bolls per plant (59, 58 and 54 respectively).The greatest boll weight was recorded for CIM-497 (4.6 g). Researchers noticed that CIM-496, CIM-506 and BH-160 were superior among the evaluated genotypes and were recommended for cultivation in Multan.

Soomro et al. (2005) compared the yield and yield components of six commercial cotton cultivars in an experiment conducted in Multan, Pakistan during 2004 cotton season. They revealed that the cultivars were statistically similar for boll weight and cotton yield per plant of second pick at 120 days after planting (DAP). The cultivars statistically showed significant differences for cotton yield per plant of first pick at 90 DAP, cotton yield per plant of third pick at 150 DAP, number of bolls per plant and cotton yield per hectare. The mean performance of genotypes ranged from 11.22 to 25.85 for bolls per plant, from 3.07 to 3.30 g for boll weight, from 1.50 to 8.80, 7.91 to 13.57 and 19.59 to 63.89 g for cotton yield per plant of first pick at 90 DAP, second pick at 120 DAP and third pick at 150 DAP, respectively; while the range recorded for cotton yield per hectare was 1424 to 3393 kg ha $^{-1}$.

Basbag and Temiz (2004) conducted a study in Diyarbakir, Turkey, in 2001 to 2002, involving cotton lines and cultivars. They reported that Ogosta 644 had the greatest plant height (90.44 cm) followed by green fibered line (90.28 cm); and Beliizvor 432 (89.46 cm) and Sayar-314 had the highest number of bolls (22.00 per plant), ginning percentage (39.45%) and cotton seed yield (3907.5 kg ha^{-1}). They also noticed that Beliizvor, green fibered line and Sayar-314 recorded the best results for fibre length (30.02 mm), fiber fineness (2.87 mic.) and fiber strength (33.41 g tex^{-1}) compared with the other cultivars and lines.

Arshad et al. (2003) evaluated the performance of new cotton strains, along with a commercial cultivar in Multan, Pakistan, during 1997 to 1998 and 1998 to 1999. They reported that the highest cotton seed yield (3026 kg ha^{-1}) was recorded with CIM-433 followed by CIM-435 (2896 kg ha^{-1}). The longest stapel (28.13 mm) was recorded in CIM-435 followed by CIM-443 (26.43 mm). Researchers also reported that CIM-443 was significantly the best in ginning outturn percentage (37.98%) and number of bolls per plant (36.00) followed by CIM-435. Boll weight was highest (4.34 g) in CIM-435.

Wondimu (2000) tested a set of 12 cotton (*G. hirsutum* L.) genotypes during the main growing season, from 1985 to 1990 at Abobo, Ethiopia, which is characterized by low elevation (530 m above sea level) and a sub-humid climate. They noticed that combined analysis of yield data indicated significant differences among genotypes and environments. Genotype-environment interaction was highly significant, indicating differential performance of the cultivars in an array of environments.

In this study, cultivars of Agdas-3, Agdas-6, Agdas-7 and Agdas-17 (*G. hirsutum* L.) brought from Azerbaijan were compared with local standard cultivars of Sayar-314, Maras-92 and Stoneville-453 and their adaptations were evaluated taking into consideration cotton seed yield, yield components and fiber technological properties.

MATERIALS AND METHODS

In this study, seven cotton (*G. hirsutum* L.) varieties were used. Four of these (Agdas-3, Agdas-6, Agdas-7 and Agdas-17) were early maturing mutant varieties created in Azerbaijan by using mutation method of 1975 to 1990. The other three (Sayar-314, Maras-92 and Stoneville-453) were local standard varieties (std) in the Sanliurfa Province in Southeast Anatolian Region of Turkey. Some agronomical and technological characteristics of the varieties tested are given in Table 1.

The study was conducted in 2001 to 2004 at the Koruklu Agricultural Research Station's experimental field in Akcakale-Sanliurfa Province, based on randomized block design with four replications.

Soil properties of the experiment location

The experiment location is flat or nearly flat, generally deep and has much lime, heavy texture and clay structure. Organic matter (0.09 to 0.4%) and salt content are too low, cation exchange capacity is high, pH of the soil varies from 7.4 to 7.6 (Dinc et al., 1988). Physical and chemical properties of the experiment location soil are given in Table 2.

Climatic properties of the experiment location

Sanliurfa Province is located in Akcakale-Harran Plain, in the South east Anatolian Region of Turkey (38°56′ N 36°41′ E) and has Mediterranean climatic conditions. In Harran Plain, yearly average temperature is 17.1°C, average rainfall is 369.3 mm and average relative humidity is 49% according to a long time data. Generally, average temperature exceeds 30°C in July and August and the highest temperature is 46.8°C in July in this plain. Rainfall is experienced mostly in winter and it does not rain between June and September. Relative humidity reduces in summer and, in July, the average relative humidity is 32% while total evaporisation is 2061.7 mm (Anonymous, 2005). Some of the climatic data of the experiment location (Akcakale-Harran Plain, Sanliurfa) in 2001 to 2004 cotton seasons are given in Table 3.

Previously, maize and wheat were grown in 2001 to 2002 and 2003 to 2004, respectively. After harvesting of previous crops, experimental field was plowed deeply and cultivated in winter twice using cultivator shallow depending on weeds. Before sowing, the experimental field was again tilled using cultivator shallow, and it was harrowed two times. And then, seed bed was prepared.

The seeds were sown by experimental mechanical planter in four-row plots of 12 m length at a row space of 70 cm in 27 April, 2 May, 8 May and 11 May in 2001, 2002, 2003 and 2004, respectively. Later, germinated plants were thinned to 20 cm within row twice. During the growing season, plants were hoed three times

Table 1. Some agronomical and technological characteristics of the varieties tested.

Variety	Sowing-first boll opening duration (day)	Plant height (cm)	Seed cotton yield (kg ha^{-1})	Seed cotton weight per boll (g)	100 Seed weight (g)	Ginning outturn (%)	Fiber length (mm)	Fiber fineness (micro-naire)	Fiber strength (g tex^{-1})
Agdas-3	112	95-100	3410	6.0	11.2	37.5	33.5	4.9	29.3
Agdas-6	119	90-95	3870	5.8	11.0	37.0	32.6	4.8	28.8
Agdas-7	118	85-95	3930	6.9	11.6	39.3	33.5	4.5	29.0
Agdas-17	124	90-100	3650	6.3	12.7	38.6	34.8	4.8	27.0
Maras-92 (STD)	-	90-100	3500-4000	6.0	9-10	39	29-30	3.6	31.0
Sayar-314 (STD)	-	95-100	3500-4000	5.8-6.0	10	41-42	29.5-31.5	4.4-4.5	25.7-26.7
Stoneville-453 (std)	120	-	-	5.6	9.4	41.9	29.3	3.84	28-30

STD: Local standard variety **(**Anonymous, 1978; 1979; 1982; 1983; 2001; Harem, 2000; Calhoun et al., 1997). (Each of the references (Anonymous (1978, 1979, 1982 and 1983) is registration certificate for each variety. If you look at reference list you can see it. The other two references in this table are also related to varieties).

Table 2. Soil physical and chemical properties of the experiment location (Akcakale-Harran Plain, Sanliurfa) (Dinc et al., 1988).

Horizon	Soil depth (cm)	pH	CEC (Meq/100 g)	Salt (%)	Loam (%)	Silt (%)	Clay (%)	Class of structure
Ap	0 - 18	7.5	52.1	0.090	2.6	36.6	60.8	c
A_{12}	18 - 48	7.5	56.1	0.080	3.0	27.8	69.2	c
B_2	48 - 87	7.4	64.4	0.080	4.0	22.9	73.1	c
B_3	87 - 112	7.6	58.0	0.075	2.4	25.8	71.8	c
C	112 - 150	7.6	54.4	0.078	8.9	23.6	67.5	c

Table 3. The some climatic data of the experiment location in 2001 to 2004 cotton seasons.

Month	Average temperature (°C)				Average relative humidity (%)				Total rainfall (mm)			
	2001	2002	2003	2004	2001	2002	2003	2004	2001	2002	2003	2004
April	16.7	14.8	15.6	15.7	61.1	69.1	61.4	53.4	25.1	53.9	35.5	27.0
May	20.5	20.8	23.5	21.9	50.3	44.9	41.7	46.5	52.1	4.0	13.4	14.0
June	29.0	27.6	27.9	28.7	30.0	32.2	31.4	40.7	-	-	-	-
July	32.2	30.6	30.9	31.8	37.3	35.4	34.5	50.7	-	-	-	-
August	30.6	29.0	31.1	29.7	44.4	41.5	37.2	55.5	-	-	-	-
September	25.8	25.3	25.0	25.7	48.4	47.6	42.2	50.9	2.5	6.3	2.2	-
October	19.2	21.0	20.4	20.2	50.0	47.2	55.0	56.2	29.7	9.5	42.5	2.5

Anonymous (2005).

Table 4. Combined analysis of variance of the varieties tested for yield,yield components, earliness and fiber quality characters for four years (2001 to 2004).

Source of variation	df	Plant height	Sympo-dial number	Boll number per plant	Seed cotton weight per boll	Seed cotton yield	Ginning outturn	100-seed weight	First harvest ratio	Fiber length	Fiber fineness	Fiber strength	Fiber uniformity
Block/Year	12	226.33	4.98	1.00	0.37	177.70	3.89	0.19	12.64	0.98	0.18	1.81	1.38
Years (Y)	3	8661.89**	91.25**	91.05**	13.49**	136375.02**	7.24	3.18**	2920.98**	13.16**	7.36**	195.36**	10395.76**
Varieties (V)	6	764.81**	4.63**	31.06**	0.56*	6431.91**	9.42**	0.90**	107.09**	1.65*	0.17	0.86	2.57
YxV Interaction	18	158.89**	1.85	4.47**	0.14	7516.93**	3.98	0.41	36.26**	1.12	0.11	1.16	1.24
Error	72	68.36	1.09	1.43	0.19	114.18	2.86	0.27	6.34	0.66	0.14	1.73	1.86
Coefficient of variation (CV) (%)		8.21	8.07	8.51	8.09	3.09	4.28	5.05	3.20	2.79	8.08	4.92	2.04

(*)P<0.05; (**)P<0.01; df: Degree of freedom.

and four times with harrow.

In each year, compost fertilizer of 20:20:0 was applied at presowing at a rate of 8 kg da^{-1} N, and P_2O_5. 26% of ammonium nitrate was treated at a rate of 5 kg da^{-1} N by using fertilizer spreader in inter-rows prior to first and second irrigation. After treatment, plants were irrigated by furrow method 8 to 9 times until bolls opened up to 60%. Plants were harvested on 27 September and 12 October in 2001; on 28 September and 26 October in 2002; on 26 September and 24 October in 2003 two times by hand. In 2004, harvesting was done on 19 October only once due to environmental conditions. At harvesting time, samples of 20 bolls were taken from each plot.

Morphological and agronomical characteristics of the varieties were determined according to Gencer et al. (1992). Boll samples of each plot were ginned in experimental gin roller and fiber technological traits were determined using lint samples in high volume instruments (HVI) analyser. Obtained data were analysed for each year separately and over four years according to randomized block design, using MSTAT C statistical package. The means were compared by LSD test.

RESULTS AND DISCUSSION

The results of combined analysis of variance for four years (2001-2004) of varieties tested for yield, yield components, earliness and fiber quality characters are given in Table 4.

According to four years' combined analysis of variance, it was determined that the differences among varieties were statistically significant for plant height, sympodial number, boll number per plant, cotton seed yield, ginning outturn, 100 seed weight, first harvest ratio (P<0.01), cotton seed weight per boll and fiber length (P<0.05). Differences among years were statistically significant (P<0.01) for investigated traits, except ginning outturn. Furthermore, it was determined that year x variety interactions were statistically significant (P<0.01) for plant height, boll number per plant, cotton seed yield and first harvest ratio (Table 4).

Plant height

In Table 5, it is seen that the plant height means for years varied between 86.59 and 126.00 cm; the shortest plants were obtained in 2002 (86.59 cm), and the longest plants were obtained in 2003 (126.00 cm). The plant height of varieties among years varied between 68.25 cm (Stoneville-453) and 102.97 cm (Agdas-3) in 2001; 77.17 cm (Stoneville-453) and 91.42 cm (Maras-92) in 2002; 108.20 cm (Stoneville-453) and 139.05 cm (Agdas-6) in 2003; 90.90 cm (Agdas-3) and 107.00 cm (Agdas-6) in 2004.

According to mean results of over four years, Agdas-6 was the longest variety with 109.15 cm. Maras-92 (103.78 cm), Agdas-7 (103.61 cm) and Agdas-3 (103.21 cm) followed this. The shorter variety was Stoneville-453 (standard variety) with 87.12 cm (Table 5). Basbag and Temiz (2004) reported similar results (89.46 to 90.44 cm). Hanif et al. (2005) reported that the highest plant height was 159 cm. This finding is higher than that of our results. Plant height is a cultivar trait but it can be affected by environmental and cultivation conditions.

Year × variety interaction was statistically significant for plant height. It can be explained that varieties with genotypic differences respond to ecological variablesdifferently (Figure 1). The highest plant height values were seen in Agdas-6 in 2003, while the lowest plant height values were seen in Stoneville-453 in 2001.

Sympodial number

It has been relized that sympodial numbers of years varied between 10.39 number/plant and 14.61 number/plant. While the least sympodial number was obtained in 2002 (10.39 number/plant), the highest sympodial number was

Table 5. Means for plant height and sympodia number and arised groups.

Variety	Plant height (cm)					Sympodia number				
	2001	2002	2003	2004	Means of varieties	2001	2002	2003	2004	Means of varieties
Agdas-3	102.97[a]	88.62	130.35[ab]	90.90	103.21[ab]	14.65[a]	10.72	15.55	14.25	13.79[a]
Agdas-6	101.07[a]	89.47	139.05[a]	107.00	109.15[a]	13.37[abc]	10.92	14.15	12.80	12.81[abc]
Agdas-7	96.35[ab]	86.80	130.60[ab]	100.70	103.61[ab]	14.90 a	10.22	14.25	14.15	13.38[ab]
Agdas-17	95.07[ab]	88.25	115.60[bc]	99.85	99.69[b]	14.30[ab]	10.07	14.70	13.85	13.23[ab]
Maras-92 (std)	94.72[ab]	91.42	131.90[ab]	97.10	103.78[ab]	12.07[c]	9.80	14.45	13.60	12.48[bc]
Sayar-314 (std)	81.87[bc]	84.40	126.30[abc]	100.75	98.33[b]	12.40[bc]	10.55	14.70	13.40	12.76[bc]
Stoneville-453 (std)	68.25[c]	77.17	108.20[c]	94.85	87.12[c]	11.74[c]	10.42	14.45	12.40	12.25[c]
LSD (1%)	17.24	ns	8.47	ns	7.73	1.93	ns	ns	ns	0.97
Means of years	91.47[c]	86.59[c]	126.00[a]	98.74[b]		13.37[b]	10.39[c]	14.61[a]	13.49[b]	
LSD (1%)			5.85							
CV (%)	9.26	8.09	7.20	8.49	8.21	7.11	6.29	8.88	7.11	8.07

ns: Not significant; std: local standard variety; * means followed by the same letter are not significantly different at 5% level of probability.

obtained in 2003 (14.61 number/plant) (Table 5). Sympodial number of varieties varied between 11.74 number/plant (Stoneville-453) and 14.90 number/plant (Agdas-7) in 2001; 9.80 number/plant (Maras-92) and 10.92 number/plant (Agdas-6) in 2002; 14.15 number/plant (Agdas-6) and 15.55 number/plant (Agdas-3) in 2003; 12.40 number/plant (Stoneville-453) and 14.25 number/plant (Agdas-3) in 2004.

According to mean results of over four years, the highest sympodial number was taken from Agdas-3 (13.79 number/plant); Agdas-7 and Agdas-17 varieties followed it respectivelly. The lowest sympodial number was taken from Stoneville-453 (12.25 number/plant) (Table 5). Singh et al. (2008) noticed that the highest sympodial number was 29.5 plant^{-1}. Ashokkumar and Ravikesavan ((2011) also reported higher sympodial number (24.17 and 28.97). These findings are very higher than that of our results. Sympodial number is a trait of cultivar. It can occur due to genotypic differences.

Boll number per plant

The highest number of boll per plant was obtained in 2003 (16.11), while the lowest boll number per plant was obtained in 2004 (12.30). Boll number per plant of varieties was between 16.30 (Agdas-3) and 13.25 (Stoneville-453) in 2001; 14.27 (Agdas-6) and 10.90 (Maras-92) in 2002; 18.85 (Agdas-6) and 12.75 (Maras-92) in 2003; 14.20 (Agdas-17) and 10.17 (Maras-92) in 2004 (Table 6). All Agdas varieties had more boll number than standard varieties in all the experiment years except 2002.

According to mean results of over four years, Agdas-17 had the highest boll number per plant with 15.41; Agdas-6 (15.39), Agdas-7 (14.97) and Agdas-3 (14.56) followed this. Maras-92 had the lowest boll number per plant with 11.79 (Table 6). Singh et al. (2008), Hanif et al. (2005), Hassan et al. (2007) and Arshad et al. (2003) reported that the highest boll number per plant was 33.2, 54 to 59, 40.2 to 52.1 and 36 respectively. Boll number per plant is related to plant height and sympodial number. Researchers noticed that the cultivar having the highest boll number was the cultivar having the highest sympodial number. Soomro et al. (2005) noticed that boll number per plant varried between 11.22 and 25.85. Basbag and Temiz (2004) and Ashokkumar and Ravikesavan (2011) reported that boll number per plant was 22 and 25.17 to 26.47, respectively.

Moreover, year x variety interaction was found statistically significant for boll number per plant (Figure 2). This could be due to different responses of varieties to ecological conditions of years and to cultural treatments. While the highest boll numbers per plant were taken from Agdas-6, Agdas-17 and Agdas-7 in 2003, the lowest boll number per plant was taken from Maras-92 in 2004. Being statistically significant, year x variety interaction showed that different varieties can be different in different years for boll number. Similar results were also reported by Bridge et al. (1969), Gill and Singh (1982), Gill et al. (1992) and

Table 6. Means for boll number per plant and seed cotton weight per boll and arised groups.

Variety	Boll number per plant					Seed cotton weight per boll (g)				
	2001	2002	2003	2004	Means of varieties	2001	2002	2003	2004	Means of varieties
Agdas-3	16.30[a]	12.97[bc]	16.65[ab]	12.35 [abc]	14.56 [a]	4.63	4.92	5.17 [a]	5.94	5.16 [bc]
Agdas-6	15.87[ab]	14.27[a]	18.85[a]	12.57 [abc]	15.39 [a]	4.75	4.82	5.80 [ab]	6.14	5.38 [abc]
Agdas-7	16.15[ab]	13.37[abc]	17.85[a]	12.52 [abc]	14.97 [a]	4.65	5.38	6.12 [a]	6.00	5.54 [a]
Agdas-17	16.02 [ab]	12.82[c]	18.60[a]	14.20 [a]	15.41 [a]	4.58	5.22	5.94 [a]	6.08	5.45 [ab]
Maras-92 (std)	13.35[c]	10.90[d]	12.75 [c]	10.17 [c]	11.79 [c]	4.63	5.10	5.93 [a]	5.98	5.41 [a]
Sayar-314 (std)	13.97[bc]	11.40[d]	14.40 [bc]	12.65 [ab]	13.10 [b]	4.82	4.92	6.16 [a]	6.02	5.48 [a]
Stoneville-453 (std)	13.25[c]	13.85[ab]	13.70 [bc]	11.65 [bc]	13.11 [b]	4.14	4.80	5.57 [ab]	5.68	5.05 [c]
LSD (1%)	2.31	1.01	3.39	2.42	1.12	ns	ns	(5%) 0.67	ns	(5%) 0.30
Means of years	14.98[b]	12.80[c]	16.11 [a]	12.30 [c]		4.49 c	5.02 b	5.81 a	5.98 a	
LSD (1%)	0.84									
CV (%)	7.57	3.89	10.34	9.65	8.51	7.02	8.76	7.84	4.98	8.09

ns: Not significant; std: local standard variety; *means followed by the same letter are not significantly different at 5% level of probability.

Gencer et al. (1992).

Cotton seed weight per boll

In Table 6, it can be seen that the highest cotton seed weight per boll was obtained in 2003 and 2004 (5.98 and 5.81 g), followed by 2002 (5.02 g). The lowest cotton seed weight per boll was determined in 2001 (4.49 g). Over the years, cotton seed weight per boll of varieties varied between 4.82 g (Sayar-314) and 4.14 g (Stoneville-453) in 2001; between 5.38 g (Agdas-17) and 4.80 g (Stoneville-453) in 2002; 6.12 g (Agdas-7) and 5.57 g (Stoneville-453) in 2003; 6.14 g (Agdas-6) and 5.68 g (Stoneville-453) in 2004. In all the years of experiment, variety Stoneville-453 had the lowest cotton seed weight per boll (Table 6). Begum and Hossain (2011), Begum et al. (2005), Hanif et al. (2005), Arshad et al. (2003) and Ashokkumar and Ravikesavan (2011) reported similar results (5.6 to 5.7 g, 4.9 to 5.7 g, 4.6, 4.34, 4.20 g respectivelly). Although Soomro et al. (2005) noticed that cotton seed weight per boll was 3.07 to 3.30 g. These findings are lower than that of our findings. However boll weight and cotton seed weight per boll are characters depending on varieties. Some varieties form smaller bolls than others. From the same table, when the four years's mean results are looked at, it is seen that there is also a similar case; Stoneville-453 had the lowest cotton seed weight per boll. Among Agdas varieties only Agdas-7 had more cotton seed weight per boll than standard varieties.

Ginning outturn

From Table 7, it can be seen that in years, there were no significant differences for ginning outturn, and that it varied between 38.83 and 39.97%. Also, from Table 7, when years of trial are investigated separately, it is seen that there were no significant differences among ginning outturn of varieties in the first three years. In 2004, the highest ginning outturn was obtained from standard varieties (Maras-92, Sayar-314 and Stoneville-453, respectively). Ginning outturns of Azerbaijan varieties were between 37.87% (Agdas-7) and 39.60 % (Ağdaş-6).

According to four years' mean results, there were two different groups among varieties for ginning outturn (Table 7). The highest ginning outturns were taken from standard varieties (Sayar-314 and Stoneville-453), followed by Agdas-17 (39.96%), Agdas-3 (39.27%) and Agdas-6 (38.68%), respectively. Agdas-7 had the lowest ginning outturn (38.39%). Agdas varieties having lower ginning outturn is due to their higher 100 seed weights. Arshad et al. (2003) and Basbag and Temiz (2004) reported similar results (37.98 and 39.45%). Ashokkumar and Ravikesavan (2011) reported lower ginning outturn (35.43 and 36.24%).

100 seed weight

The highest 100 seed weight was taken in 2004 (10.81 g) and there were no significant differences

Table 7. Means for ginning outturn and 100 seed weight and arised groups.

Variety	Ginning outturn (%)					100 Seed weight (g)				
	2001	2002	2003	2004	Means of varieties	2001	2002	2003	2004	Means of varieties
Agdas-3	38.33	39.97	40.70	38.10^{c}	39.27^{ab}	10.12	10.22	10.12^{ab}	11.09	10.38^{a}
Agdas-6	39.10	38.35	37.67	39.60^{abc}	38.68^{ab}	10.71	10.04	10.18^{ab}	10.98	10.48^{a}
Agdas-7	37.62	38.96	39.12	37.87^{c}	38.39^{b}	9.82	10.06	10.71^{a}	11.12	10.43^{a}
Agdas-17	41.25	38.84	40.47	39.27^{bc}	39.96^{ab}	10.25	10.09	10.87^{a}	10.94	10.54^{a}
Maras-92 (std)	38.92	39.14	40.02	41.87^{a}	39.99^{ab}	9.87	9.97	10.58^{a}	10.63	10.26^{ab}
Sayar-314 (std)	40.22	38.82	40.75	41.13^{ab}	40.23^{a}	10.38	10.16	11.07^{a}	10.64	10.56^{a}
Stoneville-453 (std)	40.13	38.75	41.05	40.72^{ab}	40.16^{a}	9.78	10.01	9.42^{b}	10.29	9.87^{b}
LSD	ns	ns	ns	(1%)2.58	(1%)1.58	ns	ns	(5%) 1.00	ns	(1%) 0.48
Means of years	39.37	38.83	39.97	39.79		10.13 ^{b}	10.08 ^{b}	10.42^{b}	10.81^{a}	
LSD (5%)	ns					(1%) 0.37				
CV (%)	5.78	1.02	5.29	3.19	4.28	5.42	3.97	6.55	3.80	5.05

ns: Not significan; std: local standard variety; *means followed by the same letter are not significantly different at 5% level of probability.

among average 100 seed weight values obtained in the other years of trial. In 2003, the highest 100 seed weights were obtained from Sayar-314 (11.07 g), Agdas-17 (10.87 g), Agdas-7 (10.71 g) and Maras-92 (10.58 g). Stoneville-453 had the lowest 100 seed weight (9.42 g) (Table 7). Ashokkumar and Ravikesavan ((2011) reported similar results (10.44 g).

In the same table, looking at the four years' mean results, it is seen that the highest 100 seed weight was taken from Sayar-314, Agdas-17, Agdas-6, Agdas-7 and Agdas-3 and that the lowest 100 seed weight was taken from Stoneville-453. Varieties having higher 100 seed weights except Sayar-314 (especially Agdas varieties) had lower ginning outturn than the others.

First harvest ratio

In Table 8, it can be seen that the highest first harvest ratio was obtained in 2001 (90.52%), followed by 2003 (73.95%) and that the lowest first harvest ratio was obtained in 2002 (71.89%). In 2001 there was not any difference among varieties for first harvest ratio. In 2002, Stoneville-453 had the highest first harvest ratio (80.41%), followed by Agdas-17 (73.02%). The lowest first harvest ratio was taken from Agdas-7 (66.28%). In 2003, the highest first harvest ratios were obtained from Stoneville-453 (83.87%) and Agdas-3 (78.57%), followed by Sayar-314 (76.68%) and Agdas-17 (73.02%). Agdas-7 had the lowest first harvest ratio (68.78%).

According to three years' mean results, Stoneville-453 had the highest first harvest ratio (83.87%), followed by Agdas-3 (81.30%). For this trait among Agdas varieties, Agdas-3 attracted attention because of higher first harvest ratio (Table 8).

Furthermore, first harvest ratio year x variety interaction was found statistically significant (Figure 3).

While the highest first harvest ratio was taken from Stoneville-453 in 2003, the lowest first harvest ratio was taken from Agdas-7 in 2002. Earliness is an important factor in cotton cultivation. In hand harvest, as long as numbers of opened boll are more in first picking, the variety has been defined as "early maturing". In machine harvesting, it is desired that most bolls open at harvesting time. From this point of view, Agdas-3 can be defined as an early maturing variety because approximately 81% of its bolls open at harvest time.

Cotton seed yield

The highest seed cotton yield was taken in 2003 (4490.5 kg ha^{-1}) followed by 2001 (3271.3 kg ha^{-1}) and 2004 (3052.5 kg ha^{-1}) (Table 8). The lowest seed cotton yield was obtained in 2002 (3015.5 kg ha^{-1}). In 2003, cotton seed yield was more (120 kg) than the other years of trial. This could be

Table 8. Means for first harvest ratio and seed cotton yield and arised groups.

Variety	First harvest ratio (%)					Seed cotton yield (kg ha^{-1})				
	2001	2002	2003	2004	Means of varieties	2001	2002	2003	2004	Means of varieties
Agdas-3	93.11	72.23^{bc}	78.57^{a}	-	81.30^{ab}	3050.8^{b}	3233.9^{b}	5026.3^{b}	3064.1^{b}	3593.8^{ab}
Agdas-6	89.86	69.40^{bc}	69.40^{c}	-	76.22^{d}	3194.6^{b}	3226.7^{b}	4702.2^{c}	2899.3^{b}	3505.7^{bc}
Agdas-7	91.75	66.28^{c}	68.78^{c}	-	75.60^{d}	3200.8^{b}	3087.5^{bc}	4697.4^{c}	2925.5^{b}	3477.8^{c}
Agdas-17	87.88	73.02^{b}	73.02^{bc}	-	77.97^{cd}	2852.2^{c}	3512.5^{a}	5346.3^{a}	2905.7^{b}	3654.2^{a}
Maras-92 (std)	90.42	70.25^{bc}	70.25^{c}	-	76.97^{cd}	3859.8^{a}	2408.9^{e}	4117.8^{d}	3420.5^{a}	3451.7^{c}
Sayar-314 (std)	90.33	71.68^{bc}	76.68^{ab}	-	79.56^{bc}	3694.6^{a}	2933.7^{c}	3980.9^{d}	3321.1^{a}	3482.6^{c}
Stoneville-453 (std)	90.31	80.41^{a}	80.91^{a}	-	83.87^{a}	3045.9^{b}	2705.3^{d}	3552.4^{e}	2831.4^{b}	3033.7^{d}
LSD (1%)	ns	6.36	4.63		2.72	17.13	21.36	22.82	24.93	9.99
Means of years	90.52^{a}	71.89^{c}	73.95^{b}	-		3271.3^{b}	3015.5^{c}	4490.5^{a}	3052.5^{c}	
LSD (1%)	2.05					7.55				
CV (%)	2.23	4.35	3.08	-	3.20	2.57	3.48	2.50	4.01	3.09

ns: Not significant ; std: local standard variety; * means followed by the same letter are not significantly different at 5% level of probability.

because farm manure was applied to experiment field in the previous year.

In 2001, Maras-92 (3859.8 kg ha^{-1}) and Sayar-314 (3694.6 kg ha^{-1}) have the highest cotton seed yield. Agdas-7, Agdas-6, Agdas-3 and Stoneville-453 followed them. The lowest cotton seed yield was obtained from Agdas-17 (2852.2 kg ha^{-1}). In 2002, the highest cotton seed yield was taken from Agdas-17 (3512.5 kg ha^{-1}), followed by Agdas-3 (3233.9 kg ha^{-1}) and Agdas-6 (3226.7 kg ha^{-1}). Maras-92 was the variety with the lowest cotton seed yield (2408.9 kg ha^{-1}). In 2003, the highest cotton seed yield was taken from Agdas-17 (5346.3 kg ha^{-1}), followed by Agdas-3 (5026.3 kg ha^{-1}). Stoneville-453 had the lowest cotton seed yield (3552.4 kg ha^{-1}). In 2004, local standard varieties of Maras-92 (3420.5 kg ha^{-1}) and Sayar-314 (3321.1 kg ha^{-1}) had the highest cotton seed yields and the other varieties followed in the same group (Table 8).

According to four years' mean results, significant differences among the varieties were observed for cotton seed yield. The highest cotton seed yield was taken from Agdas-17 (3654.2 kg ha^{-1}), followed by Agdas-3 (3593.8 kg ha^{-1}); and Stoneville-453 (3033.7 kg ha^{-1}) had the lowest cotton seed yield. Begum and Hossain (2001) reported lower cotton seed yields than that of our results (2634 and 2632 kg ha^{-1}). Copur (2006) reported that cotton seed yields were found between 1884 and 4322 kg ha^{-1}. Basbağ and Temiz (2004) and Arshad et al (2003) reported similar results to that of ours for cotton seed yield (3907.5 kg ha^{-1} and 2896-3026 kg ha^{-1}) . Hanif et al (2005) reported higher cotton seed yield (4294-4629 kg ha^{-1}), Hassan et al (2007) also reported higher cotton seed yield (5095 to 5417 kg ha^{-1}) and Karademir et al (2010) reported higher cotton seed yield (4087 kg ha^{-1}) more than that of our four years' mean results. The different ecological conditions and varieties with different genotypes can give different results because these traits are quantitative. All the Agdas varieties except Agdas-seven gave higher cotton seed yield more than standard varieties. The reason might be that these varieties had more sympodial and boll numbers than standards. It can be said that among Agdas varieties the most hopeful varieties for this region are Agdas-17 and Agdas-3. Agdas-17 gave more cotton seed yield of 170 kg ha^{-1} than standard Sayar-314 with higher cotton seed yield; Agdas-3 gave more cotton seed yield of 110 kg ha^{-1}. The other varieties (Agdas-6 and Agdas-7) could not pass standard varieties.

Cotton seed yield year x variety interaction was found statistically significant (Figure 4). This could be due to ecological and cultural treatment differences in different years. Essentially, cotton seed yield has quantitative heredity and is controlled by more than one gene pair. Therefore, it can be affected by environmental conditions. This finding is similar to the results of Killi (1994), Kaynak et al. (1997), Copur and Oglakci (1997) and Mert and Caliskan (1999).

In Figure 4, it is seen that the highest cotton seed yield was taken from Agdas-17 in 2003 and

Table 9. Means for fiber length and fiber fineness and arised groups.

Variety	Fiber length (mm)					Fiber fineness (micronaire)				
	2001	2002	2003	2004	Means of varieties	2001	2002	2003	2004	Means of varieties
Agdas-3	28.40	28.85	29.12	29.55^{ab}	28.98^{b}	5.17	4.70	4.00	5.07	4.73
Agdas-6	29.12	29.62	29.92	28.40^{c}	29.26^{b}	4.90	4.57	3.77	5.12	4.59
Agdas-7	28.27	28.25	30.52	28.80^{bc}	28.96^{b}	4.92	4.95	4.17	5.10	4.78
Agdas-17	28.35	28.67	30.37	28.85^{bc}	29.06^{b}	5.10	4.75	4.17	5.15	4.79
Maras-92 (std)	28.85	28.12	30.47	29.52^{ab}	29.24^{b}	4.97	4.37	3.65	5.12	4.53
Sayar-314 (std)	29.37	29.15	31.25	29.85^{a}	29.90^{a}	4.72	4.62	4.20	5.02	4.64
Stoneville-453 (std)	29.15	29.25	30.07	28.45^{c}	29.23^{b}	4.92	4.87	3.62	5.02	4.61
LSD (1%)	ns	ns	ns	(5%) 0.96	(5%) 0.57	ns	ns	ns	ns	ns
Means of years	28.79^{b}	28.85^{b}	30.25^{a}	29.06 ^{b}		4.96^{a}	4.69^{b}	3.94^{c}	5.08^{a}	
LSD (1%)	0.58					0.26				
CV (%)	2.45	3.12	3.17	2.24	2.79	4.40	5.04	15.27	6.31	8.08

ns: Not significant ; std: local standard variety; * means followed by the same letter are not significantly different at 5% level of probability.

that the lowest cotton seed yield was taken from Maras-92 in 2002. All the varieties had the highest yield performance in 2003.

Fiber length

As seen in Table 9, the longest fiber was obtained in 2003 (30.25 mm) and fiber length values obtained in the other years took place at the same group. In the same table, years of trial were investigated separately. It can be seen that there was no statistically difference among varieties for fiber length in the first three years and that fiber length values of varieties varied between 28.12 mm and 31.25 mm in this years. In 2004, the longest fiber was taken from Sayar-314 (29.85 mm), followed by Agdas-3 and Maras-92. Stoneville-453 and Agdas-6 had the lowest fiber.

According to mean results of over four years, Sayar-314 had the longest fiber (29.90 mm) and the other varieties had similar fiber length. Arshad et al. (2003) reported that the longest fiber was 28.13 mm followed by 26.43 mm. Basbağ and Temiz (2004) reported that the longest fiber was 30.02 mm. But Karademir et al. (2010) reported that longer fibers were obtained (32.33 mm). However, researchers also reported that advanced cotton strains derived from a cotton breeding program were used in the study. Ashokkumar and Ravikesavan (2011) also reported they obtained long fibers (32.90 mm).

Fiber fineness

Over the years, fiber fineness varied between 5.08 and 3.94 micronaire (Table 9). The thickest fibers were obtained in 2004, while the thinest fibers were obtained in 2003. Fiber fineness of varieties varied between 4.72 and 5.17 micronaire in 2001; between 4.37 and 4.95 micronaire in 2002; between 3.62 and 4.20 micronaire in 2003; and between 5.02 and 5.15 micronaire in 2004. The thickest fibers were taken from all the varieties in 2004.

According to four years' mean results, there was no statistical signifacant difference among fiber fineness of varieties and these values varied between 4.53 (Maras-92) and 4.79 (Agdas-17) micronaire (Table 9). Basbağ and Temiz (2004) reported that the thickest fibers were 2.87 micronaire. Otherwise, Ashokkumar and Ravikesavan ((2011) noticed that the thickest fibers were 4.6 micronaire. This finding is similar to that of our results.

Fiber strength

As seen in Table 10, the strongest fibers were obtained in 2003 (30.53 g tex^{-1}), followed by 2004 (26.45 g tex^{-1}). The weakest fiber values were obtained in 2001 and 2002. No statistical differences were found among fiber strength of varieties in individual years of trial and combined

Table 10. Means for fiber strength and fiber uniformity and arised groups.

Variety	Fiber strength (g tex^{-1})					Fiber uniformity (%)				
	2001	2002	2003	2004	Means of varieties	2001	2002	2003	2004	Means of varieties
Agdas-3	25.32	25.17	30.20	26.52	26.80	50.97	49.50	83.12	82.85	66.61
Agdas-6	25.02	25.37	30.60	25.85	26.71	49.65	49.90	83.82	83.20	66.64
Agdas-7	24.60	24.70	30.52	27.02	26.71	49.80	50.92	84.20	84.10	67.25
Agdas-17	24.65	25.02	30.62	25.60	26.47	50.52	49.90	84.40	83.65	67.12
Maras-92 (std)	24.52	24.87	31.50	27.27	27.04	51.65	50.20	83.52	83.82	67.30
Sayar-314 (std)	25.00	25.35	29.87	27.35	26.89	51.65	49.82	84.47	84.05	67.50
Stoneville-453 (std)	24.27	25.36	30.37	25.50	26.37	49.55	49.80	83.17	83.15	66.42
LSD (%1)	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Means of years	24.77^{c}	25.2^{c}	30.53^{a}	26.45^{b}		50.54^{b}	50.01^{b}	83.82^{a}	83.47^{a}	
LSD (1%)	0.93					0.96				
CV (%)	2.87	4.43	6.60	3.99	4.92	2.79	2.26	2.23	0.99	2.04

ns: Not significant; std: local standard variety; * means followed by the same letter are not significantly different at 5% level of probability.

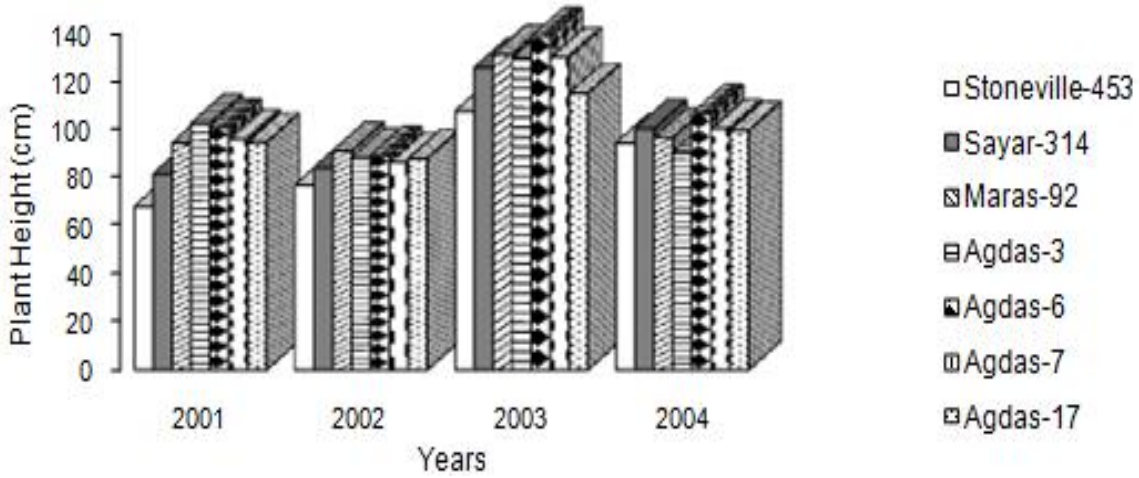

Figure 1. Year × Variety interaction for plant height.

anlysis. Averaged fiber strength values of varieties were in the range of 26.37 to 27.04 g tex^{-1}. According to these results, varieties were found in the strong class (25 to 27 g tex^{-1}): [medium class: 22-24 g tex^{-1}; strong class: 25 to 27 g tex^{-1}; very strong class: 28 to 35 g tex^{-1}]. Basbağ and Temiz (2004) reported that the strongest fibers had 33.41 g tex^{-1}. However, Ashokkumar and Ravikesavan (2011) noticed that the strongest

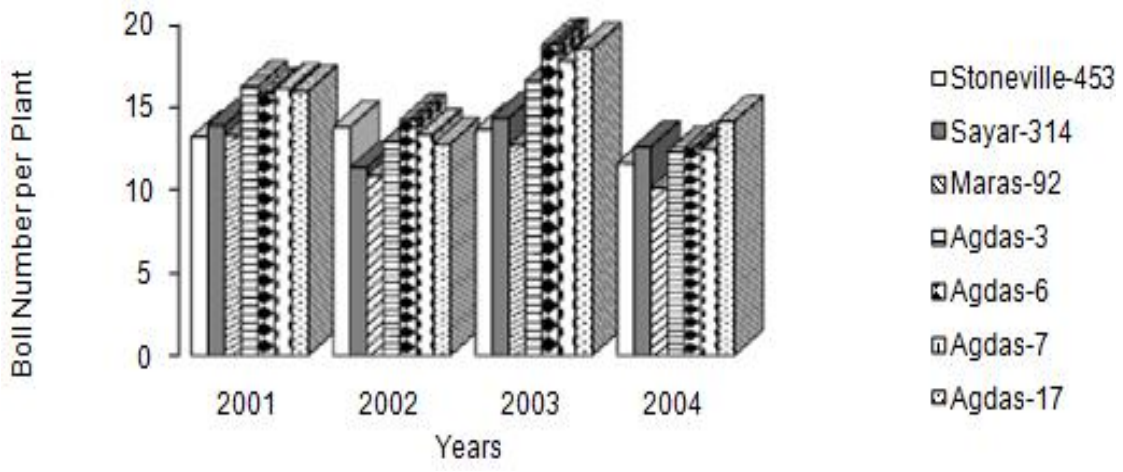

Figure 2. Year × Variety interaction for boll number per plant.

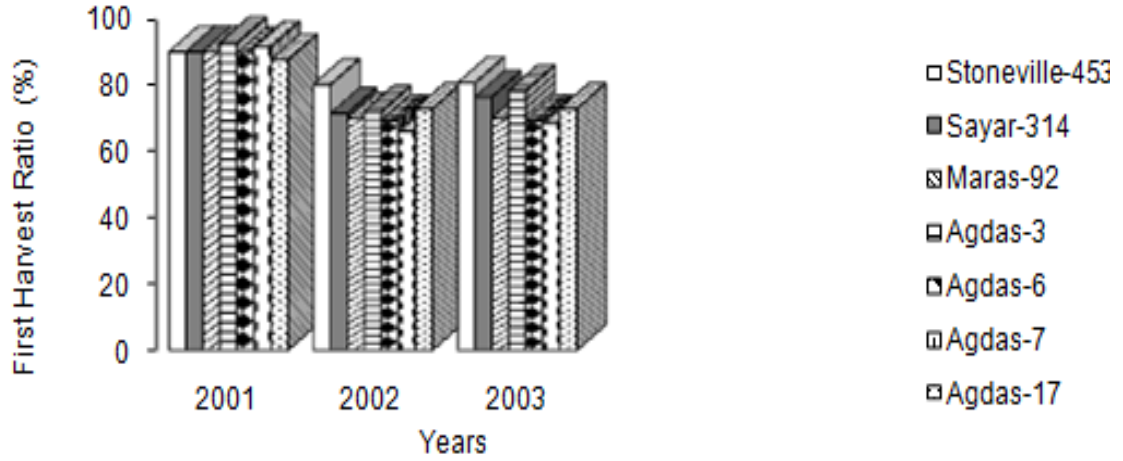

Figure 3. Year × Variety interaction for first harvest ratio.

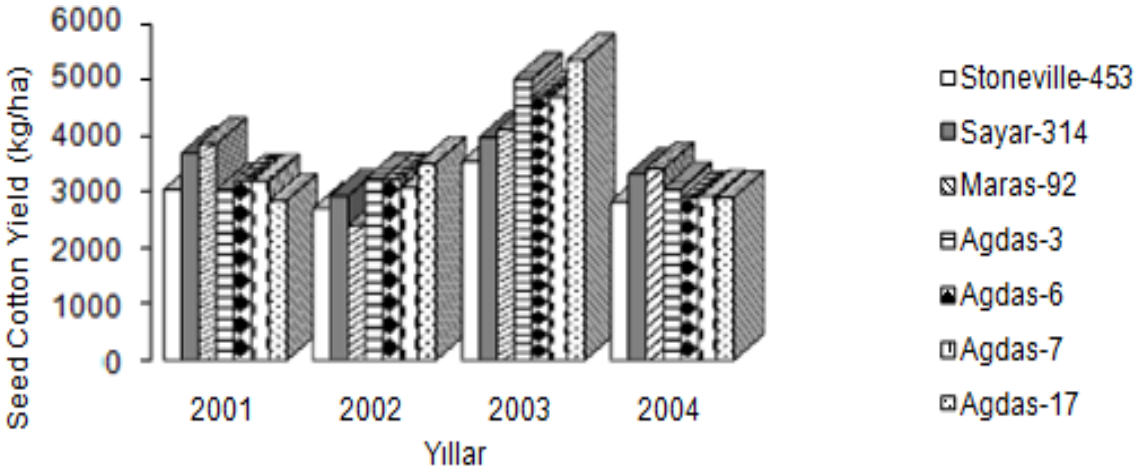

Figure 4. Year × Variety interaction for seed cotton yield.

fibers had 22.9 g tex^{-1}.

Fiber uniformity

In Table 10, it can be seen that the highest fiber uniformity was got in 2003 and 2004. In the individual trial years, statistical differences were not found among varieties for fiber uniformity. In 2003 and 2004, fiber uniformity of varieties increased greatly compared to the two previous years. According to four years' mean results, fiber uniformity of varieties varied in the range of 66.42 to 67.50%.

Conclusion

According to the results of over four years, differences among varieties were statistically significant for investigated traits except for fiber fineness, fiber strength and fiber uniformity; and differences among years were statistically significant for investigated traits except for ginning outturn. Furthermore, it was determined that year x variety interactions were statistically significant for plant height, boll number per plant, cotton seed yield and first harvest ratio. Agdas-3 variety had the highest sympodial number (13.79). Agdas-17 was the variety with the highest boll number per plant (15.41). The highest cotton seed weight per boll was taken from Agdas-7 (5.54 g). All the Agdas varieties had less ginning outturn than local standard varieties. The highest cotton seed yield was obtained from Agdas-17 (3654.2 kg ha^{-1}), followed by Agdas-3 (3593.8 kg ha^{-1}). All the Agdas varieties had more cotton seed yield than standards except Agdas-7. Among Azerbaijan varieties, Agdas-3 variety was the earliest maturing variety with 81.3% of first harvest ratio. All investigated varieties were similar to one another in terms of fiber technological properties.

In conclusion, it can be said that among Azerbaijan varieties, Agdas-17 and Agdas-3 had higher cotton seed yield than local standard varieties, and that they are the most hopeful varieties for South east Anatolian Region.

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