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Seed production strategies in alfalfa (*Medicago sativa* L.) Cv. RL-88

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Abstract
The ideal time to plant and trim alfalfa was determined through an experiment conducted at the Seed Science and Technology (E-block) Department of Agriculture, UAS, GKVK, Bengaluru. The growth parameter data showed that the maximum plant height (89.17 cm) was obtained by the first of July planting with no pruning. Similar results were observed for the crop sown at August 15 + cutting followed at 60 DAS, with more seeds per pod (6.67), generative branches per plant (13.33), vegetative branches numbering 23.00, and seed yields (1.49 g plant^{-1}, 161.07 g plot^{-1}) recorded higher than other treatments.

Keywords: Alfalfa, cutting intervals, vegetative and generative branches, dry matter

Introduction
Indian agriculture uses livestock as a source of energy and employment. Alfalfa, also known as lucerne (*Medicago sativa* L.), is referred to be the "Queen of Forage" in India for good reason. There is a great demand for forage crop seeds notwithstanding the extremely low seed output in these crops. The most vital and significant input to increase the production potential of all crops, including fodder, is seed. The timely and accessible planting of high-quality seeds with enhanced genetics is a major factor in the effectiveness of other inputs. Therefore, improving fodder output requires a guaranteed supply of better types or hybrid fodder seeds to farmers at a fair price.

Thus, one of the main challenges facing alfalfa is the production of high-quality seeds for a variety of reasons, including: a) physiological issues: most varieties have very poor seed-setting and low seed production ability; many forage species have unpredictable growth habits; poor photosynthetic translocation mechanisms from vegetative to reproductive structures; non-synchronization of flowering, prolonged flower drop, and uneven maturity; improper management of monetary and non-monetary inputs, particularly in forage crops; Low seed productivity in entomophilous allogamous legume species is caused by the preferential use of low capability marginal lands and rainfed conditions for raising the majority of the forage seed crops, as well as low insect activity during the hot summer months. b) Others, blank seeds, seed dormancy, apomixes, seed shedding, and harvesting.

Alfalfa has a high potential for production; nevertheless, the amount and quality of fodder output were reduced due to improper agronomic practices, such as improper seed rate, timing of sowing, cutting intervals, and nutrient level, as well as the use of various insect pollinators for tripping. To standardize the planting time and cutting intervals on alfalfa fodder and seed production, a study was conducted in this respect. To get the most number of cuts possible and the highest possible yield of green forage at each cut, it is crucial to timing the first cut following seeding. As a result, cutting management offers data on the crop's capacity for regeneration as well as its growth peak and yield. Furthermore, the amount and quality of forage crops, especially alfalfa forage, may fall under the purview of cutting management.

Materials and Methods
This study examined the impact of sowing and cutting dates on the growth, forage, and seed yield of alfalfa (*Medicago sativa* L.) cv. RL-88 in the Eastern Dry Zone of Karnataka. The research was conducted in the kharif/rabi season of 2015 at Seed Science and Technology, experimental E-block, GKVK, University of Agricultural Sciences, Bengaluru.

The factorial randomised block design field experiment was set up with three replications with a gross plot size of 2.1 m × 2.0 m = 4.20 m2 with a spacing of 30 x 10 cm. Treatment consists of four distinct sowing dates (D1: July 1st, D2: July 15th, D3: August 1st, and D4: August 15th) with four cutting management dates (i.e., A cut is made at distinct stages of crop growth (C0: no cut, C1: first cut at 60 DAS, C2: second cut at 85 DAS, and C3: third cut at 110 DAS).
Using the method, the percentage of filled seeds to all seeds in a panicle was determined to determine the seed setting.

$$\text{Seed setting (\%)} = \frac{\text{Number of filled seeds}}{\text{Total number of seeds (Both filled and unfilled)}} \times 100$$

Results and Discussion

Effect of dates of sowing and cutting intervals on growth parameters of alfalfa

For fodder crops, cutting interval timing and frequency are also crucial agronomic considerations. To get the most number of cuts possible and the highest possible yield of green forage at each cut, it is crucial to timing the first cut following seeding. As a result, cutting management offers data on the crop's capacity for regeneration as well as its growth peak and yield. Furthermore, the amount and quality of fodder as well as the seed output may be under the cutting management's control.

Dates of sowing

According to Tables 1 and 2, there is a quantitatively greater significant difference between the sowing dates and the corresponding plant growth features. The crop planted on July 1st showed noticeably greater plant height (69.46 cm), fresh weight (609.43 kg ha^{-1}), and dry weight (128.26 kg ha^{-1}). In D4: August 15th date sowing, these qualities were lowered to tune (8%, 4.2%, and 8.6%, respectively). The data unequivocally shows that growth metrics significantly decrease when planting dates are later. This may be because there was enough time for the vegetative phage to successfully finish under favorable climatic circumstances, which improved root and vegetative development and subsequently increased the plant's outputs of dry matter and green feed. These findings are consistent with the research conducted on lucerne by Amit Kumar and Patel (2013) [1], berseem by Sonu Ram *et al*. (2014) [9], and lucerne by Subhan UD Din *et al*. (2015) [10].
In the D1: First July seeded crop, the durations for first flower initiation and days to 50% blooming (95.67 and 102.75 days, respectively) were longer (Figs. 3.3 and 3.4). On the other hand, blooming started earlier on delayed-sown dates (D4: August 15) (76.92 and 82.17 days, respectively). The early seeding and delayed flowering of the crop might be caused by lower temperatures, increased relative humidity, and the onset of the monsoon in July, which could have prolonged the crop's vegetative phase. Flexibility in flowering period is a frequent adaptive characteristic of fodder crops. The three main factors that affect flowering time are photoperiod, genotype, and temperature. According to Ehrmann and Cocks (1996) [3], blooming period is a typical adaptation shared by annuals, including legumes, in dry or semiarid settings. Due to delayed sowing and a shortened growth season, the amount of time from planting to blooming reduced. Planting dates have a major impact on days to 50% blooming. These outcomes concur with Prasad *et al*. (2012) [8] findings in chick pea and Amit Kumar and Patel (2013) [1] in lucerne.

Cutting intervals

At 85, 100, and harvest, the impact of various cutting intervals was discovered to be considerable. The plants in C3: Cut at 110 DAS had the greatest reported height (66.51 cm), with C0: No cut (66.38 cm), C2: Cut at 85 DAS (64.04), and C1: Cut at 60 DAS (40.46 cm) following in order of height. In keeping with this pattern, the plant height (71.46 cm) in C3: Cut at 110 DAS was seen to be greater than that of C0: No cut (69.72 cm), C1: Cut at 60 DAS (53.54 cm), and C2: Cut at 85 DAS (44.25 cm). The treatment with the maximum plant height (82.38 cm) at harvest was C0: no cut. It was shorter than the plant heights of C1: cut at 60 DAS, C2: cut at 85 DAS, and C3: cut at 110 DAS (66.42 cm, 61.83 cm, and 55.79 cm, respectively). This might be because of the extended period of cutting intervals, which allowed for enough photosynthesis and therefore higher development, which in turn led to increased plant height.
The cutting interval stage also had a substantial impact on the output of dry feed as well as green feed. The greatest forage yield (602.06 kg ha^{-1} and 127.03 kg ha^{-1}, respectively) was obtained in the no-cut condition. The percent drop was 2.6% and 3.0%, respectively, in the cutting intervals carried out in C1: 63.23 kg ha^{-1} and 586.61 kg ha^{-1}, respectively, were cut at 60 DAS. This might be because later crop stages saw shorter cutting intervals, which decreased the crop's capacity for regeneration and growth. Compared to the first cuts at 75 and 90 DAS, the straw yield from the cutting made at 60 DAS, which was then left for seed production, was noticeably greater.
It's possible that inadequate regeneration, which lowers straw output, is the cause of the oats' reduced yield when they were first harvested at 75 and 90 DAS. When compared to alternative cutting management, cutting three times (C3) had a highly significant influence on plant height after 60 days. This might be because more branches can sprout from the crown buds at the stem's base when there are more cuttings made. This outcome is consistent with Granfield's (1964) [5] findings that alfalfa should normally be chopped and then allowed to regrowth.

Interaction (DXC)

Plant height at 60 DAS and the number of generative tillers per plant were two growth metrics on which the combined effects of the sowing date and cutting intervals were found to be non-significant. Notably, treatment combination D1C0 resulted in the maximum plant height (89.17 cm). The greatest fresh weight and dry weight of fodder were reported by D1C3 (625.63 kg ha^{-1} and 131.25 kg ha^{-1}, respectively). The alfalfa's growth metrics, such as plant height and leaf count per plant, may have grown as a result of favorable temperature impacts and longer cutting intervals. These findings concur with the alfalfa research conducted by Amit Kumar and Patel (2013) [1]. The notably shorter timespan (73.67 and 79.33 days, respectively) observed in D4C3 (15th August seeded crop, cut at 110 DAS) for flower initiation and 50% blooming. This is around 30 days ahead of the crop that was harvested without cutting treatment on July 1st (D1C0).

Effect of dates of sowing and cutting intervals on yield attributes

The dates of planting had a substantial impact on alfalfa seed production (Tables 3 and 4). At 322.00 kg per hectare, the maximum seed yield was reported in D4, the crop seeded on August 15. The percentage decrease in seed output on D1: July 1st (222.52 kg), D2: July 2nd (236.79 kg), and D3: August 1st (280.59 kg) was 30.90%, 26.46%, and 12.86%, respectively. The greater seed output recorded in D4 on August 15th is mostly attributable to the 1.35 g seed yield per plant and the 146.13 g seed yield per net plot. This might be because of a favorable temperature throughout the growing season of the crop, which leads to more pods and seeds per pod as well as stronger growth qualities be in charge of improving the source-sink interaction between the environment and lucerne fertilization.

They showed a positive correlation between the length of the pollen tube and the number of filled pods per plant. In comparison to an earlier planting time, the crop was exposed to a somewhat greater temperature (36 to 40 degrees Celsius) during the flowering period under the delayed sowing. The length of the pollen tube may have risen as a result, and "autotripping of flowers" may have boosted all the yield qualities. Therefore, under the conditions of later planting, the temperature that prevails throughout the blooming period—longer days and better sun light—may be ideal for improved fertilization and seed setting, which will diversify plant energy and aid in the growth of reproductive organs. These results are conformity with those results obtained by Kabir *et al*. (2009) [7] in chickpea and Gawariya *et al*. (2015) [4] in forage mustard.

Cutting interval (C)

The study's findings demonstrated the substantial and reliable impact of cutting treatments on the several seed yield-related and quality-related metrics examined. At various phases of crop growth, the number of cuttings rose from C0 (no cut) crop to three cuts.

Following a percentage decrease in yield over the best treatment, namely 22.60%, 6.60%, and 14.08%, respectively, the initial cutting at 60 days after sowing and then left for seed production recorded a significantly higher seed yield (297.51 kg ha^{-1}). C0: no cut (230.44 kg ha^{-1}), C2: cut taken at 85 (278.02 kg ha^{-1}) and C3:110 DAS (255.93 kg ha^{-1}). The highest and noticeably higher number of seeds per pod (5.92), seed yield per plant (1.27 g), and seed yield per net plot (136.40 g) were generated during the first cutting session at 60 DAS. These findings shown that cutting management had a negative impact on alfalfa seed and fodder yields when considering the amount of cuttings from no cut to three cuts at 60, 85, and 110 DAS. It is also clear that the increased number of cuttings—up to three cutting intervals—might have interfered with the normal growth of the cut plants, resulting in poorer regrowth, insufficient production of fertile tillers, delayed inflorescence emergence, and inefficient synchronization of productive tillers. These factors could have eventually led to poor seed setting, low plant weight, and poor fodder yield per plant.

Interaction (DXC)

The trials showed that the interaction between the sowing dates and cutting intervals (D x C) at various and same levels resulted in notable differences in the parameters attributing to seed yield.

The dates of sowing and the intervals between cuttings had a substantial impact on alfalfa seed yield (D x C). The crop planted on August 15th, D4C1, had the maximum seed yield of 355.00 kg per hectare, with a cutting interval of 60 days after sowing. In the other sowing dates, namely D3C1: 1st August sown crop with cutting interval imposed at 60 DAS (328.81 kg ha^{-1}), D4C2: 15th August sown crop with cutting interval imposed at 85 DAS (326.43 kg ha^{-1}), D4C0: 15th August sown crop with no cut (305.00 kg ha^{-1}), and D1C0: 1st July sown crop with no cut (170.08 kg ha^{-1}) as control, the percentage reduction in seed yield (7.38%, 8.0%, 14.10%, and 52.10%, respectively) was recorded. In D4C1 (sown on August 15th, second cut at 60 DAS), the seed yield per pod was 6.67, the seed yield per plant was 1.49 g, and the seed yield per net plot was 161.07 g. Comparably, the greatest harvest index (70.96%) was seen in the 15th August sowing + second cut at 60 DAS (D4C1), the highest test weight (3.866 g) was recorded in the 15th July sowing + second cut at 85 DAS D2C2, and the highest seed setting percentage (88.00) was noted in the 15th July sowing + third cut at 110 DAS (D2C3) (Table 5).

The synergistic impact of early seeding in June and early crop growth cutting aid in strong crown development and formation of the maximum number of seed yield attributing characteristics in a nutshell, which may be the cause of the continuous rise in seed yield components observed in the D4C1 interaction. These findings are consistent with the forage cow pea research conducted by Sunitha Devi and Satyanarayana Rao (2007) [11] & Asaadi *et al*. (2014) [2] in Bam v. Alfalfa.

Table 1: Effect of dates of sowing and cutting intervals on plant height, number of vegetative and generative braches per plant of alfalfa (*Medicago sativa* L.) Cv. RL-88

Treatments	Plant height (cm)				Vegetative branches (plant^{-1})	Generative branches (plant^{-1})
Dates of Sowing (D)	**60 DAS**	**85 DAS**	**110 DAS**	**At harvest**		
D_1: 1stJuly	59.21	55.54	58.00	69.46	17.33	10.83
D_2: 15th July	62.92	59.67	61.38	68.17	17.83	10.83
D_3: 1st August	61.75	60.25	58.92	63.92	17.00	10.33
D_4: 15th August	62.65	61.93	60.75	64.88	19.50	11.67
S. Em±	1.32	0.27	0.23	0.36	1.01	0.69
CD (P=0.05)	NS	0.95	0.79	1.26	NS	NS
Cutting intervals (C)						
C_0: No cut	63.71	66.38	69.79	82.38	15.25	9.08
C_1: First cut @ 60DAS	60.13	40.46	53.54	66.42	21.17	13.08
C_2: Second cut @ 85 DAS	61.00	64.04	44.25	61.83	18.75	11.25
C_3: Third cut @ 110 DAS	61.69	66.51	71.46	55.79	16.50	10.25

S. Em±	1.89	0.31	0.41	0.04	0.27	0.35
CD (P=0.05)	NS	0.91	1.21	0.11	0.80	1.03
Interaction (DXC)						
D_1C_0	63.17	65.83	70.50	89.17	16.33	8.67
D_1C_1	57.00	32.67	55.33	65.33	20.33	13.33
D_1C_2	56.33	60.33	40.33	66.33	17.33	10.67
D_1C_3	60.33	63.33	65.83	57.00	15.33	10.67
D_2C_0	67.00	66.67	70.67	80.00	14.33	8.67
D_2C_1	60.50	42.00	59.83	76.00	22.33	13.33
D_2C_2	64.17	66.33	43.67	61.00	18.67	11.67
D_2C_3	60.00	63.67	71.33	55.67	16.00	9.67
D_3C_0	61.83	65.00	69.33	79.33	14.33	9.00
D_3C_1	61.33	42.83	50.33	63.67	19.00	12.33
D_3C_2	60.17	63.17	45.33	59.67	19.00	10.67
D_3C_3	63.67	70.00	70.67	53.00	15.67	9.33
D_4C_0	62.83	68.00	68.67	81.00	16.00	10.00
D_4C_1	61.67	44.33	48.67	60.67	23.00	13.33
D_4C_2	63.33	66.33	47.67	60.33	20.00	12.00
D_4C_3	62.77	69.03	78.00	57.50	19.00	11.33
S. Em±	3.78	0.62	0.83	0.52	0.55	0.71
CD (P=0.05)	NS	1.82	2.42	1.53	1.60	NS
CV	9.61	19.43	20.14	16.10	18.81	19.07

Table 2: Effect of dates of sowing and cutting intervals on days taken to flower initiation, days to 50% flowering, forage dry matter content and racemes per plant of alfalfa (*Medicago sativa* L.) Cv. RL-88

Treatments	**First flower initiation (days)**	**Days to 50% flowering**	**Forage dry matter content (kg ha^{-1})**	
Dates of Sowing (D)			**Fresh weight basis**	**Dry weight basis**
D_1: 1stJuly	95.67	102.75	609.43	128.26
D_2: 15th July	88.67	93.42	592.51	124.52
D_3: 1st August	83.42	88.25	597.69	125.75
D_4: 15th August	76.92	82.17	557.51	117.34
S. Em±	0.49	0.90	2.70	0.07
CD (P=0.05)	1.68	3.11	9.33	0.24
Cutting intervals (C)				
C_0: No cut	83.42	92.25	602.06	127.02
C_1: First cut @ 60DAS	82.08	86.33	584.46	122.83
C_2: Second cut @ 85 DAS	88.33	92.67	584.01	122.80
C_3: Third cut @ 110 DAS	90.83	95.33	586.61	123.23
S. Em±	1.06	1.04	1.36	0.11
CD (P=0.05)	3.11	3.05	3.96	0.32
Interaction (DXC)				
D_1C_0	83.67	98.00	612.33	130.07
D_1C_1	87.00	91.33	613.63	128.41
D_1C_2	104.00	108.33	586.14	123.33
D_1C_3	108.00	113.33	625.63	131.25
D_2C_0	82.67	90.67	607.93	127.85
D_2C_1	82.00	86.33	586.26	123.18
D_2C_2	98.00	102.33	597.14	125.32
D_2C_3	92.00	94.33	578.73	121.72
D_3C_0	86.67	94.00	605.84	127.55
D_3C_1	80.67	84.33	590.56	124.55
D_3C_2	76.67	80.33	604.16	126.93
D_3C_3	89.67	94.33	590.21	123.98
D_4C_0	80.67	86.33	582.14	122.60
D_4C_1	78.67	83.33	547.39	115.18
D_4C_2	74.67	79.67	548.60	115.60
D_4C_3	73.67	79.33	551.89	115.97
S. Em±	2.13	2.09	2.71	0.22
CD (P=0.05)	6.22	6.10	7.91	0.64
CV	12.30	11.36	4.12	3.92

Table 3: Effect of dates of sowing and cutting intervals on pods per raceme, filled pods per raceme, total number of pods per plant and number of filled pods per plant of alfalfa (*Medicago sativa* L.) cv. RL-88

Treatments	Number of pods (raceme^{-1})	Filled pods (raceme^{-1})	Total number of pods (plant^{-1})	Number of filled pods (plant^{-1})
Dates of Sowing (D):				
D_1: 1stJuly	11.08	4.50	146.58	76.27
D_2: 15th July	12.92	5.08	186.25	84.99
D_3: 1st August	12.83	5.08	155.67	90.05
D_4: 15th August	13.83	5.75	215.42	108.24
S. Em±	0.35	0.17	1.08	0.43
CD (P=0.05)	1.20	0.60	3.73	1.49
Cutting intervals (C)				
C_0: No cut	12.17	4.50	144.92	75.36
C_1: First cut @ 60 DAS	14.00	5.83	187.17	99.15
C_2: Second cut @ 85 DAS	12.92	5.17	183.67	92.33
C_3: Third cut @ 110 DAS	11.58	4.92	188.17	92.71
S. Em±	0.24	0.14	0.97	0.27
CD (P=0.05)	0.71	0.42	2.83	0.80
Interaction (DXC)				
D_1C_0	10.67	3.67	90.67	47.15
D_1C_1	12.33	5.00	162.67	84.59
D_1C_2	11.00	5.00	151.33	78.87
D_1C_3	10.33	4.33	181.67	94.47
D_2C_0	12.33	4.67	155.67	80.95
D_2C_1	13.67	6.00	200.67	90.33
D_2C_2	14.33	5.00	194.00	88.00
D_2C_3	11.33	4.67	194.67	80.67
D_3C_0	11.33	4.33	132.67	68.99
D_3C_1	14.67	5.67	130.67	104.35
D_3C_2	13.33	5.00	189.67	98.63
D_3C_3	12.00	5.33	169.67	88.23
D_4C_0	14.33	5.33	200.67	104.35
D_4C_1	15.33	6.67	254.67	117.33
D_4C_2	13.00	5.67	199.67	103.83
D_4C_3	12.67	5.33	206.67	107.47
S. Em±	0.49	0.29	1.94	0.55
CD (P=0.05)	1.42	0.84	5.67	1.60
CV (%)	13.85	19.48	21.54	18.63

Table 4: Effect of dates of sowing and cutting intervals on number of seeds per pod seed yield per plant, seeds yield per net plot and seed yield per hectare of alfalfa (*Medicago sativa* L.) Cv. RL-88

Treatments	Number of seeds (pod^{-1})	Seed yield (g plant^{-1})	Seeds yield (g net plot^{-1})	Seed yield (kg ha^{-1})
Dates of Sowing (D):				
D_1: 1stJuly	4.50	0.953	102.35	222.52
D_2: 15th July	5.08	0.997	107.44	236.79
D_3: 1st August	6.67	1.185	127.32	280.59
D_4: 15th August	6.50	1.351	146.13	322.00
S. Em±	0.11	0.004	0.02	2.07
CD (P=0.05)	0.37	0.014	0.06	7.18
Cutting intervals (C)				
C_0: No cut	5.42	0.971	104.54	230.44
C_1: First cut @ 60 DAS	5.92	1.265	136.40	297.51
C_2: Second cut @ 85 DAS	5.67	1.168	126.15	278.02
C_3: Third cut @ 110 DAS	5.75	1.082	116.16	255.93
S. Em±	0.08	0.003	0.02	1.86
CD (P=0.05)	0.22	0.010	0.05	5.42
Interaction (DXC)				
D_1C_0	4.33	0.717	77.08	170.08
D_1C_1	4.67	1.137	122.87	258.39
D_1C_2	4.67	1.009	108.87	239.94
D_1C_3	4.33	0.950	100.59	221.67
D_2C_0	3.67	0.845	90.22	198.83
D_2C_1	5.67	1.041	112.47	247.86
D_2C_2	5.67	1.061	114.63	252.62
D_2C_3	5.33	1.041	112.47	247.86
D_3C_0	6.67	1.041	112.47	247.86

D_3C_1	6.67	1.391	149.19	328.81
D_3C_2	6.67	1.231	132.99	293.09
D_3C_3	6.67	1.078	114.63	252.62
D_4C_0	7.00	1.281	138.39	305.00
D_4C_1	6.67	1.491	161.07	355.00
D_4C_2	5.67	1.371	148.11	326.43
D_4C_3	6.67	1.261	136.97	301.59
S. Em±	0.15	0.007	0.03	3.71
CD (P=0.05)	0.44	0.020	0.10	10.84
CV	20.18	18.003	18.23	19.29

Table 5: Effect of dates of sowing and cutting intervals seed setting per cent, harvest index and test weight of alfalfa (*Medicago sativa* L.) cv. RL-88

Treatments	Seed setting (%)	Harvest index (%)	Test weight (g)
Dates of Sowing (D)			
D_1: 1st July	77.50	41.75	3.047
D_2: 15th July	81.17	45.94	3.431
D_3: 1st August	73.61	50.40	3.424
D_4: 15th August	68.84	62.67	3.486
S. Em±	0.81	0.01	0.002
CD (P=0.05)	2.79	0.03	0.007
Cutting intervals (C)			
C_0: No cut	76.21	41.97	3.302
C_1: First cut @ 60DAS	75.06	61.14	3.332
C_2: Second cut @ 85 DAS	73.71	51.20	3.462
C_3: Third cut @ 110 DAS	76.13	46.45	3.292
S. Em±	0.63	0.05	0.002
CD (P=0.05)	1.85	0.16	0.006
Interaction (DXC)			
D_1C_0	76.67	32.51	3.005
D_1C_1	78.33	49.00	3.099
D_1C_2	78.33	42.13	3.078
D_1C_3	76.67	43.36	3.006
D_2C_0	72.22	33.37	3.284
D_2C_1	82.22	62.29	3.294
D_2C_2	82.22	45.16	3.866
D_2C_3	88.00	42.96	3.280
D_3C_0	84.92	39.69	3.432
D_3C_1	69.84	62.31	3.444
D_3C_2	69.84	54.39	3.412
D_3C_3	69.84	45.20	3.409
D_4C_0	71.03	62.30	3.488
D_4C_1	69.84	70.96	3.492
D_4C_2	64.44	63.11	3.490
D_4C_3	70.03	54.30	3.473
S. Em±	1.27	0.11	0.004
CD (P=0.05)	3.70	0.31	0.012
CV (%)	9.54	22.48	6.540

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Conclusion
The highest plant growth parameters was recorded in 1st July sown crop (cutting intervals followed after 30 DAS) compared to other dates of sowings. Whereas, the seed yield and quality was recorded highest when crop sown at 15th August.

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