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Effect of sowing date and varieties on growth and yield of okra

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Abstract
India is the largest producer of okra in the world. Among the cultural factors required for obtaining maximum yield and high returns, date of sowing and choice of cultivars is very important. It is an important factor that affects the physiological, morphological properties of any crop plant as well as yield. Keeping this in view, the present investigation was carried out at Vegetable Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, during the rainy season 2020-21 with five different dates of sowing S_1 (15th June), S_2 (30th June), S_3 (15th July), S_4 (30th July) and S_5 (14th August) and three varieties V_1 (Varsha Uphar), V_2 (Hisar Naveen) and V_3 (Hisar Unnat). The growth and yield attributes *viz.*, Maximum plant stand after 15 days, plant height, number of fruit pickings, fruit length, number of fruits per plant, average fruit weight, fruit yield per plant and yield were recorded from 15th July date of sowing in the cultivar Hisar Naveen. However, minimum number of days to 50% flowering and days to first fruit picking were recorded from 14th August date of sowing in the cultivar Hisar Naveen. Maximum number of branches, internodal length and crop duration were recorded from 15th June date of sowing in the cultivar Hisar Naveen. Based on the study, it was found that higher fruit yield was obtained from Hisar Naveen sown on 15th July which was statistically at par with 30th July date of sowing under prevailing Haryana climatic conditions.

Keywords: Okra, dates of sowing, variety, yield

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] commonly known as Lady's finger or Bhindi, is one of the most important vegetable crops grown during both summer as well as rainy season in India. The name Okra comes from Africa and means Lady's finger in Igbo, a Nigerian language. It is said to have originated in the Hindustani Center, primarily in India, Pakistan, Burma (Zeven and Zhukvsky, 1975) [28], as well as Africa (Thomson and Kelly, 1979) [23].
It belongs to botanical family Malvaceae. It is mainly grown for its pods which are used as fresh, canned or dried fruits. The immature tender fruit is cut into small pieces, then boiled and served with the soup. Fruits are rich source of protein, vitamins, Fibre and minerals like calcium, magnesium, potassium. One hundred gram green fruits contains 36 kcal, 88.6 g of water, 8.2 g of carbohydrate, 2.1 g of protein, 1.7 g of Fibre, 0.2 g of fat, P 90 mg, Ca 84 mg, Fe 1.2 mg, riboflavin 0.08 mg, niacin 0.6 mg, thiamine 0.04 mg, and ascorbic acid 47 mg. Leaves are a good source of iron and can also be used to make soup and is an important part of the West African diet.
In India, it occupies an area of about 509 thousand hectares with a production of 6095 million metric tonnes and a productivity of 119.74 quintal/hectare, while in Haryana, it occupies an area of 24.53 thousand hectares with a production of 233.96 thousand metric tonnes and productivity of 95.37 quintal/hectare (Anonymous, 2018) [1]. Okra is commercially grown in India in the states of Gujarat, Maharashtra, Andhra Pradesh, Madhya Pradesh, West Bengal, Orissa, Uttar Pradesh, Tamil Nadu, Karnataka, Haryana, and Punjab.
Among the cultural factors required for obtaining maximum yield and high returns, date of sowing and choice of cultivars is very important. It is an important factor that affects the physiological, morphological properties of any crop plant as well as yield (Akramghaderi *et al.*, 2003) [2]. Sowing date affects both plant growth and fruit yield depending on prevailing environmental conditions especially temperature and relative humidity. Optimum temperature, low relative humidity and low rainfall results in higher pod yield and quality of okra. It is sensitive to cold and cannot tolerate low temperature for long period (Miri, 2006) [15]. In general monthly mean optimum temperature range for growth, flowering and pod development

of okra is reported between 21-30^{0}C, while, the minimum and maximum temperature of this plant were 18^{0}C and 35^{0}C (Abd El-Kader *et al.*, 2010) [7]. Its sowing in April, as compared to June gave more number of branches, pod number, pod length, pod diameter, pod size, pod weight and fruit yield (Mondal *et al.*, 1989; Hussain *et al.*, 2006) [16, 11]. Different cultivars require different climatic conditions as well as different sowing dates, because a good cultivar sown at an improper time gives low yield (Hussain *et al.*, 2006; Zeb *et al.*, 2015) [11, 27].

It has become very essential to find out the optimum date of planting and good cultivars so that the plants may be exposed to most conducive atmosphere during their growth period for better fruit set and higher total yield. However, the information regarding the effect of planting time in conjunction with cultivars on growth and pod yield of okra is meager.

2. Material and Methods

The experiment was carried out at the Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana during during Rainy season of 2020. The soil of the experimental field was non-saline, sandy loam in texture, medium in organic carbon, low in available nitrogen, high in available phosphorus and rich in available potassium.. The experiment was conducted in Split Plot Design (SPD) having 15 treatments –

Treatments	Abbreviation used	Details of treatments
T1	S1V1	Varsha Uphar sown on 15th June
T2	S1V2	Hisar Naveen sown on 15th June
T3	S1V3	Hisar Unnat sown on 15th June
T4	S2V1	Varsha Uphar sown on 30th June
T5	S2V2	Hisar Naveen sown on 30th June
T6	S2V3	Hisar Unnat sown on 30th June
T7	S3V1	Varsha Uphar sown on 15th July
T8	S3V2	Hisar Naveen sown on 15th July
T9	S3V3	Hisar Unnat sown on 15th July
T10	S4V1	Varsha Uphar sown on 30th July
T11	S4V2	Hisar Naveen sown on 30th July
T12	S4V3	Hisar Unnat sown on 30th July
T13	S5V1	Varsha Uphar sown on 14th August
T14	S5V2	Hisar Naveen sown on 14th August
T15	S5V3	Hisar Unnat sown on 14th August

Seed sowing of okra was done on five different dates as per the treatment details mentioned in the treatments. Two - three healthy seeds were dibbled 2 cm deep at a spacing of 60 x 30 cm in two successive hills. A recommended basal dose of 1/3rd nitrogen, *i.e.*, 34 kg ha^{-1} and full dose of 60 kg P_2O_5 ha^{-1} through single super phosphate, respectively was uniformly applied in all the plots. The remaining dose of nitrogen (66 kg ha^{-1}) was applied in two split doses, *i.e.*,1st after three weeks of sowing and 2nd at the time of flowering.

Growth attributes *viz.*, plant stand after 15 days of sowing was determined by counting the total number of seedlings emerged after 15 days of sowing. Plant height was measured from sample plants in centimeter (cm) from the ground level to the tip of the longest stem of five plants. Total number of branches/plant were counted from each selected plant. Days taken to 50% flowering in each plot were recorded after first flowering on the basis of visual inspection. The inter-nodal length was measured from each labelled plant after final harvest. Days taken from the date of sowing to the first harvest of the fruits were counted and considered as days to first fruit picking per plant. Yield attributes *viz.* number of pickings, plant height, number of fruit pickings, fruit length, number of fruits per plant, average fruit weight, fruit yield per plant and yield were recorded at the time of harvesting. The number of pickings were counted from the first picking of the fruit to final harvesting of the crop. Length of fruits from randomly selected five okra fruits were measured from the base of the fruit to the tip of the fruit. To measure the fruit diameter, five fruits were selected randomly from the tagged plants from each plot and the diameter of the fruits was measured just above the calyx-joint using Vernier calipers. To calculate the number of fruits per plant the fruit at harvest stage from five observational plants were counted and averaged. The average fruit weight of fruits was measured from the fruits collected from five selected plants in each plot in each replication. All the fruits from five selected plants of each treatment were harvested and the average weight of fruits from five plants was recorded as fruit yield per plants in kilogram and the fruit yield obtained from each plot was converted into quintal per hectare to get the yield per hectare

2.1 Statistical analysis of data

The experiment was laid out in split plot design (SPD) and in completely randomized design (CRD) for field and laboratory parameters, respectively. The data obtained from experiment conducted in RBD and CRD were analyzed as per standard method suggested by Panse and Sukhatme (1985) [18]. The data observed for the various characters during the study were statistically analyzed following the technique of analysis of variance (ANOVA). The significance of difference between mean of two treatments were judge with the critical difference (CD) worked out using following formula:

$$CD = \sqrt{\frac{2 \text{ X Mean square error}}{n}} \text{ X 't'}$$

Where,
CD = Critical difference
N = Number of replications of the factor for which C.D. is to be calculated.
T = The value from fisher table for error degree of freedom at 5 per cent
level of significance.

3. Results and Discussion

3.1 Growth attributes

The perusal of data related to growth attributes of okra presented in Tables depicts that various sowing dates and varietes has significantly influenced the growth attributes *viz.* plant stand after 15 days of sowing, plant height, number of branches per plant, the inter-nodal length and days to first fruit picking per plant.

3.1.1 Plant stand after 15 days

The data presented in the Table 1. depicts that the plant stand after 15 Days was found maximum (93.9%) when the crop was sown on 15th July which was statistically at par with 30th June sowing (91.7%) and minimum plant stand was recorded on 14th August date of sowing (78.1%), whereas, among different cultivars Hisar Naveen showed the highest plant stand (90.2%) and was found significantly superior to all other treatments. The minimum plant stand was observed under cultivar Hisar Unnat (84.7%).

Table 1: Effect of planting dates and varieties on plant stand after 15 days in Okra

Plant stand after 15 days (%)				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	85.8	90.3	86.6	87.6
30-June	91.1	94.6	87.5	91.7
15-July	93.2	95.7	92.8	93.9
30-July	82.1	87.6	80.3	83.3
14-August	77.2	82.8	74.3	78.1
Mean V	85.9	90.2	84.7	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	2.3	2.0	NS	NS
SE(m)	0.7	0.7	1.2	1.4

3.1.2 Plant height at different stages of okra plant

The data for plant height at different stages in Table 2 shows that the plant height increased with the advancement in the crop stages (30 DAS, 50 DAS and at harvest) and it was maximum at harvest. Maximum plant height was recorded when the crop was sown on 15th July at all the stages of crop growth (24.2, 61.1 and 93.6 cm, respectively) and it was significantly superior to all other dates of sowing. Minimum plant height was observed on 14th August date of sowing (18.3, 40.4 and 63.2 cm, respectively). Among different cultivars the maximum plant height was recorded in Hisar Naveen (85.3 cm) followed by Varsha Uphar and minimum was recorded in cultivar Hisar Unnat (81.8 cm).

Table 2: Effect of planting dates and varieties on Plant height of okra

Treatments	**Plant height (cm)**		
	30 DAS	**50 DAS**	**At Harvest**
Date of sowing			
15-June	21.5	54.2	86.8
30-June	23.1	58.3	90.3
15-July	24.2	61.1	93.6
30-July	22.0	48.4	77.3
14-August	18.3	40.4	63.2
C.D. at 5%	0.5	0.7	2.0
SE(m)	0.2	0.2	0.6
Varieties			
Varsha Uphar	19.6	52.5	83.2
Hisar Naveen	21.1	54.5	85.3
Hisar Unnat	18.7	51.0	81.8
CD. at 5%	0.3	1.1	1.1
SE(m)	0.1	0.4	0.4

3.1.3 Number of branches per plant

The data on number of branches per plant presented in Table 3 indicates that the maximum number of branches per plant (3.7) was observed when the seeds were sown on 15th June dates of sowing which was found statistically at par with 30th June (3.7) and 15th July date of sowing and minimum was recorded on 14th August date of sowing (2.4). Among the cultivars, Hisar Naveen showed maximum number of branches (3.6) which was statistically at par with Varsha Uphar. The minimum number of branches (2.8) was reported in cultivar Hisar Unnat.

Table 3: Effect of planting dates and varieties on number of branches per plant in okra

Number of branches/ plant				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	3.6	4.2	3.3	3.7
30-June	3.8	4.0	3.1	3.6
15-July	3.7	4.0	3.1	3.6
30-July	3.0	3.2	2.5	2.9
14-August	2.4	2.8	2.0	2.4
Mean V	3.3	3.6	2.8	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	0.5	0.3	NS	NS
SE(m)	0.1	0.1	0.3	0.3

3.1.4 Internodal length

The interaction of date of sowing and varieties was found non-significant. The average length of internode recorded at the stage of final fruit harvesting of crop was statistically analyzed and presented in Table 4. It is clear from the table that internodal length decreased as the planting delayed. The maximum internodal length (4.7 cm) was recorded when the crop was sown on 15th June and minimum intermodal length (3.8 cm) was recorded on 14th August which was at par with 15th and 30th July date of sowing. Among different cultivars the minimum intermodal length was observed from Hisar Naveen which was at par with Varsha Uphar, whereas, Hisar Unnat showed maximum internodal length.

Table 4: Effect of planting dates and varieties on internodal length of okra

Internodal length (cm)				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	4.7	4.5	4.9	4.7
30-June	4.4	4.2	4.6	4.4
15-July	4.1	3.9	4.3	4.1
30-July	4.0	3.9	4.1	4.0
14-August	3.8	3.7	3.9	3.8
Mean V	4.2	4.0	4.4	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	0.3	0.2	NS	NS
SE(m)	0.2	0.1	0.1	0.1

3.1.5 Days to first fruit picking

It is one of the most important characters which is attributed to the fruit yield. The data pertaining to first picking influenced by different dates of sowing and varieties presented in Table 5 described that minimum (46.5 days) takes to first fruit picking was recorded from 15th June and maximum days to first fruit picking (51.4 days) was recorded when the crop was sown from 14th August. Whereas, among different okra cultivars minimum days taken to first fruit picking was found in Hisar Naveen (47.3 days) which was at par with Varsha Uphar (48.2 days) and maximum days to first

fruit picking (49.5 days) was observed in cultivar Hisar Unnat. The interaction effect was found non-significant.

The results associated with the growth attributes that is plant stand after 15 days of sowing, plant height, number of branches per plant, the inter-nodal length and days to first fruit picking per plant indicated that the growth attributing characters differed significantly with different sowing dates. The plant stand after 15 days was maximum (93.9%) on 15th July date of sowing. This might be due to the availability of favourable environmental conditions to the crop, while, crop sown on 14th August observed minimum plant stand after 15 days it might be due to variation in temperature which affected the plant stand. Gadakh *et al.* (1990) [8] also reported that variation in sowing dates was the main cause of seedling emergence their survival and vigour. Similar results were also reported by Grewal *et al.* (1974) [10] and Yadav *et al.* (2001) [26]. According to the data the plant height at all the stages of growth (24.2, 61.1 and 93.6 cm, respectively) was recorded maximum on 15th July sown crop, which was at par with 30th June sowing and found significantly superior over other dates of sowing. This was mainly due to prevailing favourable weather condition for their growth. The 14th August sown crop recorded shortest plant height at harvest (63.2 cm). It might be due to prevailing low temperature during growth periods, which ultimately restricted vegetative growth of the plants. These observations were in agreement with Chattopadhyay *et al.* (2011) [5], Shahid *et al.* (2015) [20, 27] and Tandel *et al.* (2017) [22]. They reported that prevailing low temperature during growth periods, restricted vegetative growth of the plants. The difference in plant height of different cultivars was due to genetic constitution of okra cultivars which contributed in the higher plant height. Similar findings have been reported by Shahid *et al.* (2015) [20, 27] and Vikash *et al.* (2016) [25].

Significantly higher number of branches per plant (3.7 cm) and internodal length (4.7) was recorded maximum when crop was sown on 15th June.This might be attributed due to prevailing high temperature and longer days available. However, these two parameters were observed lowest when okra crop was sown on 14th August. The results were coincided with the findings of Tandel *et al.* (2017) [22].

The different dates of sowing significantly influenced days to first fruit picking (46.5 days) which was recorded early on 15th June sown crop which was at par with 30th June and 15th July date of sowing and showed significant difference with other planting dates where days to first fruit picking (43.1 and 51.4 days, respectively) was noticed from on 14th August sown crop. This might be attributed due to optimum temperature and longer days available during the growth period. The results obtained indicated that planting time thus had a direct effect on maturity of okra fruits which is in agreement with the findings of Islam (1997) [13] and Hussain *et al.* (2006) [11]. Similarly, Pundarika *et al.* (1972) [19] also observed that maximum temperature and sunshine hours affected okra initial growth and flower production. Among different cultivars, the minimum days to first fruit picking (47.3 days) was observed in cultivar Hisar Naveen. This might be due to favourable response to optimum temperature and favorable environmental conditions which led to accumulation of enough thermal units for early maturity. Similar findings were also reported by Sood *et al.* (2019) [21].

Table 5: Effect of planting dates and varieties on days to first fruit pickings of okra

Days to first fruit picking				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	46.5	45.4	47.6	46.5
30-June	46.9	45.8	48.0	46.9
15-July	47.2	46.5	48.9	47.5
30-July	49.1	48.4	50.2	49.2
14-August	51.2	50.5	52.6	51.4
Mean V	48.2	47.3	49.5	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	1.2	0.9	NS	NS
SE(m)	0.3	0.4	0.6	0.5

3.2 Yield attributes

The perusal of data related to yield attributes of okra presented in Tables depicts various sowing dates and varietes has significantly influenced the yield and yield attributes that is number of fruits per plant, fruit length, fruit girth, average fruit weight, fruit yield per plant and yield per hectare.

3.2.1 Number of fruits per plant

The data on the effect of sowing times and varieties presented in Table 6 revealed that number of fruits per plant was significantly influenced by dates of sowing. The number of fruits per plant was maximum (33.2) on 15th July date of sowing which was statistically at par with 30th June date of sowing (32.0) and minimum number of fruit per plant was recorded on 14th August date of sowing, whereas, cultivars Hisar Naveen showed the highest (30.3) number of fruits per plant which was statistically at par with Varsha Uphar (29.4) and minimum number of fruits per plant was observed in cultivar Hisar Unnat (28.6).

Table 6: Effect of planting dates and varieties on number of fruits per plant in okra

No. of fruits per plant				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	30.1	30.5	29.7	30.1
30-June	32.3	32.8	31.1	32.0
15-July	33.4	34.1	32.1	33.2

30-July	27.2	28.2	26.7	27.4
14-August	24.1	25.8	23.6	24.5
Mean V	29.4	30.3	28.6	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	1.9	0.9	NS	NS
SE(m)	0.6	0.3	1.0	0.8
SE(m)	0.4	0.2	0.7	0.6

3.2.2 Fruit length (cm)

The fruit length (Table 7) was significantly influenced by dates of sowing and different cultivars but the interaction was found not significant. The maximum fruit length (10.5 cm) was recorded when sowing was done on 15th July which was found significantly superior to all other dates of sowing. Among different varieties Hisar Naveen showed maximum fruit length (9.5 cm) which was found significantly superior to all other treatments.

Table 7: Effect of planting dates and varieties on fruit length of okra

Fruit length (cm)				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	8.3	9.5	7.8	8.5
30-June	9.9	10.6	9.1	9.9
15-July	10.7	11.1	9.6	10.5
30-July	8.3	8.6	8.0	8.3
14-August	7.5	7.8	7.6	7.7
Mean V	8.9	9.5	8.4	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	0.5	0.3	NS	NS
SE(m)	0.2	0.1	0.3	0.3

3.2.3 Fruit girth (cm)

The data on fruit girth affected by planting dates and varieties has been presented in (Table 8). A persual of data indicated that dates of sowing and varieties had no significant on fruit girth. However, the maximum girth (1.3 cm) was obtained when sowing was done on 30th June to 30th July and minimum from 15th June and 14th August date of sowing. Among the varieties fruit girth was maximum in Hisar Unnat (1.3 cm).

Table 8: Effect of planting dates and varieties on fruit girth (cm) in okra

Fruit girth (cm)				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	1.2	1.2	1.3	1.2
30-June	1.2	1.3	1.4	1.3
15-July	1.3	1.3	1.4	1.3
30-July	1.2	1.3	1.4	1.3
14-August	1.2	1.2	1.4	1.2
Mean V	1.2	1.2	1.3	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	NS	NS	NS	NS
SE(m)	0.1	0.0	0.1	0.1

3.2.4 Average Fruit weight

The data on average fruit weight presented in Table 9 revealed that maximum average fruit weight (9.2 g) was observed when sowing was done on 15th July which was significantly superior to all other dates of sowing except 30th June (9.0 g), whereas, among cultivars Hisar Naveen recorded the maximum average fruit weight (9.4 g) and found significantly superior to other variety and minimum average fruit weight was observed in cultivar Hisar Unnat (8.4 g).

Table 9: Effect of planting dates and varieties on average fruit weight (g) in okra

Average fruit weight (g)				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	8.6	9.1	8.4	8.7
30-June	8.9	9.5	8.7	9.0
15-July	9.2	9.7	8.8	9.2
30-July	8.1	9.3	8.1	8.5
14-August	7.9	9.2	7.9	8.3
Mean V	8.6	9.4	8.4	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	0.3	0.2	0.4	0.5
SE(m)	0.1	0.1	0.2	0.1

3.2.5 Fruit yield per plant (kg)

The perusal of data on fruit yield per plant presented in Table 10 indicated that maximum fruit yield per plant (0.186 kg) was recorded when the sowing was done on 15th July, which was found significantly superior to all other dates of sowing except 30th June (0.175 kg) and minimum was recorded on 14th August (0.103 kg) date of sowing, whereas, cultivars Hisar Naveen showed the maximum fruit yield per plant (0.162 kg) which was followed by Varsha Uphar (0.150 kg) and minimum fruit yield per plant was observed in cultivar Hisar Unnat (0.138 g).

Table 10: Effect of planting dates and varieties on fruit yield per plant (kg) in okra

Fruit yield per plant (kg)				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	0.159	0.167	0.153	0.160
30-June	0.173	0.191	0.161	0.175
15-July	0.187	0.203	0.167	0.186
30-July	0.128	0.138	0.117	0.128
14-August	0.105	0.112	0.092	0.103
Mean V	0.150	0.162	0.138	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	0.012	0.007	NS	NS
SE(m)	0.004	0.002	0.006	0.005

4.1.11 Average Fruit weight

The data on average fruit weight presented in Table 9 revealed that maximum average fruit weight (9.2 g) was observed when sowing was done on 15th July which was significantly superior to all other dates of sowing except 30th June (9.0 g), whereas, among cultivars Hisar Naveen recorded the maximum average fruit weight (9.4 g) and found significantly superior to other variety and minimum average fruit weight was observed in cultivar Hisar Unnat (8.4 g).

4.1.12 Fruit yield per plant (kg)

The perusal of data on fruit yield per plant presented in Table 10 indicated that maximum fruit yield per plant (0.186 kg) was recorded when the sowing was done on 15th July, which was found significantly superior to all other dates of sowing except 30th June (0.175 kg) and minimum was recorded on 14th August (0.103 kg) date of sowing, whereas, cultivars Hisar Naveen showed the maximum fruit yield per plant (0.162 kg) which was followed by Varsha Uphar (0.150 kg) and minimum fruit yield per plant was observed in cultivar Hisar Unnat (0.138 g).

3.2.6 Fruit Yield (q/ha)

The data pertaining to total fruit yield (q/ha) influenced by dates of sowing and different varieties has been presented in Table 11. There was significant effect of date of sowing on pod yield. A perusal of the data indicated that the maximum pod yield (104.0 q/ha) was obtained when the sowing was done on 15th July and it was significantly higher than all other dates except 30th June, while, minimum pod yield (62.2 q/ha) was recorded on 14th August date of sowing. Whereas, among different varieties Hisar Naveen gave maximum fruit yield (92.0 q/ha) followed by Varsha Uphar (85.6 q/ha), while, minimum was recorded in Hisar Unnat (79.2 q/ha). The interaction of dates of sowing and varieties was found non-significant. The results associated with yield and yield attributes that is number of fruits per plant, fruit length (cm) and fruit girth (cm) and average fruit weight indicated that fruit yield attributes were significantly influenced by the different dates of sowing and okra varieties. The yield of okra plant depends upon the yield attributing characters like number of pickings, length and girth of fruit, number of fruits per plant, average weight of fruit, and fruit yield per plant which was highest (104.0 q/ha) under 15th July sown crop which was statistically at par with 30th June date of sowing (97.3 q/ha). This might be attributed due to prevailing environmental conditions especially temperature and relative humidity that prevailed throughout the crop growth. Ghannad *et al.* (2014) [9] also suggested that environmental factors could explain delicate balance between vegetative and reproductive growth of okra. These findings were also confirmative with the result of Ijoyah *et al.* (2010) [12], Morwal and Patel (2017) [17], Bake *et al.* (2017) [4], Undie and Litio (2018) [24] and Das *et al.* (2018). The fruit yield (62.2 q/ha) of okra was extremely poor on 14th August sown crop, which indicated that okra cultivated in late season might be affected due to weather condition prevailing during crop season, which adversely affected the number of fruits, weight of fruits per plant and number of pickings resulting into poor yield of okra. Gadakh *et al.* (1990) [8] also reported that among the autumn, winter and summer, the crop gave the lowest yield in winter season. Among different varieties, the early maturing cultivar Hisar Naveen recorded maximum fruit yield (92.0 q/ha). The reason might be due to more number of pickings, maximum length and girth of fruit, number of fruits per plant, average weight of fruit, and fruit yield per plant recorded under the cultivar Hisar Naveen as compared to the other cultivars. The interaction between sowing dates and variety was found non-significant. These results are in close confirmity with the findings of Hussain *et al.* (2006) [11], Kumar *et al.* (2016) [14] and Atallah (2016) [3] who reported that early maturing cultivar produced maximum fruit yield.

Table 11: Effect of planting dates and varieties on yield (q/ha) in okra

Fruit yield q/ha				
Treatments	**Varieties**			
Date of sowing	**Varsha Uphar**	**Hisar Naveen**	**Hisar Unnat**	**Mean D**
15-June	88.2	93.0	85.1	88.8
30-June	96.0	106.3	89.5	97.3
15-July	104.1	113.1	95.0	104.0

30-July	76.2	81.6	70.2	76.0
14-August	63.2	67.2	56.2	62.2
Mean V	85.6	92.2	79.2	
	Factor (D)	Factor (V)	Factor (V) at same level of D	Factor (D) at same level of V
C.D. at 5%	8.5	3.9	NS	NS
SE(m)	2.6	1.3	4.4	3.5

4. Conclusion

On the basis of present study it may be concluded that maximum okra growth and fruit yield (104 q/ha) was recorded when Hisar Naveen was sown on 15th July which was statistically at par with 30th June date of sowing under Haryana conditions.

5. References

1. Anonymous, Horticultural Statistics at a Glance 2018, 196, 10.
2. Akramghaderi F, Latifi N, Rezaei J, Soltani A. Effects of planting date on the phenology and morphology of three cotton cultivars in Gorgan. Iranian Journal of Agricultural Sciences 2003;34(1):221-230.
3. Atallah SY. Performance of five okra cultivars sown on different dates under assiut environmental conditions. Assiut Journal of Agricultural Sciences, Assiut (Egypt) 2016;47(6-1):217-224.
4. Bake ID, Singh BK, Singh AK, Moharana DP, Maurya AK. Impact of planting distances and sowing dates on yield attributing traits of okra [*Abelmoschus esculentus* (L.) Moench] cv. Kashi Pragati. International Journal of Current Microbiology and Applied Sciences, Varanasi (India) 2017;6(7):4112-4125.
5. Chattopadhyay A, Dutta S, Chatterjee S. Seed yield and quality of okra as influenced by sowing dates. African Journal of Biotechnology, West Bangal (India) 2011;10(28):5461-5467.
6. Das S, Pandey V, Mishra S. Growth and fruit yield of okra as influenced by different growing environment. International Journal of Agricultural Innovation and Research, Anand (Gujrat), 2018;6(5):232-234.
7. El-Kader A, Shaaban SM, El-Fattah M. Effect of irrigation levels and organic compost on okra plants (*Abelmoschus esculentus* L.) grown in sandy calcareous soil. Agriculture and Biology Journal of North America, Egypt 2010;1(3):225-231.
8. Gadakh SR, Lawande KE, Kale PN. Effect of different seasons and spacings on yield and quality of bhindi. Haryana Journal of Horticultural Sciences 1990;19(3, 4):329-332.
9. Ghannad M, Madani H, Darvishi HH. Responses of okra crop to sowing time, irrigation interval and sowing methods in Shahrood region. International Journal of Agriculture and Crop Sciences (IJACS), Sharood (Iran), 2014;7(10):676-682.
10. Grewal BS, Nandpuri KS, Kumar JC. Reproductive capacity of okra as influenced by the time of sowing, row spacing and green pods picking. Punjab horticultural journal 1974, 60-66.
11. Hussain S, Sajid M, Amin N, Alam S, Iqbal Z. Response of okra (*Abelmoschus esculentus*) cultivars to different sowing times. *Journal of agricultural and biological science*, Skardu (Pakistan), 2006;1(1):55-59.
12. Ijoyah MO, Unah PO, Fanen FT. Response of okra (*Abelmoschus esculentus* L. Moench) to intra-row spacing in Makurdi, Nigeria. Agriculture and biology journal of north America 2010;1(6):1328-1332.
13. Islam MS. Off season performance of okra for vegetable and seed production (Doctoral dissertation, MS Thesis. Department of Horticulture Bangabandhu Sheikh Mujibor Rahman Agriculture University, Salna, Gazipur, Uttar Pradesh) 1997.
14. Kumar V, Dhankhar SK, Aniketvilas C, Yadav N. Effect of spacing on growth and yield parameters of two varieties of okra [*Abelmoschus esculantus* (L) Moench]. International Journal of Farm Sciences 2016; 6(1):163-168.
15. Miri K. Effects of sowing date and density on yield and yield components of okra, *Abelmoschus esculentus* (l.) moench, in iranshahr. Seed and Plant 2006;22(3):369-379.
16. Mondal G, Malik SC, Maity TK. Effect of sowing date and spacing on the growth and yield of okra. Crop Research Hisar 1989;2(2):230-231.
17. Morwal BR, Patel MC. Growth and yield of okra (*Abelmoschus esculentus* L) as affected by date of sowing and spacing under north Gujarat condition. Journal of Krishi Vigyan, Dantiwada (Gujarat) 2017;6(1):93-96.
18. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi 1985.
19. Pundarika KR, Rap HK, Moenak PC. Effect of NPK content in plant maturity on yield and dry matter production of America cotton. Indian Journal of Agriculture Science 1972;42(8):690-694.
20. Shahid M, Rehman A, Malik AA, Khan MS, Zakaria. Effect of sowing dates on the yield and seed production of okra cultivars in Mansehra. *Journal of Biology, Agriculture and Healthcare*, a Mansehra (Pakistan), 2015;5:172-177.
21. Sood R, Kaur R. Effect of sowing time on performance of okra [*Abelmoschus esculentus* (L.) Moench] varieties under Jalandhar conditions. International Journal of Current Microbiology and Applied Sciences 2019;8(12):568-576.
22. Tandel BM, Nayaka P, Shah KA. Yield of okra as influenced by the different sowing dates and plant spacing. International Journal of Chemical Studies, 2017;5(5):91-93.
23. Thomson HC, Kelly WC. Vegetables Crops. *McGraw Hill Co., New York*, 1979;562:262.
24. Undie, Litio. Influence of Planting Date and Harvesting Sequence on Growth and Fruit/Seed Yields in West African Okra (*Abelmoschus Caillei* (A. Chev [Stevels]). International Journal of Agriculture and Earth Science 2018;4(4):8-17.
25. Vikash K, Dhankhar SK, Vilas CA, Neha Y. Influence of fertilizers and varieties on growth and yield of okra [*Abelmoschus esculentus* (L.) Moench]. Annals of Biology 2016;32(1):45.
26. Yadav SK, Dhankhar BS, Deswal DP, Tomer RPS. Effect of sowing date and plant geometry on seed production and quality of okra (*Abelmoschus esculentus* (L.) Moench) cv. Varsha Uphar. Seed Research-New

Delhi 2001;29(2):149-152.
27. Zeb S, Ali QS, Jamil E, Ahmad N, Sajid M, Siddique S, Shahid M. Effect of sowing dates on the yield and seed production of Okra cultivars in Mansehra. Pure Appl. Biol 2015;4(3):313-317.
28. Zeven AC, Zhukovsky PM. Dictionary of cultivated plants and their centres of diversity. Centre for Agricultural Publishing and Documentation, Wageningen. The Netherlands 1975, 210.