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Original Research Article

Growth and yield of cotton as influenced by different date of sowing and varieties

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A B S T R A C T

A field experiment was conducted at integrated farming system research Dr. PDKV, Akola, during *kharif* season of 2017 on clayey soil. The experiment was laid out in factorial randomized block design with four replications consisting of nine treatment combinations in each. The cotton crop was planted in three dates i.e. 21st May, 15th June and 15th July and different genotypes viz., Ajeet-199 (90x30 cm), AKA-8 (60x15 cm) and PKV-Rajat (60x30 cm). Plant height, number of branches, leaf area plant^{-1}, leaf area index and dry matter weight plant^{-1} were significantly superior with crop sown under 21st May . Highest seed cotton yield yield (2962 kg ha^{-1}) was obtained when cotton crop was sown on 21st May(D_1). Crop sown on 15th July recorded lowest seed cotton yield (2207 kg ha^{-1}). Genotypes Ajeet - 199 recorded significantly higher seed cotton yield (2801 kg ha^{-1}) and biological yield (6866 kg ha^{-1}). The variety AKA-8 recorded significantly higher plant height, dry matter per ha^{-1} and biological yield. The number of harvested bolls plant^{-1} and seed cotton weight plant^{-1} was significantly higher in Ajeet-199 (D_1) over AKA-8 and PKV-Rajat. Lint yield found to be significant with different genotypes. It was observed that the variety Ajeet-199(V_1) recorded significantly more lint yield (1088) than all other varieties. Ginning percentage found to be significant with different genotypes. It was observed that the variety Ajeet-199 (V_1) significantly more ginning percentage (36.8) than all other varieties.

Keywords

Cotton, Harvest index, Leaf area index, Ginning percentage

Introduction

Cotton is the most important fiber crop of Indian farming community and plays an important role in rural economy of India. World cotton production is estimated at 100.22 million bales of 480 lb in 2015-16 (USDA, March, 2016) which is 16 % lesser than the previous year 2014-15 and cotton area decreased to the tune of 3.22 million ha compared to 2014-15. India is the largest cotton growing country in the world with area under cotton around 34% followed by China. China and India are the major cotton producing country in the world (around 46% of world cotton production). As regards export USA & India export 28% & 20% of the world cotton export.

With suitable climate for cotton cultivation across the country and with improved technologies from public and private sectors, Cotton occupies a pre-eminent place among cash crop as it guides the destiny of a large section of farming community as well as flourishing textile industries. At the time of

country independence, cotton was the source of raw material for which the textile mills had to depends heavily on imports. In Vidarbha, cotton is grown prominently as a rainfed crop. As such about 89.1% cultivable land is under rainfed farming and rainfed cotton production has direct bearing on the agrarian economy of the region.Planting date management not only has a large effect on crop growth, development, and yield but it also impacts insect pest management (Brown *et al.*, 1992, 1993, 1994, 1995, 1996 and 1997). Reduced season management, of which early planting plays a major role, has become increasingly important in recent years.

The ability to plant and establish a crop early, carry it through the primary fruiting cycle in a timely and efficient manner, followed by early termination; has become increasingly important with increased late-season insect pressures in Arizona. This approach to earliness management has also been important in terms of avoiding inclement weather conditions commonly associated with the summer monsoon season, which creates higher humidity's (higher dew point temperatures) and higher night temperatures, resulting in accelerated rates of fruit loss and abortion (Brown and Zeiher, 1997). Optimum sowing date for a cultivar in a region is considered to be the most important manageable factor in cotton crop (Bozbek *et al.*, 2006). Drought condition during flowering and boll development stage (august- September) adversely affects the growth and later the shedding of reproductive parts resulting in poor crop yield. Early sowing appears higher yield potential and alternately, late planting of cotton crop shows very vegetative and difficult to manage resulting in lower seed cotton yield as well (Ali *et al.*, 2009).

High cotton yield could not be obtained previously due to many biotic and abiotic stresses such as weed infestation, insect pests and diseases, sowing too early or too late, nutrients stress and improper use of genotypes at different agro-ecological zones (Arshad *et al.*, 2007; Zia-ul-Hassan *et al.*, 2014). Optimum sowing date plays key role in yield potential; similarly, suitable genotype for a region is essential for optimum growth and development. Genotype selection and sowing date management are important factors that can have a large impact on yield and quality attributes of a cotton crop (Deho *et al.*, 2012).

Materials and Methods

The field experiment was conducted at the field of Integrated farming system resarch (IFSR) unit Dr. PDKV Akola during 2016-17 in *Kharif* season. The topography of the field was fairly uniform and levelled. The soil was medium black cotton belonging to *Vertisols.* Akola is situated in the subtropical zone at an elevation of 307.42 m above the mean sea level at 22^0 42' North latitude and 77^0 02' East longitude and lies in subtropical continental climate. The experiment was laid out in Factorial Randomized Block Design with four replications. The experiment consisted of nine treatment combinations, comprising of three dates of sowing and three varieties. The nine treatment combinations were laid out in a Factorial Randomized Block Design with four replications. The cotton crop was planted in three dates i.e. 21st May, 15th June and 15th July. The experiment was laid out in Factorial randomized block design with four replication. There were nine treatments combination comprising of three different genotypes viz., Ajeet-199 (90x30 cm), AKA-8 (60x15 cm) and PKV-Rajat (60x30 cm)

Results and Discussion

Effect of date of sowing & Genotype on Growth parameter

Plant height was increased with successive stage of crop growth up to harvest. The mean of plant height at different growth stages ranged from 39.43 cm at 30 DAS to 118.68 cm at harvest. Increase in mean height was more between 30–60 DAS with a rate of increase of 1.60 cm per day. The rate of increase in plant height was declined subsequently. Plant height was significantly influenced by sowing dates throughout the crop growth period except at 30 and 90 DAS. The sowing dates 21st May (D_1) at 90 DAS was significantly superior to 15th June (D_2) and 15th July (D_3).15th June was found at par with 15th July. Same trend was fallowed in 120 DAS and at harvest.

The effect of genotypes on the plant height was found to be significant at all growth stages except at 120 DAS and at harvest. It was observed that the growth stages of genotype Bt hybrid Ajeet 199 (V_1) recorded significantly higher plant height as compared to genotypes AKA-8(V_2) and PKV-Rajat (V_3) in 30 DAS. At 60 and 90 DAS the genotypes AKA-8 recorded highest plant height fallowed by V_1 and V_3. Same trend fallowed in 120 DAS.

Sympodial branches plant^{-1} was recorded from 60thday after sowing at an interval of 30 days. Mean number of sympodial branches plant^{-1} ranged from 8.23 (60 DAS) to 16.40 (at harvest stage). The maximum rate of increase in sympodial branches was recorded during 60 to 90 days.

Mean number of branches per plant was significantly influenced throughout the crop growth period by various growing environment created through different sowing times. Dates pertaining to the no. of sympodial branches, treatment D_1 (21st may) produced significantly superior branches per plant^{-1} treatment D_2 (15th June) is statistically similar with treatment D_1.However treatment $D_3$is statistically minimum value. Same trend will be allowed in 90,120 and at harvest. In case of monopodia at 90 DAS not significant

It was observed that all the growth stage of Ajeet-199 (V_1) recorded significantly higher number of sympodial branches per plant as compared to AKA-8(V_2) and PKV – Rajat (V_3). At 60 DAS the treatment V_1 observed significantly superior fallowed by V_3 and treatment V_3 showed statistically minimum value. Same trend fallowed in 90, 120 and at harvest stage. The superior performance of Ajeet-199 (V_1) Bt hybrid compared to AKA-8 (V_2) and PKV-Rajat (V_3). In case of monopodia the treatment (V_2) shows significantly superior over treatment V_2 and V_1. The treatment V_3 (PKV Rajat) is statistically similar with treatment V_2 (AKA-8).

Leaf area index being photosynthetic surface plays a vital role in production and availability of photosynthates for seed cotton production. Leaf area index was expanded progressively up to 120 DAS and decrease subsequently due to leaf senescence toward harvest stage. The maximum leaf area index was (3.85) at 120 DAS.

Leaf area index per plant were significantly influenced due to various sowing times except at 30 DAS. Sowing time of the D_1 - 20 MW (21st May) produced significantly higher leaf area index per plant over rest, of sowing dates Whereas sowing time D_3-28 MW (15th July) recorded least leaf area index per plant. D_2 (15th June) is statistically at par with D_1. The same trend followed in all the growth stages.

Different genotypes in terms of leaf area index per plant were significantly influenced due genotypes. AKA-8 (V_2) produced significantly higher leaf area index plant^{-1} than the V_1 (Ajeet-199) and V_3 (PKV - Rajat) At 30 DAS the genotypes V_2 recorded significantly higher value fallowed by V_3, however genotypes V_1 (Ajeet-199) recorded lowest leaf area index plant^{-1}. Same trend followed in 60, 90 DAS and at harvest. At last harvest stage the leaf area index was less due to leaf senescence.

The difference observed could be attributed more to the inherent genetic potential and different plant population AKA-8 was sown under high density planting.

Sowing time was significantly influenced by dry matter accumulation. Sowing at D_1-20 MW (21st May) produced significantly higher dry matter plant^{-1}.where D_3-28 MW (15thJuly) recorded least dry matter accumulation. This could be attributed comparatively less soil moisture, relative humidity and high temperature that decreased dry matter accumulation. In general moisture stress and high temperature reduces the assimilates of photosynthesis and thereby decrease the crop growth. Among the different sowing dates treatment D_1 was significantly superior than D_3 and at par with treatment D_2. Same trend fallowed in all the growth stages.

Differences in dry matter portioning per plant due to the different sowing dates were found not significant at all the crop growth stages except at harvest stage.D_1 (21st May) recorded maximum value of leaf dry weight as compared to D_2 (15th June) and 15th July (D_3) at harvest stage. Taha (1982) found that the early sown crops produced greater dry matter as a result of increase size of the photosynthetic system and high crop rate during the vegetative phase ad on the other hand late sown crop produced less dry matter.

Koraddi *et al.*, (1992) reported that plant height, number of sympodial and monopodial branches plant^{-1} decreased significantly with delay in planting of cotton.

Arain *et al.*, (2001) observed that early sown cotton gave significantly higher plant height, number of sympodial branches, number of bolls formed, seed cotton weight plant^{-1} and seed cotton yield ha^{-1} whereas there was a remarkable decline in yield of late sown crop.

Effect of date of sowing & Genotype on Yield parameter

Data in respect of number of bolls harvested per plant as influenced by various treatments. The average bolls per plant were recorded 22.74. Sowing on 21st may (D_1) was significantly superior over 15th July (D_3) and at par with sowing on 15th June (D_2). However sowing on 15th June at par with sowing on 15th July. The differences among all the three genotypes significantly differ in terms of no. of bolls plant^{-1}. Bt hybrid Ajeet 199 (V_1) recorded significantly superior no. of bolls per plant followed by variety PKV-Rajat (V_3) and AKA-8 (V_2).

Interaction effect among different date of sowing and genotypes was found to be non-significant in respect to boll weight.

Data regarding boll weight as influenced by different dates of sowing and varieties are presented in Table 26. The boll weight significantly varies with genotypes. The average boll weight was recorded 2.91(g).
The effects of sowing dates were found to be non-significant in respect of boll weight per plant.

The differences among all the three genotypes expressively change in terms of boll weight per plant. Bt hybrid Ajeet 199 (V_1) recorded significantly maximum boll weight per plant followed by variety PKV-Rajat (V_3) and AKA-8 (V_2). Data pertaining to seed cotton yield per plant as influenced by different treatments are presented in Table 1. On average seed cotton yield per plant was 56.14 g.

Seed cotton yield per plant found to be significant with different date of sowing. It was observed that the sowing dates 21th May significantly more seed cotton yield per plant 62.56 than 15th June and 15th July.

Table.1 Seed cotton yield plant^{-1} and seed cotton yield (kgha^{-1}) as influenced by sowing dates and genotypes

Treatment Detail	Seed cotton yield per plant (gm)	Seed cotton yield (kgha^{-1})
A) Sowing Dates		
D_1 - 21st May (20thMW)	62.56	2962
D_2 - 15th June (24thMW)	56.85	2618
D_3 - 15th July (28thMW)	49.00	2207
SE (m)+-	1.23	47.5
CD at 5%	3.63	139.34
B) Genotypes		
V_1 - Ajeet 199	87.84	2801
V_2 - AKA-8	30.94	2753
V_3 - PKV- Rajat	49.63	2234
SE (m)+-	1.23	47.5
CD at 5%	3.63	139.34
Interaction (DXV)		
SE (m)+-	2.14	82.28
CD at 5%	6.28	241.35
GM	56.14	2596.4

Table.2 `Yield plant^{-1} and yield per ha (kg ha^{-1}) as influenced by different dates x genotypes Interaction

D X V	Seed cotton yield per plant (g)			Seed cotton yield (kg ha^{-1})		
	V_1	**V_2**	**V_3**	**V_1**	**V_2**	**V_3**
D_1	95.77	34.60	57.34	3121	3134	2633
D_2	87.41	30.14	53.00	2784	2676	2394
D_3	80.36	28.08	38.56	2499	2448	1674
SE(m)±	2.14			82.28		
CD at 5%	6.28			241.35		

Seed cotton yield per plot found to be significant with different varieties It was observed that the Bt hybrid Ajeet 199 (V_1) significantly more seed cotton yield per plant 87.84g than AKA-8 and PKV-Rajat.

Interaction effect found statistically significantly influenced on seed cotton yield plant^{-1}.Seed cotton yield kg ha^{-1} found to be significant with different date of sowing. It the early sowing dates (21th May) significantly recorded height seed cotton yield 2962 kg ha^{-1} than15th June and 15th July.

Seed cotton yield per ha^{-1} found to be significant with different varieties. It was observed that the Bt hybrid Ajeet 199 (V_1) meaningfully extra seed cotton yield 2801 kg ha^{-1} than AKA-8 and PKV-Rajat.

Interaction effect found statistically significantly influenced seed cotton yield per plant.

The treatment combination (D_1V_2) sowing date 21st May with variety AKA-8 produced significantly higher seed cotton yield (3134 Kg ha^{-1}) than all other treatment combination. The lowest yield was recorded in treatment combination D_3V_3.

Arain *et al.,* (2001) observed that early sown cotton gave significantly higher plant height, number of sympodial branches, number of bolls formed, seed cotton weight plant^{-1} and seed cotton yield ha^{-1} whereas there was a remarkable decline in yield of late sown crop.

Ginning % as influenced by sowing dates and genotypes

The average ginning % recorded was 32.80.The different sowing dates influence ginning percentage in cotton during the experimentation. Sowing date (D_1) recorded significantly more ginning % (37.66) than remaining sowing dates

Ginning percentage found to be significant with different genotypes. It was observed that the variety Ajeet-199 (V_1) significantly more ginning percentage (36.8) than all other varieties. Similar result found by Tomar *et al.,* (2002).The average lint yield was recorded 847.60

The different sowing dates influence lint yield in cotton during the experimentation. Sowing date (D_1) recorded significantly more lint yield (1122) than remaining sowing dates. Lint yield found to be significant with different genotypes. It was observed that the variety Ajeet-199(V_1) recorded significantly more lint yield (1088) than all other varieties.

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