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Assessment of crop growth and development of pigeonpea varieties (*Cajanus cajan* (L.) under different sowing windows in Western Maharashtra

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Abstract
An agro-meteorological investigation was undertaken to study "Crop growth and development of pigeonpea (*Cajanus cajan*) varieties under different sowing windows" during *kharif*, 2017-18 and 2018-19 at Department of Agricultural Meteorology Farm, Centre of Advanced Faculty Training (CAFT) in Agricultural Meteorology, College of Agriculture, Pune, Maharashtra State (India). The experiment was laid out in split plot design with three replications. The treatment comprised of four varieties *viz.*, Vipula, Rajeshwari (Phule T 0012), BDN 711 and ICPH 2740 as main plot and four sowing windows *viz*., 24th meteorological window (MW) (11th to 17th June), 26th MW (25th June to 01st July), 28th MW (9th to 15th July) and 30th MW (23rd to 29th July) as sub plot treatments. All the growth attributes were increased with the advancement in age of the pigeonpea crop. Plant height (178.7 and 175.6 cm), total number branches (12.17 and 11.80), leaf area index (1.378 and 1.315), total dry matter accumulation per plant (220.0 and 216.9 g), mean days to 50 per cent flowering (122.7 and 121.6) and mean days to physiological maturity (175.6 and 172.2) during both the years of 2017-18 and 2018-19, respectively which were found Significantly higher in variety ICPH 2740 over Vipula, Rajeshwari and BDN 711. This was followed by varieties *viz*., Rajeshwari, Vipula and BDN 711.

Keywords: Assessment, development, pigeonpea, windows, *Cajanus cajan* L.

1. Introduction
Pigeonpea [*Cajanus cajan* (L.) Millspaugh] is one of the major pulse crop grown between 30° N and 30° S in the semi-arid tropics. It is the second most important pulse crop in India, after chickpea (Nene *et al*., 1996) [8]. It is an important source of high quality dietary protein and is mostly consumed in the form of split pulse; green seeds are used as a vegetable. On the other hand, crushed dry seeds are used as animal feed, green and dry leaves as fodder, stems as fuel wood and to make huts and baskets in tribal areas. It is an agricultural crop of rainfed-drylands which can be grown on mountain slopes to reduce soil erosion.

Pigeonpea is grown on an area of 5 m ha and production of 3.84 m tonnes in Asia with production shared by 82.1 per cent. In India, it is grown over an area of 0.38 m ha with a production of 0.33 m t and the productivity is 859 kg ha^{-1} (Anonymous, 2016). All of these cultivated types of pigeonpea fall into two group's *viz*., *Cajanus cajan* var. Bicolour and *C. indicus* var. flavus.

Pigeonpea requires a tropical climate for its growth and development. Warm dry climate is the most suitable for better germination and establishment of seedlings, a temperature range of 20-25 ^{0}C is considered favourable for the vegetative growth, the optimum temperature range is 13 ^{0}C to 25 ^{0}C. It cannot withstand frost and heavy rains. The plants can thrive well in regions where annual rainfall is 250 cm, provided the fields are well drained. It can also grow well under very low rainfall *i.e*. 50 cm per annum, provided the soil is deep enough to hold the water for sufficient time. Bright sunny days are very essential during the flowering and the ripening stages of *arhar*.

In pigeonpea (*Cajanus cajan* L. Millsp) flowering stage is strongly affected by rainfall and temperature. Low day and night temperature during reproductive phase favoured higher crop production (Nanda *et al*., 2010) [7].

Crop phenology is one of the important aspects since the biomass production and seed yields are known to depend greatly on prevailing environmental conditions during various phenophases.

Phenological development of crops is known to be closely influenced by the changes in weather conditions occurring during crop growth season. So, a detailed study of crop phenological events in pigeonpea would provide a base for understanding different growth and developmental processes as related to weather parameters.

2. Materials and Methods

2.1 Location of the experimental site

The field experiment was conducted for two consecutive years at Department of Agricultural Meteorology farm, College of Agriculture, Pune during *kharif*, 2017 and 2018. The geographical location of the site (Pune) was 18° 32'N, latitude; 73°51E, longitude and 559 m above mean sea level (MSL). The soil is medium black having depth of about 1m. The average annual rainfall of Pune is 675mm.

2.2 Weather conditions during experimental period

The weekly maximum temperature experienced during 2017-18 was 33.4 ^{0}C and lowest maximum temperature was 27.1 ^{0}C. The highest minimum temperature experienced was 23.9 ^{0}C and the lowest was 10.3 ^{0}C. The maximum morning relative humidity was 97.0 per cent and the minimum was 81.1 per cent. The maximum evening relative humidity was 82.1 per cent and the minimum was 31.1 per cent. The total rainfall was 909.1 mm and maximum amount of rainfall 135.1 mm in a week.

The weekly maximum temperature experienced during 2018-19 was 33.8 ^{0}C and lowest maximum temperature was 26.2 ^{0}C. The highest minimum temperature experienced was 24.6^{0}C and the lowest was 8.7 ^{0}C. The maximum morning relative humidity was 94.3 per cent and the minimum was 77.9 per cent. The maximum evening relative humidity was 85.4 per cent and the minimum was 22.6 per cent. The total rainfall was 420.3 mm and maximum amount of rainfall 90.8 mm in a week.

2.3 Experimental details

The experiment was conducted in a split plot design with three replications and sixteen treatment combinations of different varieties and sowing windows. The treatment comprised of four varieties *viz.*, Vipula, Rajeshwari (Phule T 0012), BDN 711 and ICPH 2740 (*Mannem Konda Kandi*) as main plot and four sowing windows *viz*., 24th, 26th MW, 28th and 30th MW as sub plot treatments. Inter row spacing was 45 cm and plant to plant spacing was 20 cm. Gross plot size was 4.0 × 4.5 square metres and net plot size was 3.6 × 4.0 square metres. Seeds were treated with Thiram @ 4 g per kg of seed followed by Rhizobium and PSB @ 10 g per kg of seed. The seed rate @ 18 kg ha^{-1} for all varieties. Urea and DAP were used as source of N and P, and applied as per recommended dose i.e., 25 kg N and 50 kg per hectare.

2.4 Growth studies

2.4.1 Plant height (cm)

The height of plant generally indicates the growth of crop. Five randomly selected plants from one meter length from each net plot were used for recording the plant height with the help of meter scale. The height of the plant was recorded from the base of stem to the tip of the main shoot of sampling plants and average height plant-1 was worked out. The observations were recorded at 28, 56, 84, 112, 140 DAS and at harvest.

2.4.2 Number of branches plant^{-1}

The number of branches arising from main shoot was recorded on randomly selected five plants at 28, 56, 84, 112, 140 DAS and at harvest.

2.4.3 Leaf area index (LAI)

The plants collected for dry matter were used for the estimation of leaf area. The leaf area was measured with the help of automatic leaf area meter in cm^2. The leaf area recorded at 28, 56, 84, 112, 140 DAS and at harvest. The following formula given by Watson (1947) was used to calculate leaf area index:

$$\text{LAI} = \frac{\text{Leaf area per plant}}{\text{Land area per plant}}$$

2.4.4 Dry matter plant^{-1} (g)

The plants collected for the estimation of leaf area index were used for dry matter studies. Observations for dry matter recorded at 28, 56, 84, 112, 140 DAS and at harvest. One representative plant from each net plot was selected randomly and uprooted at each observation date. Roots were discarded for dry matter studies. Leaves and stem part was stored separately in well labeled brown paper bag for drying. Initially plant samples were sundried for three days followed by oven drying at a constant temperature of 60 ^{o}C until constant dry weight was obtained. After weighing the material the dry matter of plant was recorded.

2.5 Phenological studies

2.5.1 Days to 50 per cent flowering

The number of days from sowing to 50 per cent of the plants in the plot showed flowering was recorded by observing plants from net plot.

2.5.2 Days to maturity

Number of days required from sowing to physiological maturity of pods was recorded by observing plants from net plot.

3. Results and Discussion

This investigation was undertaken to study "Crop growth and development of pigeonpea (*Cajanus cajan*) varieties under different sowing windows" during *kharif*, 2017-18 and 2018-19. The data obtained from the experiments were duly analyzed and are presented discussed as below:

3.1 Plant height (cm)

The data pertaining to mean plant height (cm) as influenced periodically by different treatments, during 2017-18 and 2018-19 are presented in Table 1. The mean plant height increased as the crop advanced in age. The mean plant height increased from 28 DAS (12.41 cm) to harvest (173.6 cm) during 2017-18 and from 28 DAS (11.71 cm) to harvest (168.4 cm) during 2018-19.

3.1.1 Effect of varieties

The mean plant height differences due to varieties were significant at all the stages of crop growth during both the seasons of 2017-18 and 2018-19 (Table 2). It could be observed that variety ICPH 2740 recorded significantly higher plant height (178.7 and 175.6), which was followed by Rajeshwari (174.3 and 168.0 cm), Vipula (175.0 and 165.4 cm). Plant height of variety BDN 711 was found significantly

lowest (166.2 and 164.8 cm) during 2017-18 and 2018-19, respectively.

Plant height is basically a genetic character. Among the varieties, ICPH 2740 has recorded the highest plant height. Plants of ICPH 2740 are non-determinate with profuse secondary and tertiary branches, photo-sensitive, and respond positively to wider spacing. Plant height ranges in between 204 - 235 cm (Saxena *et al*., 2016) [14].

3.1.2 Effect of sowing windows

The mean plant height was significantly influenced by different growing environments created through different sowing windows throughout the crop growth period. The mean plant height was increased with advancement in the crop age and maximum plant height was recorded at maturity. The higher plant height (205.0 and 202.7 cm) was recorded under 24th MW sowing window, followed by 26th MW sowing window (178.2 and 174.7 cm) and 28th MW sowing window (163.4 and 153.3 cm) during 2017-18 and 2018-19, respectively. The 30th MW sowing produced least plant height (147.6 and 141.1 cm) during both the seasons 2017-18 and 2018-19, respectively. Similar results were observed earlier by Rani and Rajireddy (2010) [11] in pigeonpea.

Increase in plant height might be due to utilization of available resources at early sowing and better use of precipitation and soil moisture. Prasad *et al.* (2013) [9] also showed that, with delayed sowings, the plant height reduced. These results are also in confirmation with Sharanappa *et al.* (2018) [154].

3.1.3 Effect of interaction

Plant height was significantly influenced by the interaction between pigeonpea varieties and sowing windows at all the stages of plant growth. Sowing at 24th MW recorded higher plant height (220.4 cm) in ICPH 2740 variety. The same trend was observed in both the seasons' *i.e* 2017-18 (221.4 cm) and 2018-19 (219.4 cm). It was followed by variety Rajeshwari variety 207.5 cm. The same trend was observed in both the seasons *i.e* 2017-18 (209.5) and 2018-19 (205.5 cm). ICPH 2740 was followed by Vipula 203.0 cm (203.4 and 202.7 cm) and BDN 711 184.6 cm (185.8 and 183.4 cm). All the varieties recorded the lowest plant height in last sowing window. This might be due to quick change in photo period during the late sown crops.

Table 1: Plant height (cm) of pigeonpea affected periodically by different treatments

Treatment	28 DAS			56 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	11.73^{c}	11.52^{b}	11.63^{c}	38.59^{b}	37.21^{b}	37.90^{b}
V_2: Rajeshwari	13.17^{b}	11.53^{b}	12.35^{b}	40.91^{a}	39.13^{a}	40.02^{b}
V_3: BDN 711	10.74^{d}	10.36^{c}	10.55^{d}	37.63^{b}	36.60^{b}	37.12^{c}
V_4: ICPH 2740	13.99^{a}	13.45^{a}	13.72^{a}	43.21^{a}	40.88^{a}	42.05^{a}
S. E.±	0.18	0.24	0.22	1.02	0.89	0.69
C. D. at 5%	0.61	0.84	0.68	3.53	3.08	2.13
B) Sub plot: Sowing windows						
D_1: 24 MW	15.51^{a}	13.67^{a}	14.59^{a}	44.54^{a}	42.98^{a}	43.76^{a}
D_2: 26 MW	12.87^{b}	12.80^{a}	12.84^{b}	42.15^{b}	40.03^{b}	41.09^{b}
D_3: 28 MW	11.47^{b}	10.84^{b}	11.15^{c}	38.56_{c}	37.41^{c}	37.99^{c}
D_4: 30 MW	9.77^{c}	9.54^{b}	9.66^{d}	35.10^{d}	33.42d	34.26^{d}
S. E.±	0.24	0.25	0.12	0.76	0.63	0.49
C. D. at 5%	0.71	0.72	0.33	2.22	1.83	1.38
C) Interaction (A×B)						
D_1V_1	15.31^{bc}	12.55^{bc}	13.93^{d}	43.32^{b}	41.86^{bc}	42.59^{c}
D_2V_1	11.45^{de}	12.75^{b}	12.10^{f}	40.43^{bc}	39.27_{c}	39.85^{cd}
D_3V_1	10.70^{e}	11.17^{c}	10.93^{g}	38.07^{c}	36.67^{cd}	37.37^{de}
D_4V_1	9.47^{ef}	9.63^{d}	9.55^{i}	32.54^{d}	31.05^{e}	31.80^{f}
D_1V_2	15.73^{b}	13.02^{b}	14.37^{c}	45.85^{ab}	43.91^{b}	44.88^{bc}
D_2V_2	13.96^{c}	11.97^{bc}	12.97^{e}	42.34^{bc}	40.12^{c}	41.23^{cd}
D_3V_2	12.52^{d}	10.54^{cd}	11.53^{fg}	40.10^{bc}	38.71^{c}	39.41^{d}
D_4V_2	10.46^{e}	10.57^{cd}	10.51^{gh}	35.35^{cd}	33.79^{de}	34.57^{e}
D_1V_3	13.14^{cd}	12.68^{b}	12.91^{e}	38.73^{c}	37.66^{cd}	38.20^{d}
D_2V_3	10.75^{e}	11.02^{cd}	10.89^{gh}	38.68^{c}	36.70^{cd}	37.69^{de}
D_3V_3	10.20^{ef}	9.92^{cd}	10.06^{hi}	37.34^{c}	37.10^{cd}	37.22^{de}
D_4V_3	8.86^{f}	7.81^{e}	8.34^{j}	35.76^{cd}	34.95^{d}	35.36^{e}
D_1V_4	17.87^{a}	16.43^{a}	17.15^{a}	50.24^{a}	48.47^{a}	49.36^{a}
D_2V_4	15.33^{bc}	15.47^{a}	15.40^{b}	47.14^{ab}	44.01^{b}	45.58^{b}
D_3V_4	12.44^{d}	11.72^{bc}	12.08^{f}	38.72^{c}	37.17^{cd}	37.94^{de}
D_4V_4	10.30^{e}	10.17^{cd}	10.24^{h}	36.73^{cd}	33.89^{de}	35.31^{e}
S. E.±	0.48	0.49	0.23	1.52	1.26	0.97
C. D. at 5%	1.41	1.44	0.66	4.43	3.67	2.76
General Mean	12.41	11.71	12.06	40.08	38.46	39.27

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 2: Plant height (cm) of pigeonpea affected periodically by different treatments

Treatment	84 DAS			112 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	75.57^{b}	72.41^{b}	73.99^{b}	112.4^{b}	97.2^{b}	104.8^{c}
V_2: Rajeshwari	80.62^{a}	77.50^{a}	79.06^{a}	118.6^{b}	106.1^{a}	112.4^{b}
V_3: BDN 711	72.93^{b}	70.37^{b}	71.65^{b}	108.2^{c}	95.5^{b}	101.9^{c}
V_4: ICPH 2740	83.15^{a}	78.61^{a}	80.88^{a}	126.8^{a}	108.5^{a}	117.6^{a}
S. E.±	1.27	1.41	0.97	1.94	2.03	1.55
C. D. at 5%	4.39	4.86	2.99	6.70	7.02	4.79
B) Sub plot: Sowing windows						
D_1: 24 MW	86.64^{a}	83.71^{a}	85.18^{a}	136.0^{a}	116.5^{a}	126.2^{a}
D_2: 26 MW	80.57^{b}	77.61^{b}	79.09^{b}	125.5^{b}	108.0^{b}	116.7^{b}
D_3: 28 MW	75.12^{c}	71.87^{c}	73.49^{c}	111.1^{c}	99.8^{c}	105.4^{c}
D_4: 30 MW	69.94^{d}	65.70^{d}	67.82^{d}	93.5^{d}	83.1^{d}	88.3^{d}
S. E.±	1.03	1.03	0.71	1.75	1.18	0.83
C. D. at 5%	3.00	2.98	2.03	5.11	3.44	2.36
C) Interaction (A×B)						
D_1V_1	83.40^{bc}	80.70^{bc}	82.05^{c}	128.6^{b}	108.7^{cd}	118.7^{cd}
D_2V_1	76.69^{cd}	73.62^{cd}	75.16^{d}	123.3^{bc}	102.5^{d}	112.9^{de}

D_3V_1	72.39^{d}	71.28^{d}	71.84^{de}	104.5^{d}	95.4^{e}	100.0^{f}
D_4V_1	69.79^{de}	64.03^{e}	66.91^{ef}	93.2^{e}	82.2^{f}	87.7^{g}
D_1V_2	86.74^{bc}	83.61^{bc}	85.18^{bc}	141.4^{ab}	120.2^{b}	130.8^{b}
D_2V_2	81.39^{c}	78.20^{c}	79.79^{c}	128.3^{b}	117.7^{bc}	123.0^{c}
D_3V_2	79.83^{cd}	76.32^{cd}	78.08^{cd}	110.5^{cd}	103.1^{d}	106.8^{ef}
D_4V_2	74.52^{d}	71.88^{d}	73.20^{d}	94.3^{de}	83.5^{f}	88.9^{g}
D_1V_3	80.78^{cd}	78.42^{c}	79.60^{c}	122.6^{bc}	106.6^{cd}	114.6^{d}
D_2V_3	74.86^{d}	73.29^{cd}	74.08^{d}	118.3^{c}	99.5^{de}	108.9^{e}
D_3V_3	70.58^{de}	67.3d^{e}	68.94^{e}	101.4^{de}	93.5^{e}	97.4f^{g}
D_4V_3	65.50^{e}	62.49^{e}	64.00^{f}	90.6^{e}	82.4^{f}	86.5^{g}
D_1V_4	95.65^{a}	92.12^{a}	93.88^{a}	151.3^{a}	130.4^{a}	140.8^{a}
D_2V_4	89.34^{b}	85.32^{b}	87.33^{b}	132.0^{b}	112.3^{c}	122.1^{cd}
D_3V_4	77.66^{cd}	72.59^{cd}	75.13^{d}	127.7^{bc}	107.2cd	117.5^{d}
D_4V_4	69.95^{de}	64.40^{e}	67.18^{ef}	96.0^{de}	84.3^{f}	90.1^{g}
S. E.±	2.06	2.06	1.43	3.50	2.36	1.66
C. D. at 5%	6.00	6.00	4.07	10.22	6.90	4.71
General Mean	78.07	74.72	76.39	116.50	101.84	109.17

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 3: Plant height (cm) of pigeonpea affected periodically by different treatments

Treatment	140 DAS			At harvest		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	154.1^{a}	146.5^{b}	150.3^{b}	175.0^{a}	165.4^{b}	170.2^{b}
V_2: Rajeshwari	157.7a	148.5^{b}	153.1^{a}	174.3^{a}	168.0^{b}	171.2^{b}
V_3: BDN 711	147.7^{b}	146.0^{b}	146.9^{b}	166.2^{b}	164.8^{b}	165.5^{c}
V_4: ICPH 2740	159.9^{a}	154.5^{a}	157.2^{a}	178.7^{a}	175.6^{a}	177.1^{a}
S. E.±	1.96	1.63	1.51	2.28	1.85	1.73
C. D. at 5%	6.78	5.63	4.65	7.89	6.41	5.32
B) Sub plot: Sowing windows						
D_1: 24 MW	184.9^{a}	181.6^{a}	183.3^{a}	205.0^{a}	202.7^{a}	203.9^{a}
D_2: 26 MW	162.5^{b}	155.8^{b}	159.2^{b}	178.2^{b}	174.7^{b}	176.4^{b}
D_3: 28 MW	144.8^{c}	136.9^{c}	140.8^{c}	163.4^{c}	155.3^{c}	159.3^{c}
D_4: 30 MW	127.1^{d}	121.2^{d}	124.2^{d}	147.6^{d}	141.1^{d}	144.3^{d}
S. E±	2.73	2.33	1.73	2.50	2.40	1.70
C. D. at 5%	7.96	6.80	4.92	7.41	7.13	4.75
C) Interaction (A×B)						
D_1V_1	180.7^{bc}	178.5^{b}	179.6^{b}	203.4^{b}	202.7^{b}	203.0^{b}
D_2V_1	155.2^{cd}	141.7^{d}	148.5^{d}	173.6^{cd}	161.0^{d}	167.3^{d}
D_3V_1	145.2^{de}	136.7^{de}	140.9^{de}	164.7^{d}	155.0^{de}	159.8^{de}
D_4V_1	135.1^{de}	129.1^{de}	132.1^{ef}	158.4^{de}	142.8^{e}	150.6^{ef}
D_1V_2	187.1^{b}	185.7^{ab}	186.4^{b}	209.5^{ab}	205.5^{ab}	207.5^{b}
D_2V_2	165.3^{c}	156.3^{c}	160.8^{c}	178.3^{cd}	175.4^{c}	176.8^{c}
D_3V_2	146.9^{de}	132.3^{de}	139.6d^{e}	162.6^{d}	151.1^{de}	156.8^{e}
D_4V_2	131.3^{e}	120.0^{e}	125.7^{f}	146.8^{e}	140.1^{e}	143.5^{f}
D_1V_3	166.2^{c}	165.1^{bc}	165.6^{c}	185.8^{c}	183.4^{c}	184.6^{c}
D_2V_3	162.3^{cd}	159.0^{c}	160.6^{c}	175.9^{cd}	177.0^{c}	176.4^{cd}
D_3V_3	137.7^{de}	136.9^{d}	137.3^{e}	156.1^{de}	154.8^{de}	155.4^{e}
D_4V_3	124.5^{e}	123.1^{e}	123.8^{f}	147.2^{e}	144.1^{e}	145.6^{f}
D_1V_4	205.8^{a}	197.2^{a}	201.5^{a}	221.4^{a}	219.4^{a}	220.4^{a}
D_2V_4	167.0^{c}	166.4^{bc}	166.7^{c}	185.0^{cd}	185.3^{c}	185.2^{c}
D_3V_4	149.3^{d}	141.8^{d}	145.6^{de}	170.2^{d}	160.3^{d}	165.3^{de}
D_4V_4	117.4^{e}	112.8^{e}	115.1^{f}	138.1^{e}	137.2^{e}	137.6^{f}
S. E±	5.46	4.66	3.46	5.08	4.89	3.34
C. D. at 5%	15.93	13.61	9.85	14.82	14.26	9.49
General Mean	154.82	148.91	151.86	173.6	168.4	171.0

Note: Observations with same superscript are on par and with different superscript are significantly different

3.2 Number of branches plant^{-1}

The data in respect to number of branches plant^{-1} of pigeonpea as affected by different treatments are presented in Table 3. The mean number of branches plant^{-1} was progressively increased with advancement of age of the crop, 11.17 and 10.65 at harvest during the year, 2017-18 and 2018-19, respectively.

3.2.1 Effect of varieties

The mean number of branches plant^{-1} as influenced due to varieties was significant at all the stages of crop growth during both the years of 2017-18 and 2018-19 (Table 4). It could be observed that significantly higher number of branches plant^{-1} was observed in var. ICPH 2740 (12.17 and 11.80) followed by var. Rajeshwari (11.04 and 10.39) and Vipula (10.89 and 10.24). Lower number of branches plant^{-1} was observed in var. BDN 711 (10.58 and 10.18 cm) at harvest during the year 2017-18 and 2018-19, respectively. This difference in varietal performance may be attributed to genotypic variation affecting branching pattern and duration. Plants of ICPH 2740 are non-determinate with profuse secondary and tertiary branches, photo-sensitive, and respond positively to wider spacing (Saxena *et al*., 2016) [14].

3.2.2 Effect of sowing windows

The mean number of branches plant^{-1} of pigeonpea was significantly influenced throughout the crop growth period by different growing environments with different sowing windows is presented in Table 5.

The maximum number of branches plant^{-1} of pigeonpea (13.73 and 12.96 cm) was recorded in 24th MW (D_1) sowing window, followed by 26th MW sowing window (11.77 and 11.21 cm) *i.e.* (D_2) which was followed by 28th MW sowing window (D_3) (10.06 and 9.68 cm) and 30th MW sowing window (D_4) (9.12 and 8.75 cm) during 2017-18 and 2018-19, respectively. These results are corroborated with Mishra *et al.*, (2008) and Hari *et al.* (2011).

Reduced number of branches plant^{-1} with delay in sowing may be due to quick changes in photoperiod, which accelerated development towards reproductive stage and hence less time was available for vegetative growth. The similar results were recorded by Mishra *et al.* (2008) and Sharanappa *et al.* (2018) [15].

Table 4: Number of branches plant^{-1} of pigeonpea affected periodically by different treatments

Treatment	28 DAS			56 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	1.41^{b}	1.21^{b}	1.31^{c}	3.71^{b}	3.14^{c}	3.42^{b}
V_2: Rajeshwari	1.60^{a}	1.24^{b}	1.42^{b}	3.73^{b}	3.59^{b}	3.66^{b}
V_3: BDN 711	1.27^{b}	1.05^{c}	1.16^{d}	3.13^{c}	3.04^{d}	3.08^{c}
V_4: ICPH 2740	1.84^{a}	1.68^{a}	1.76^{a}	4.35^{a}	4.12^{a}	4.23^{a}
S. E±	0.070	0.044	0.046	0.124	0.080	0.092
C. D. at 5%	0.24	0.15	0.14	0.43	0.27	0.28
B) Sub plot: Sowing windows						
D_1: 24 MW	2.27^{a}	2.11^{a}	2.19^{a}	4.99^{a}	4.69^{a}	4.84^{a}
D_2: 26 MW	1.83^{b}	1.43^{b}	1.63^{b}	4.05^{b}	3.77^{b}	3.91^{b}
D_3: 28 MW	1.29^{c}	1.04^{c}	1.16^{c}	3.30^{c}	3.03^{c}	3.16^{c}
D_4: 30 MW	0.73^{d}	0.60^{d}	0.67^{d}	2.57^{d}	2.40^{d}	2.48^{d}
S. E±	0.071	0.059	0.042	0.118	0.084	0.067
C. D. at 5%	0.21	0.17	0.12	0.35	0.245	0.19
C) Interaction (A×B)						
D_1V_1	2.27^{b}	1.90^{bc}	2.09^{b}	5.46^{a}	4.57^{ab}	5.01^{a}
D_2V_1	1.55^{cd}	1.54^{c}	1.55^{c}	3.8^{bc}	3.48^{c}	3.64^{d}
D_3V_1	1.15^{d}	0.77^{de}	0.96^{e}	3.08^{cd}	2.36^{d}	2.72^{fg}
D_4V_1	0.67^{e}	0.65^{e}	0.66^{f}	2.48^{d}	2.14^{d}	2.31^{g}
D_1V_2	2.12^{bc}	2.10^{ab}	2.11^{b}	5.22^{a}	4.98^{a}	5.10^{a}
D_2V_2	1.92^{bc}	1.37^{c}	1.65^{c}	3.97^{bc}	3.83^{bc}	3.9^{cd}
D_3V_2	1.33^{d}	1.02^{d}	1.18^{de}	3.37^{c}	3.21^{c}	3.29^{de}
D_4V_2	1.05^{de}	0.48^{e}	0.77^{ef}	2.37^{d}	2.35^{d}	2.36^{g}
D_1V_3	1.81^{c}	2.05^{b}	1.93^{b}	4.19^{b}	4.18^{b}	4.19^{c}
D_2V_3	1.62^{cd}	0.97^{de}	1.30^{d}	3.45^{c}	3.51^{c}	3.48^{d}
D_3V_3	1.15^{d}	0.70^{de}	0.93^{e}	2.47^{d}	2.45^{d}	2.46^{g}
D_4V_3	0.52^{e}	0.46^{e}	0.49^{f}	2.39^{d}	2.01^{d}	2.20^{g}
D_1V_4	2.89^{a}	2.41^{a}	2.65^{a}	5.09^{a}	5.03^{a}	5.06^{a}
D_2V_4	2.24^{b}	1.84^{bc}	2.04^{b}	4.98^{a}	4.25^{b}	4.62^{b}
D_3V_4	1.52^{cd}	1.65^{c}	1.58^{c}	4.28^{b}	4.09^{b}	4.19^{c}
D_4V_4	0.70^{e}	0.81^{de}	0.75^{ef}	3.05^{cd}	3.10^{c}	3.07^{e}
S. E±	0.14	0.12	0.08	0.24	0.17	0.13
C. D. at 5%	0.42	0.34	0.24	0.69	0.49	0.38
General Mean	1.53	1.30	1.41	3.73	3.47	3.60

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 5: Number of branches plant^{-1} pigeonpea affected periodically by different treatments (continued)

Treatment	84 DAS			112 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	5.92^{b}	5.47^{b}	5.70^{c}	7.67^{b}	7.22^{b}	7.44^{c}
V_2: Rajeshwari	6.21^{b}	5.74^{b}	5.97^{b}	7.94^{b}	7.61^{b}	7.77^{b}
V_3: BDN 711	5.39^{c}	5.23^{c}	5.31^{d}	7.05^{c}	6.76^{c}	6.90^{d}
V_4: ICPH 2740	6.97^{a}	6.50^{a}	6.74^{a}	8.60^{a}	8.37^{a}	8.48^{a}
S. E±	0.12	0.080	0.084	0.13	0.16	0.10
C. D. at 5%	0.43	0.27	0.26	0.45	0.54	0.32
B) Sub plot: Sowing windows						
D_1: 24 MW	7.72^{a}	7.15^{a}	7.44^{a}	9.59^{a}	9.20^{a}	9.39^{a}
D_2: 26 MW	6.45^{b}	6.02^{b}	6.24^{b}	8.12^{b}	7.89^{b}	8.01^{b}
D_3: 28 MW	5.58^{c}	5.17^{c}	5.37^{c}	7.19^{c}	6.87^{c}	7.03^{c}
D_4: 30 MW	4.73^{d}	4.60^{d}	4.67^{d}	6.37^{d}	5.99d	6.18^{d}
S. E±	0.149	0.081	0.079	0.141	0.127	0.093
C. D. at 5%	0.44	0.237	0.23	0.41	0.36	0.27
C) Interaction (A×B)						
D_1V_1	7.60^{a}	7.06^{b}	7.33^{b}	9.32^{b}	8.84^{bc}	9.08^{b}
D_2V_1	6.00^{bc}	5.67^{d}	5.84^{de}	7.77^{cd}	7.39^{d}	7.58^{d}
D_3V_1	5.47^{cd}	4.69^{ef}	5.08^{f}	7.07^{de}	6.44^{e}	6.75^{ef}
D_4V_1	4.61^{d}	4.47^{f}	4.54^{g}	6.53^{de}	6.21^{e}	6.37^{f}
D_1V_2	8.32^{a}	7.16^{ab}	7.74^{ab}	10.29a	9.35^{b}	9.82^{a}
D_2V_2	6.35^{bc}	5.96^{cd}	6.16^{d}	8.30^{c}	7.55^{d}	7.93^{cd}
D_3V_2	5.44^{cd}	5.00^{e}	5.22^{e}	6.83d^{e}	7.15^{de}	6.99^{e}
D_4V_2	4.71^{cd}	4.84^{ef}	4.78^{fg}	6.34^{e}	6.37^{e}	6.36^{f}
D_1V_3	6.50^{b}	6.78^{bc}	6.64^{c}	8.39^{c}	8.52^{c}	8.45^{c}

D_2V_3	5.56^{c}	5.64^{d}	5.6^{e}	7.32^{d}	7.62^{d}	7.47^{de}
D_3V_3	4.85^{cd}	4.66^{ef}	4.75^{fg}	6.30^{e}	5.8^{ef}	6.05^{fg}
D_4V_3	4.64^{d}	3.84^{f}	4.24^{g}	6.21^{e}	5.08^{f}	5.65^{g}
D_1V_4	8.47^{a}	7.60^{a}	8.03^{a}	10.37^{a}	10.08^{a}	10.22^{a}
D_2V_4	7.90^{a}	6.82^{b}	7.36^{b}	9.1^{bc}	9.01^{bc}	9.06^{b}
D_3V_4	6.55^{b}	6.32^{c}	6.44^{cd}	8.55^{bc}	8.11^{cd}	8.33^{c}
D_4V_4	4.97^{cd}	5.27^{de}	5.12^{f}	6.38^{e}	6.28^{e}	6.33^{f}
S. E±	0.30	0.16	0.16	0.28	0.25	0.19
C. D. at 5%	0.87	0.47	0.45	0.82	0.74	0.53
General Mean	6.12	5.74	5.93	7.82	7.49	7.65

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 6: Number of branches of pigeonpea affected periodically by different treatments (continued)

Treatment	140 DAS			At harvest		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	9.05^{c}	8.79^{c}	8.92^{c}	10.89^{c}	10.24^{b}	10.56^{a}
V_2: Rajeshwari	9.79^{b}	9.47^{b}	9.63^{b}	11.04^{b}	10.39^{b}	10.72^{a}
V_3: BDN 711	8.96^{c}	8.70^{c}	8.83^{c}	10.58^{c}	10.18^{b}	10.38^{b}
V_4: ICPH 2740	11.02^{a}	10.58^{a}	10.80^{a}	12.17^{a}	11.80^{a}	11.99^{a}
S. E±	0.20	0.10	0.12	0.26	0.21	0.17
C. D. at 5%	0.70	0.35	0.36	0.92	0.71	0.53
B) Sub plot: Sowing Windows						
D_1: 24 MW	12.13^{a}	11.18^{a}	11.65^{a}	13.73^{a}	12.96^{a}	13.34^{a}
D_2: 26 MW	9.88^{b}	9.65^{b}	9.77^{b}	11.77^{b}	11.21^{b}	11.49^{b}
D_3: 28 MW	8.84^{c}	8.85^{c}	8.85^{c}	10.06^{c}	9.68^{c}	9.87^{c}
D_4: 30 MW	7.97^{d}	7.87^{d}	7.92^{d}	9.12^{d}	8.75^{d}	8.94^{d}
S. E±	0.17	0.107	0.087	0.20	0.19	0.14
C. D. at 5%	0.52	0.31	0.25	0.59	0.565	0.39
C) Interaction (A×B)						
D_1V_1	11.35^{c}	10.42^{bc}	10.89^{c}	12.6^{bc}	11.8^{bc}	12.2^{cd}
D_2V_1	8.83^{e}	9.06^{d}	8.95^{f}	12.1^{bc}	11.2^{c}	11.6^{d}
D_3V_1	8.25^{ef}	8.10^{fg}	8.17^{gh}	9.6^{d}	9.2^{d}	9.4^{e}
D_4V_1	7.76^{f}	7.508^{g}	7.67^{h}	9.2^{d}	8.8^{d}	9.0^{e}
D_1V_2	12.43^{b}	10.98^{b}	11.71^{b}	14.2^{a}	12.6^{b}	13.4^{b}
D_2V_2	10.07^{d}	9.55^{d}	9.81^{e}	11.2^{c}	10.9^{c}	11^{d}
D_3V_2	8.55^{ef}	9.02^{d}	8.79^{f}	9.6^{d}	9.2^{d}	9.4^{e}
D_4V_2	8.11^{ef}	8.33^{e}	8.22^{g}	9.2^{d}	8.8^{d}	9.0^{e}
D_1V_3	10.49^{cd}	10.21^{c}	10.35^{d}	12.8^{b}	12.3^{bc}	12.6^{c}
D_2V_3	9.36^{d}	8.95^{ef}	9.16^{f}	11.2^{c}	10.6^{c}	10.9^{d}
D_3V_3	8.17^{ef}	8.12^{fg}	8.15^{gh}	9.5^{d}	9.2^{d}	9.4^{e}
D_4V_3	7.83^{ef}	7.53^{g}	7.68^{h}	8.8^{d}	8.5^{d}	8.7^{e}
D_1V_4	14.26^{a}	13.09^{a}	13.68^{a}	15.3^{a}	15.1^{a}	15.2^{a}
D_2V_4	11.28^{c}	11.02^{b}	11.15^{c}	12.6^{bc}	12.2^{bc}	12.4^{c}
D_3V_4	10.38^{cd}	10.17^{cd}	10.27^{de}	11.5^{c}	11.1^{c}	11.3^{d}
D_4V_4	8.17^{ef}	8.04^{fg}	8.11^{gh}	9.2^{d}	8.9^{d}	9.0^{e}
S. E±	0.35	0.21	0.17	0.40	0.39	0.27
C. D. at 5%	1.03	0.62	0.50	1.18	1.13	0.78
General Mean	9.70	9.39	9.55	11.17	10.65	10.91

Note: Observations with same superscript are on par and with different superscript are significantly different

3.2.3 Effect of interaction

The number of branches plant^{-1} of pigeonpea at all the stages of crop growth was significantly influenced by interaction between varieties and sowing windows during both the years (Table 6).

26th MW sowing window (D_1) recorded higher number of branches plant^{-1} of pigeonpea (15.3 and 15.1 cm) in var. ICPH 2740 (V_4) which was followed by var. Rajeshwari (V_2) (14.2 and 12.6 cm), Vipula (V_1) (12.6 and 11.8 cm) and BDN 711 (V_3) (12.8 and 12.3 cm) during the year 2017-18 and 2018-19, respectively.

3.3 Leaf area index (LAI)

The data pertaining to mean leaf area index of pigeonpea as influenced by different treatments are presented in Table 7. The mean leaf area index was increased up to 140 DAS and then gradually decreased. The maximum leaf area index was recorded at 140 DAS (1.200 and 1.167) during 2017-18 and 2018-19, respectively.

3.3.1 Effect of varieties

The mean leaf area index differed between varieties at all the stages of the crop growth during 2017-18, 2018-19 and pooled mean. It could be observed that at all the stages of the growth, variety ICPH 2740 recorded significantly higher leaf area index (1.378 and 1.315) at 140 DAS during 2017-18 and 2018-19, respectively, followed by Rajeshwari (1.211 and 1.183) and Vipula (1.138 and 1.119). Leaf area index of variety BDN 711 was found significantly lowest (1.073 and 1.051) during 2017-18 and 2018-19, respectively. This may be due to better utilization of solar energy by variety reported by Nagaraj *et al*. (2019).

3.3.2 Effect of sowing windows

The mean leaf area index was significantly influenced by different sowing windows at all the growth stages. The significantly higher leaf area index (1.303 and 1.268) was recorded with sowing of sorghum during 24th MW followed by 26th MW sowing window (1.235 and 1.204) and 28th MW sowing window (1.162 and 1.124) during 2017-18 and 2018-19, respectively. 30th MW sowing produced lower leaf area index (1.100 and 1.071) during both the seasons 2017-18 and 2018-19, respectively.

The similar results reported by Patel *et al.* (2000) that pigeonpea sown on earliest date attain the highest leaf area index, absorbed the largest amount of photosyntheticaly active radiation (PAR).

3.2.3Effect of interaction

Interaction effects between pigeonpea varieties and sowing windows significantly influenced the leaf area index at all the stages of plant growth (Table 8). The sowing of ICPH 2740 during 24th MW produced the highest leaf area index of 1.483 and 1.470, during 2017-18 and 2018-19, respectively, followed by variety Rajeshwari (1.390 and 1.307), Vipula (1.220 and 1.180) and BDN 711 (1.117 and 1.116) during 2017-18 and 2018-19, respectively. The differences in leaf area index might be due to genetical factors and accumulation of heat units. These results are in concurrence with the findings of Patel *et al.* (2000) and Sharanappa *et al.* (2018) [15].

3.4 Total dry matter accumulation plant^{-1} (g)

The accumulation of dry matter plant^{-1} (g) is probably the best index of growth put forth by the crop. Relevant data to this character recorded at various stages are presented in Table 9. During the crop growing period, increase in dry matter weight was continuous with the advancement in the crop age up to harvest of the crop. The rate of increase was rapid during flowering and reproductive period. The mean dry matter of pigeonpea plant at harvest (189.0 and 180.5 g) during both the season of 2017-18 and 2018-19, respectively.

3.4.1 Effect of varieties

The varietal effect on the dry matter accumulation was found significant. The variety was found superior ICPH 2740 (220.0 and 216.9 g) over all other varieties for dry matter, followed by Rajeshwari (201.4 and 197.3 g) and Vipula (169.0 and 160.4 g), whereas it was lowest in var. BDN 711 (165.5 and 147.7 g) at harvest of crop during 2017-18 and 2018-19, respectively. This was consequent to significant growth and yield parameters of variety Rajeshwari which exploited its full potential under present agro-climatic condition since, dry matter accumulation is the result of all growth and yield attributes. In all other sources the leaf area index is an important source in manufacturing photo assimilates for determining dry matter accumulation. These findings were corroborated by Nagaraj *et al.* (2019).

Table 7: Leaf area index (LAI) of pigeonpea affected periodically by different treatments

Treatment	28 DAS			56 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	0.347^{b}	0.340^{b}	0.343^{b}	0.487^{c}	0.476^{c}	0.481^{c}
V_2: Rajeshwari	0.353^{a}	0.346^{a}	0.350^{a}	0.494^{b}	0.484^{b}	0.489^{b}
V_3: BDN 711	0.338^{c}	0.332^{c}	0.335^{c}	0.470^{d}	0.459^{d}	0.464^{d}
V_4: ICPH 2740	0.355^{a}	0.349^{a}	0.352^{a}	0.508^{a}	0.503^{a}	0.505^{a}
S. E±	0.0017	0.0019	0.0013	0.0012	0.0013	0.0011
C. D. at 5%	0.0060	0.0065	0.0040	0.0041	0.0046	0.0033
B) Sub plot: Sowing windows						
D_1: 24 MW	0.368^{a}	0.360^{a}	0.364^{a}	0.503^{a}	0.497^{a}	0.500^{a}
D_2: 26 MW	0.354^{b}	0.347^{b}	0.351^{b}	0.493^{b}	0.486^{b}	0.489^{b}
D_3: 28 MW	0.340^{c}	0.335^{c}	0.338^{c}	0.485^{c}	0.475^{c}	0.480^{c}
D_4: 30 MW	0.330^{d}	0.326^{d}	0.328^{d}	0.477^{d}	0.465^{d}	0.471^{d}
S. E±	0.0012	0.0015	0.0009	0.0013	0.0016	0.0009
C. D. at 5%	0.0036	0.0043	0.0026	0.0039	0.0046	0.0026
C) Interaction (A×B)						
D_1V_1	0.369^{a}	0.358^{ab}	0.363^{ab}	0.503^{b}	0.492^{b}	0.498^{bc}
D_2V_1	0.356^{bc}	0.353^{b}	0.354^{b}	0.490^{c}	0.481^{c}	0.486^{bc}
D_3V_1	0.338^{d}	0.326^{de}	0.332^{de}	0.478^{d}	0.467^{d}	0.472^{f}
D_4V_1	0.326^{e}	0.322^{de}	0.324^{e}	0.475^{de}	0.464^{d}	0.470^{f}
D_1V_2	0.371^{a}	0.363^{a}	0.367^{a}	0.504^{b}	0.507^{a}	0.505^{b}
D_2V_2	0.36^{b}	0.355^{ab}	0.358^{b}	0.495^{c}	0.491^{b}	0.493^{c}
D_3V_2	0.349^{c}	0.342^{c}	0.346^{c}	0.490^{c}	0.477^{c}	0.484^{de}
D_4V_2	0.331^{d}	0.325^{de}	0.328^{e}	0.487^{c}	0.461^{d}	0.474^{ef}
D_1V_3	0.361^{b}	0.356^{ab}	0.359^{b}	0.487^{c}	0.471^{cd}	0.479^{e}
D_2V_3	0.343^{c}	0.33^{d}	0.337^{d}	0.469^{e}	0.462^{d}	0.466^{fg}
D_3V_3	0.326^{e}	0.325^{de}	0.326^{e}	0.467^{e}	0.458^{d}	0.463^{g}
D_4V_3	0.320^{f}	0.319^{e}	0.319^{f}	0.455^{f}	0.444^{e}	0.450^{h}
D_1V_4	0.372^{a}	0.362^{a}	0.367^{a}	0.519^{a}	0.517^{a}	0.518^{a}
D_2V_4	0.358^{b}	0.351^{b}	0.355^{b}	0.515^{ab}	0.508^{a}	0.512^{a}
D_3V_4	0.349^{c}	0.345^{bc}	0.347^{c}	0.508^{b}	0.495^{b}	0.502^{b}
D_4V_4	0.342^{c}	0.338^{c}	0.34^{cd}	0.491^{c}	0.491^{b}	0.491^{cd}
S. E±	0.0024	0.0029	0.0018	0.0027	0.0032	0.0019
C. D. at 5%	0.0071	0.0086	0.0052	0.0079	0.0092	0.0053
General Mean	0.348	0.342	0.345	0.490	0.480	0.485

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 8: Leaf area index (LAI) of pigeonpea affected periodically by different treatments (continued)

Treatment	84 DAS			112 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	0.730^{c}	0.724^{c}	0.727^{b}	0.928^{c}	0.923^{b}	0.926^{b}
V_2: Rajeshwari	0.751^{a}	0.735^{a}	0.743^{a}	0.951^{a}	0.941^{a}	0.946^{a}
V_3: BDN 711	0.720^{d}	0.712^{d}	0.716^{c}	0.916^{d}	0.911^{c}	0.913^{c}
V_4: ICPH 2740	0.737^{b}	0.726^{b}	0.731^{b}	0.945^{b}	0.942^{a}	0.944^{a}
S. E±	0.0021	0.0017	0.0018	0.0014	0.0010	0.0012
C. D. at 5%	0.0073	0.0059	0.0056	0.0048	0.0036	0.0036
B) Sub plot: Sowing windows						
D_1: 24 MW	0.750^{a}	0.739^{a}	0.744^{a}	0.953^{a}	0.949^{a}	0.951^{a}

D_2: 26 MW	0.739^{b}	0.729^{b}	0.734^{b}	0.940^{b}	0.933^{b}	0.936^{b}
D_3: 28 MW	0.728^{c}	0.719^{c}	0.723^{c}	0.930^{c}	0.922^{c}	0.926^{c}
D_4: 30 MW	0.720^{d}	0.710^{d}	0.715^{d}	0.918^{d}	0.914^{d}	0.916^{d}
S. E±	0.0015	0.0014	0.0008	0.001	0.002	0.001
C. D. at 5%	0.0044	0.0040	0.0024	0.004	0.005	0.003
C) Interaction (A×B)						
D_1V_1	0.751^{bc}	0.732^{c}	0.742^{c}	0.949^{c}	0.942^{bc}	0.946^{c}
D_2V_1	0.733^{d}	0.728^{cd}	0.731^{d}	0.928^{d}	0.923^{d}	0.926^{e}
D_3V_1	0.722^{e}	0.722^{d}	0.722^{e}	0.918^{e}	0.916^{de}	0.917^{f}
D_4V_1	0.712^{f}	0.713^{e}	0.713^{f}	0.915^{e}	0.912^{e}	0.914^{fg}
D_1V_2	0.753^{b}	0.74^{bc}	0.747^{b}	0.964^{ab}	0.963^{a}	0.963^{b}
D_2V_2	0.748^{bc}	0.731^{c}	0.739^{c}	0.951^{bc}	0.947^{b}	0.949^{c}
D_3V_2	0.729^{de}	0.716^{de}	0.722^{e}	0.942^{c}	0.935^{c}	0.939^{d}
D_4V_2	0.718^{ef}	0.716^{de}	0.717^{f}	0.924^{de}	0.923^{d}	0.924^{ef}
D_1V_3	0.732^{d}	0.729^{cd}	0.730^{d}	0.928^{d}	0.920^{de}	0.924^{e}
D_2V_3	0.721^{e}	0.715^{de}	0.718^{ef}	0.921^{de}	0.918^{de}	0.919^{f}
D_3V_3	0.718^{ef}	0.705^{ef}	0.712^{f}	0.911^{ef}	0.907^{ef}	0.909^{g}
D_4V_3	0.707^{f}	0.700^{f}	0.704^{g}	0.904^{f}	0.899^{f}	0.901^{h}
D_1V_4	0.764^{a}	0.754^{a}	0.759^{a}	0.971^{a}	0.970^{a}	0.971^{a}
D_2V_4	0.755^{ab}	0.741^{a}	0.748^{b}	0.959^{b}	0.942^{bc}	0.951^{c}
D_3V_4	0.743^{c}	0.732^{c}	0.738^{c}	0.947^{c}	0.930^{c}	0.939^{d}
D_4V_4	0.743^{c}	0.712^{e}	0.727^{d}	0.928^{d}	0.923^{d}	0.926^{e}
S. E±	0.0030	0.0027	0.0017	0.0027	0.0031	0.0018
C. D. at 5%	0.0089	0.0080	0.0047	0.0079	0.0090	0.0052
General Mean	0.734	0.724	0.729	0.935	0.929	0.932

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 9: Leaf area index (LAI) of pigeonpea affected periodically by different treatments (continued)

Treatment	140 DAS			At harvest		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	1.138^{b}	1.119^{c}	1.129^{c}	0.809^{c}	0.794^{c}	0.801^{c}
V_2: Rajeshwari	1.211^{b}	1.183^{b}	1.197^{b}	0.815^{b}	0.806^{b}	0.810^{b}
V_3: BDN 711	1.073^{c}	1.051^{d}	1.062^{d}	0.810^{c}	0.792^{c}	0.801^{c}
V_4: ICPH 2740	1.378^{a}	1.315^{a}	1.346^{a}	0.820^{a}	0.811^{a}	0.815^{a}
S. E±	0.0067	0.0074	0.0071	0.0009	0.0007	0.0013
C. D. at 5%	0.023	0.026	0.022	0.0031	0.0024	0.0040
B) Sub plot: Sowing windows						
D_1: 24 MW	1.303^{a}	1.268^{a}	1.285^{a}	0.822^{a}	0.813^{a}	0.818^{a}
D_2: 26 MW	1.235^{b}	1.204^{b}	1.220^{b}	0.817^{b}	0.804^{b}	0.810^{b}
D_3: 28 MW	1.162^{c}	1.124^{c}	1.143^{c}	0.813^{c}	0.796^{c}	0.805^{c}
D_4: 30 MW	1.100^{d}	1.071^{d}	1.086^{d}	0.802^{d}	0.789^{d}	0.795^{d}
S. E±	0.015	0.013	0.0095	0.0012	0.0017	0.0008
C. D. at 5%	0.042	0.039	0.027	0.0035	0.0051	0.0023
C) Interaction (A×B)						
D_1V_1	1.220^{c}	1.180^{cd}	1.200^{de}	0.818^{bc}	0.803^{c}	0.81^{d}
D_2V_1	1.177^{cd}	1.137^{d}	1.47^{7a}	0.813^{c}	0.795^{cd}	0.804^{e}
D_3V_1	1.117^{cd}	1.097^{de}	1.117^{ef}	0.808^{cd}	0.791^{d}	0.800^{ef}
D_4V_1	1.040^{de}	1.063^{de}	1.348^{bc}	0.796^{d}	0.788^{d}	0.792^{g}
D_1V_2	1.390^{b}	1.307^{bc}	1.052^{fg}	0.825^{ab}	0.820^{ab}	0.823^{b}
D_2V_2	1.247^{c}	1.250^{c}	1.220^{d}	0.819^{bc}	0.815^{b}	0.817^{c}
D_3V_2	1.113^{d}	1.130^{d}	1.002^{g}	0.816^{bc}	0.801^{cd}	0.809^{d}
D_4V_2	1.093^{de}	1.047^{e}	1.070^{f}	0.798^{d}	0.787^{d}	0.792^{g}
D_1V_3	1.117^{d}	1.116^{de}	1.107^{ef}	0.816^{bc}	0.802^{c}	0.809^{d}
D_2V_3	1.087^{de}	1.073^{de}	1.295^{c}	0.816^{bc}	0.791^{d}	0.804^{e}
D_3V_3	1.077^{de}	1.021^{e}	1.049^{fg}	0.806^{cd}	0.789^{d}	0.798^{f}
D_4V_3	1.012^{e}	0.992^{e}	1.122^{ef}	0.802^{d}	0.787^{d}	0.795^{fg}
D_1V_4	1.483^{a}	1.470^{e}	1.157^{e}	0.829^{a}	0.828^{a}	0.829^{a}
D_2V_4	1.430^{ab}	1.357^{b}	1.393^{b}	0.818^{bc}	0.817^{ab}	0.817^{c}
D_3V_4	1.340^{bc}	1.250^{c}	1.080^{f}	0.821^{b}	0.804^{bc}	0.812^{cd}
D_4V_4	1.257^{c}	1.183^{cd}	1.248^{cd}	0.811^{c}	0.795^{cd}	0.803^{e}
S. E±	0.029	0.026	0.019	0.002	0.003	0.002
C. D. at 5%	0.085	0.077	0.054	0.0070	0.0101	0.0045
General Mean	1.200	1.167	1.183	0.813	0.801	0.807

Note: Observations with same superscript are on par and with different superscript are significantly different

3.4.2 Effect of sowing windows

The mean dry matter accumulation plant^{-1} (g) was significantly influenced by different sowing windows at all the growth period by different growing environments created through different sowing windows. The mean dry matter accumulation plant^{-1} (g) was increased with advancement of the crop age and it was recorded at harvest (Table 10).

The maximum dry matter accumulation plant^{-1} (203.9 and 193.0 g) was recorded in 24th MW sowing window, followed by 26th MW sowing window (194.2 and 185.9 g), this was followed by 28th MW sowing window (183.9 and 175.6 g) and 30th MW sowing window (173.9 and 167.5 g) during the year 2017-18 and 2018-19, respectively. The similar results reported by Patel *et al.* (2000) that pigeonpea sown on earliest date attain the highest leaf area index, absorbed the largest amount of photosyntheticaly active radiation (PAR) and produced the highest total dry matter.

At all the stages of growth, the dry matter weight plant^{-1}(g) showed decreasing trend with late sowings (26th MW to 30th MW). Besides, growth period of the crop also decreased with each successive delay in sowing which was also caused reduction in dry matter accumulation in late sowings. From all the observations it is observed that the sowing window 24th MW was significantly superior over all the other sowing window treatments. Similar results were recorded by Sharanappa *et al.* (2018) [15].

3.4.3 Effect of interaction: The dry matter accumulation plant-^{1}of pigeonpea at all the stages of crop growth was significantly influenced by interaction between varieties and sowing windows during both the years (Table 11). 24th MW sowing window (D_1) recorded higher dry matter accumulation plant^{-1} of pigeonpea (235.0 and 231.2 g) in variety ICPH 2740 (V_4) which was followed by variety Rajeshwari (V_2) (219.8 and 215.8 g), Vipula (V_1) (184.6 and 170.8 g) and BDN 711 (V_3) (180.1 and 150.6 g) during the year 2017-18 and 2018-19 respectively. These results were reported by Sharanappa *et al.* (2018) [15].

Table 10: Dry matter per plant (g) of pigeonpea affected periodically by different treatments

Treatment	28 DAS			56 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	9.25^{b}	8.96^{b}	9.11^{b}	30.13^{c}	27.37^{c}	28.75^{c}
V_2: Rajeshwari	9.67^{b}	9.44^{b}	9.56^{b}	41.89^{b}	36.27^{b}	39.08^{b}
V_3: BDN 711	8.73^{c}	8.61^{c}	8.67^{c}	27.35^{d}	25.37^{c}	26.36^{c}
V_4: ICPH 2740	11.54^{a}	10.65^{a}	11.10^{a}	44.62^{a}	42.75^{a}	43.69^{a}
S. E±	0.24	0.16	0.17	0.62	1.17	0.80
C. D. at 5%	0.84	0.57	0.52	2.13	4.06	2.45
B) Sub plot: Sowing windows						
D_1: 24 MW	11.53^{a}	10.77^{a}	11.15^{a}	43.96^{a}	41.06^{a}	42.51^{a}
D_2: 26 MW	10.02^{b}	9.75^{b}	9.88^{b}	38.20^{b}	34.96^{b}	36.58^{b}
D_3: 28 MW	9.12^{c}	8.99^{c}	9.06^{c}	32.84^{c}	29.19^{c}	31.02^{c}
D_4: 30 MW	8.53^{d}	8.16^{d}	8.34^{d}	28.99^{d}	26.55^{d}	27.77^{d}
S. E±	0.18	0.13	0.10	0.82	0.78	0.52
C. D. at 5%	0.52	0.38	0.27	2.40	2.26	1.47
C) Interaction (A×B)						
D_1V_1	11.6^{bc}	10.6^{ab}	11.1^{c}	37.4^{cd}	32.7^{d}	35.0^{de}
D_2V_1	9.0d^{e}	9.6^{c}	9.3^{e}	33.6^{de}	30.7^{de}	32.2^{e}
D_3V_1	8.4^{e}	8.4^{d}	8.4^{f}	25.6^{ef}	24.6^{ef}	25.1^{fg}
D_4V_1	8.1^{e}	7.3^{e}	7.7^{g}	23.9^{f}	21.5^{f}	22.7^{g}
D_1V_2	10.9^{c}	11.3^{a}	11.1^{c}	47.5^{b}	46.7^{b}	47.1^{b}
D_2V_2	9.4^{de}	9.3^{cd}	9.4^{e}	45b^{c}	37.5^{c}	41.2^{c}
D_3V_2	9.3^{de}	8.7^{d}	9^{e}	40.7^{c}	31.8^{d}	36.3^{d}
D_4V_2	9.1^{de}	8.5^{d}	8.8^{ef}	34.3^{d}	29.1^{de}	31.7^{e}
D_1V_3	10.2^{cd}	9.9^{bc}	10.1^{d}	33.4^{de}	30.2^{de}	31.8^{e}
D_2V_3	9.4d^{e}	8.8^{d}	9.1^{e}	28.9^{e}	26.9^{e}	27.9^{f}
D_3V_3	8.3^{e}	8.5^{d}	8.4^{f}	24.7^{ef}	23.5^{ef}	24.1^{g}
D_4V_3	7.1^{e}	7.2^{e}	7.1^{g}	22.5^{f}	20.9^{f}	21.7^{g}
D_1V_4	13.5^{a}	11.3^{a}	12.4^{a}	57.6^{a}	54.7^{a}	56.2^{a}
D_2V_4	12.3^{b}	11.2^{a}	11.8^{b}	45.3^{bc}	44.8^{b}	45.0^{b}
D_3V_4	10.4^{cd}	10.4^{b}	10.4^{d}	40.3^{c}	36.8^{cd}	38.6^{cd}
D_4V_4	9.8^{d}	9.7^{bc}	9.8^{de}	35.2^{d}	34.7^{cd}	35.0^{de}
S. E±	0.35	0.26	0.19	1.64	1.55	1.03
C. D. at 5%	1.03	0.77	0.54	4.80	4.53	2.94
General Mean	9.80	9.42	9.61	36.00	32.94	34.47

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 11: Dry matter per plant (g) of pigeonpea affected periodically by different treatments (continued)

Treatment	84 DAS			112 DAS		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	72.4^{c}	68.7^{c}	70.6^{c}	123.2^{c}	115.0^{c}	119.1^{c}
V_2: Rajeshwari	86.1^{b}	82.7^{b}	84.4^{b}	131.4^{b}	123.5^{b}	127.4^{b}
V_3: BDN 711	67.0^{c}	61.1^{d}	64.0^{d}	89.6^{d}	84.0^{d}	86.8^{d}
V_4: ICPH 2740	93.1^{a}	87.7^{a}	90.4^{a}	147.1^{a}	140.9^{a}	144.0^{a}
S. E±	0.85	0.89	0.69	1.38	1.32	1.01
C. D. at 5%	2.93	3.086	2.12	4.76	4.58	3.11
B) Sub plot: Sowing windows						
D_1: 24 MW	88.2^{a}	82.3^{a}	85.2^{a}	133.8^{a}	129.8^{a}	131.8^{a}
D_2: 26 MW	81.0^{b}	77.6^{b}	79.3^{b}	125.6^{b}	120.2^{b}	122.9^{b}
D_3: 28 MW	77.0^{c}	73.^{5c}	75.3^{c}	120.0^{c}	111.7^{c}	115.9^{c}
D_4: 30 MW	72.3^{d}	66.8^{d}	69.5^{d}	111.9^{d}	101.8^{d}	106.8^{d}
S. E±	1.10	1.03	0.72	1.27	1.22	0.79
C. D. at 5%	3.22	2.99	2.04	3.71	3.54	2.25
C) Interaction (A×B)						
D_1V_1	77.0^{de}	76.5^{cd}	76.8^{de}	129.1^{de}	129.4^{cd}	129.2^{d}
D_2V_1	74.7^{de}	71.2^{d}	73.0^{e}	127.5^{de}	120.9^{de}	124.2^{e}
D_3V_1	70.3^{e}	65.4^{de}	67.8^{f}	121.7^{e}	114.6^{e}	118.1^{f}
D_4V_1	67.8^{ef}	62.0^{ef}	64.9^{fg}	114.7^{e}	95.3^{f}	105^{g}
D_1V_2	98.5^{b}	93.6^{ab}	96.0^{b}	138.9^{c}	134.5^{c}	136.7^{c}
D_2V_2	86.8^{cd}	84.5^{bc}	85.6^{c}	135.7^{cd}	128^{cd}	131.9^{d}
D_3V_2	80.8^{d}	78.4^{c}	79.6^{d}	129d^{e}	119.1^{de}	124.1^{e}
D_4V_2	78.3^{de}	74.4^{cd}	76.4^{de}	122.2^{e}	112.4^{e}	117.3^{f}
D_1V_3	72.1^{e}	63.4^{e}	67.8^{f}	102.1^{f}	97.4^{f}	99.8^{h}

D_2V_3	67.7^{ef}	64.2^{e}	66.0^{fg}	90.5^{g}	83.8^{g}	87.2^{i}
D_3V_3	66.1^{ef}	60.7^{ef}	63.4^{h}	86.3^{gh}	80.6^{gh}	83.4^{i}
D_4V_3	62.1^{f}	56.2^{f}	59.2^{i}	79.8^{h}	74.5^{h}	77.1^{j}
D_1V_4	105.4^{a}	95.9^{a}	100.6^{a}	165.2^{a}	158.0^{a}	161.6^{a}
D_2V_4	94.9^{bc}	90.8^{ab}	92.8^{bc}	148.9^{b}	148.0^{b}	148.5^{b}
D_3V_4	91.2^{c}	89.5^{b}	90.4^{c}	143.3^{bc}	132.7^{c}	138.0^{c}
D_4V_4	81.1^{d}	74.7^{cd}	77.9^{d}	131.2^{d}	125.1^{d}	128.2^{de}
S. E±	2.20	2.05	1.44	2.54	2.43	1.58
C. D. at 5%	6.44	5.99	4.08	7.42	7.10	4.51
General Mean	79.6	75.0	77.3	122.8	115.9	119.3

Note: Observations with same superscript are on par and with different superscript are significantly different

Table 12: Dry matter per plant (g) of pigeonpea affected periodically by different treatments (continued)

Treatment	140 DAS			At harvest		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	164.4^{c}	155.2^{c}	159.8^{c}	169.0^{c}	160.4^{c}	164.7^{c}
V_2: Rajeshwari	182.6^{b}	171.4^{b}	177.0^{b}	201.4^{b}	197.3^{b}	199.3^{b}
V_3: BDN 711	158.8^{d}	152.1^{c}	155.5^{c}	165.5^{c}	147.4^{d}	156.5^{d}
V_4: ICPH 2740	202.3^{a}	184.6^{a}	193.5^{a}	220.0^{a}	216.9^{a}	218.5^{a}
S. E±	1.48	1.57	1.59	2.22	2.50	2.40
C. D. at 5%	5.12	5.43	4.91	7.70	8.64	7.39
B) Sub plot: Sowing windows						
D_1: 24 MW	191.0^{a}	182.4^{a}	186.7^{a}	203.9^{a}	193.0^{a}	198.4^{a}
D_2: 26 MW	183.3^{b}	170.3^{b}	176.8^{b}	194.2^{b}	185.9^{b}	190.1^{b}
D_3: 28 MW	175.3^{c}	158.9^{c}	167.1^{c}	183.9^{c}	175.6^{c}	179.8^{c}
D_4: 30 MW	158.7^{d}	151.8^{d}	155.2^{d}	173.9^{d}	167.5^{d}	170.7^{d}
S. E±	1.15	1.19	0.23	1.19	1.57	0.42
C. D. at 5%	3.36	3.48	0.65	3.47	4.57	1.20
C) Interaction (A×B)						
D_1V_1	179.9^{d}	174.0^{d}	176.9^{e}	184.6^{ef}	170.8^{f}	177.7^{h}
D_2V_1	167.2^{ef}	159.3^{f}	163.3^{i}	170.1^{g}	164.8^{f}	167.4^{i}
D_3V_1	162.8^{g}	149.1^{g}	156.0^{k}	165.3^{gh}	154.4^{g}	159.8^{j}
D_4V_1	147.7^{hi}	138.5^{h}	143.1^{m}	156.4^{h}	151.8^{g}	154.1^{k}
D_1V_2	192.3^{c}	184.7^{c}	188.5^{c}	219.8^{b}	215.8^{bc}	217.8^{c}
D_2V_2	188.4^{c}	175.3^{d}	181.9^{d}	210.8^{c}	207.3^{c}	209.0^{d}
D_3V_2	179.0^{d}	165.5^{ef}	172.2^{f}	191.2^{e}	186.5^{e}	188.8^{f}
D_4V_2	170.7^{e}	160.0^{ef}	165.3^{h}	183.9^{f}	179.6^{ef}	181.8^{g}
D_1V_3	176.1^{d}	166.2^{ef}	171.2^{fg}	180.1^{f}	150.6^{g}	165.3^{i}
D_2V_3	164.1^{ef}	152.8^{g}	158.5^{j}	168.9^{g}	149.8^{gh}	159.4^{j}
D_3V_3	153.5^{h}	147.8^{gh}	150.6^{k}	159.9^{h}	148.7^{gh}	154.3^{k}
D_4V_3	141.7^{i}	141.6^{h}	141.6^{n}	153.5^{h}	140.8^{h}	147.1^{l}
D_1V_4	215.6^{a}	204.9^{a}	210.2^{a}	235.0^{a}	231.2^{a}	233.1^{a}
D_2V_4	213.3^{a}	193.6^{b}	203.5^{b}	227.2^{a}	222.0^{b}	224.6^{b}
D_3V_4	205.8^{b}	173.1^{de}	189.4^{c}	219.6^{b}	213.1^{bc}	216.4^{c}
D_4V_4	174.6^{d}	167.0^{e}	170.8^{g}	202.0^{d}	197.9^{d}	200.0^{e}
S. E±	2.30	2.39	0.46	2.38	3.14	0.84
C. D. at 5%	6.71	6.97	1.30	6.94	9.16	2.39
General Mean	177.0	165.8	171.4	189.0	180.5	184.7

Note: Observations with same superscript are on par and with different superscript are significantly different

3.5 Days to 50 per cent flowering and maturity

Data regarding mean days to 50 per cent flowering and maturity of pigeonpea as influenced significantly by the different treatments are presented Table 12.

The mean days to 50 per cent flowering were 116.4 and 114.8 during the year 2017-18 and 2018-19, respectively. The mean days to maturity were 160.7 and 157.3 for 2017-18 and 2018-19, respectively.

3.5.1 Effect of varieties

Days to 50 per cent flowering and days to maturity were influenced significantly due to different pigeonpea varieties. Maximum number of days to 50 per cent flowering (122.7 and 121.6) was observed in variety ICPH 2740 which was significantly higher. This was followed by var. Vipula (117.5 and 114.7), BDN 711 (114.0 and 112.9 and, while var. Rajeshwari was recorded significantly lower (113.8 and 109.9) during the year 2017-18 and 2018-19, respectively.

Maximum number of days to maturity (175.6 and 172.2) was observed in variety ICPH 2740 which was significantly higher. This was followed by Vipula (158.8 and 156.0) and BDN 711 (158.4 and 154.1) while var. Rajeshwari (150.1 and 147.3) was recorded significantly lower during the year 2017-18 and 2018-19, respectively. The similar results were observed by Bedis *et al.* (2014) at the time of sowing pigeonpea in *kharif* season. ICPH 2740 variety takes about 115-122 days to flower and its maturity is achieved in180-190 days (Saxena *et al*., 2016) [14].

3.5.2 Effect of sowing windows

The days to 50 per cent flowering (118.4 and 117.2) was observed significantly higher in 24th MW sowing window. This was followed by 26th MW sowing window at (116.8 and 114.8), 28th MW sowing window (115.6 and 114.3) and 30th MW sowing window (114.8 and 112.8) during the year 2017-18 and 2018-19, respectively.

The days to maturity (168.4 and 165.3) was observed significantly higher in 24th MW sowing window. This was followed by 26th MW sowing window at (163.8 and 160.7), 30th MW sowing window (158.3 and 155.2) and 30th MW sowing window (152.3 and 148.4) during the year 2017-18 and 2018-19, respectively. The similar results were observed by Salih (1990) at the time of sowing pigeonpea in *kharif* season and indicated that the early in sowing gave highest flower production. Later sowings reduced duration of flowering and flower production.

Ratnam *et al.* (2015) reported that days to 50% flowering for varieties which were sown from 2nd FN of June to 1st FN of October were affected greatly due to variation in agro-climatic environment under different sowing windows.

A delay in sowing from date 30th June substantially reduced the time taken to flower-bud initiation and maturity. Both these characters were largely influenced by prevailing temperature and rainfall distribution (Patel *et al.*, 2000).

3.5.3 Interaction effect

The days to 50 per cent flowering and days to maturity was significantly influenced by interaction between varieties and sowing windows during the year 2017-18 and 2018-19 (Table 13). Sowing at 24th MW sowing window recorded maximum days to 50 per cent flowering (125.7 and 124.9) in variety ICPH 2740. This was followed by variety Vipula (119.8 and 117.5), BDN 711 (115.3 and 114.5), and Rajeshwari (112.7 and 111.8) during the year 2017-18 and 2018-19 respectively.

Sowing at 24th MW sowing window recorded maximum days

to maturity (181.0 and 180.0) in variety ICPH 2740. This was followed by variety Vipula (167.3 and 165.0), BDN 711 (165.7 and 160.0), and Rajeshwari (159.7 and 156.0) during 2017-18 and 2018-19 respectively.

These results were corroborated by Kumar *et al.* (2008) the crops sown early sowings got longer time for attaining physiological maturity due to early flowering while crop sown delayed in sowings did not get extended period for maturity.

Table 13: Days to 50% flowering and physiological maturity of pigeonpea affected by different treatments during 2017-18 and 2018-19

Treatment	Days to 50% flowering			Days to physiological maturity		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
A) Main plot: Varieties						
V_1: Vipula	117.5^{b}	114.7^{b}	116.1^{b}	158.8^{b}	156.0^{b}	157.4^{b}
V_2: Rajeshwari	111.3^{d}	109.9^{d}	110.6^{d}	150.1^{d}	147.3^{d}	148.7^{d}
V_3: BDN 711	114.0^{c}	112.9^{c}	113.4^{c}	158.4^{c}	154.1^{c}	156.3^{c}
V_4: ICPH 2740	122.7^{a}	121.6^{a}	122.2^{a}	175.6^{a}	172.2^{a}	173.9^{a}
S. E±	0.17	0.48	0.33	0.55	0.23	0.35
C. D. at 5%	0.59	1.676	1.02	1.91	0.811	1.08
B) Sub plot: Sowing windows						
D_1: 24 MW	118.4^{a}	117.2^{a}	117.8^{a}	168.4^{a}	165.3^{a}	166.8^{a}
D_2: 26 MW	116.8^{b}	114.8^{b}	115.8^{b}	163.8^{b}	160.7^{b}	162.3^{b}
D_3: 28 MW	115.6^{c}	114.3^{c}	115.0^{c}	158.3^{c}	155.2^{c}	156.7^{c}
D_4: 30 MW	114.8^{d}	112.8^{d}	113.8^{d}	152.3^{d}	148.4^{d}	150.4^{d}
S. E±	0.25	0.29	0.15	0.61	0.43	0.36
C. D. at 5%	0.74	0.84	0.43	1.77	1.27	1.02
C) Interaction (A×B)						
D_1V_1	119.8^{cd}	117.5^{cd}	118.7^{cd}	167.3^{cd}	165.0^{d}	166.2^{c}
D_2V_1	118.0^{d}	115.2^{d}	116.6^{d}	163.3^{d}	158.7^{ef}	161.0^{de}
D_3V_1	116.6^{de}	114.7^{de}	115.7^{de}	154.7^{fg}	152.0^{gh}	153.3^{fg}
D_4V_1	115.5^{ef}	111.3^{ef}	113.4^{f}	149.7^{gh}	148.3^{hi}	149.0^{h}
D_1V_2	112.7^{ef}	111.8^{ef}	112.2^{g}	159.7^{e}	156.0^{f}	157.8^{ef}
D_2V_2	112.0^{g}	110.0^{f}	111.0^{h}	154.0^{fg}	150.0^{h}	152.0^{g}
D_3V_2	110.5^{gh}	109.0^{fg}	109.8^{i}	147.3^{h}	146.3^{i}	146.8^{i}
D_4V_2	110.2^{h}	109.0^{fg}	109.6^{ij}	139.3^{ih}	136.7^{j}	138.0^{j}
D_1V_3	115.3^{ef}	114.5^{de}	114.9^{e}	165.7^{cd}	160.0^{e}	162.8^{d}
D_2V_3	113.7^{f}	112.8^{e}	113.3^{fg}	159.7^{e}	158.0^{ef}	158.8^{e}
D_3V_3	113.4^{ef}	112.3^{ef}	112.9^{fg}	156.7^{f}	152.7^{g}	154.7^{f}
D_4V_3	113.5^{ef}	112.0^{ef}	112.8^{fg}	151.7^{g}	145.7^{ij}	148.7^{hi}
D_1V_4	125.7^{a}	124.9^{a}	125.3^{a}	181.0^{a}	180.0^{a}	180.5^{a}
D_2V_4	123.3^{b}	121.3^{b}	122.3^{b}	178.3^{ab}	176.0^{b}	177.2^{b}
D_3V_4	122.0^{bc}	121.3^{bc}	121.7^{bc}	174.3^{b}	169.7^{c}	172.0^{bc}
D_4V_4	120.0^{c}	119.0^{c}	119.5^{c}	168.7^{c}	163.0^{de}	165.8^{cd}
S. E±	0.50	0.58	0.31	1.21	0.87	0.72
C. D. at 5%	1.47	1.69	0.87	3.54	2.54	2.04
General Mean	116.4	114.8	115.6	160.7	157.3	159.0

Note: Observations with same superscript are on par and with different superscript are significantly different

4. Conclusion

In pigeonpea varieties all the growth attributes were increased with the advancement in age of the crop. Plant height (178.7 and 175.6 cm), total number branches (12.17 and 11.80), leaf area index (1.378 and 1.315), total dry matter accumulation per plant (220.0 and 216.9 g), mean days to 50 per cent flowering (122.7 and 121.6) and mean days to physiological maturity (175.6 and 172.2) during both the years of 2017-18 and 2018-19, respectively which were found significantly higher in variety ICPH 2740 over Vipula, Rajeshwari and BDN 711. This was followed by varieties *viz*., Rajeshwari, Vipula and BDN 711.

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