Forage Res., **39** (2) : pp. 71-82 (2013) **http://forageresearch.in**

EFFECT OF DATE OF SOWING AND CUTTING INTERVALS ON GROWTH ATTRIBUTES AND YIELD OF LUCERNE [*MEDICAGO SATIVA* L.] UNDER NORTH GUJARAT AGRO-CLIMATIC CONDITIONS

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(Received : 2 October 2013; Accepted : 26 October 2013)

SUMMARY

An experiment was carried out at the Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during **rabi** season of 2011-12 to find out the optimum date of sowing and cutting interval for lucerne crop under north Gujarat agro-climatic conditions. The results of growth parameters indicated that significantly higher plant height was recorded by 10th November sowing and 30 days cutting interval after common cut in the mean values of all cuts. Similarly, the mean number of leaves per plant and mean leaf area per plant were significantly higher by sowing the crop on 10th November and 30 days cutting interval after common cut and it was followed by 20th November sowing and 30 days cutting interval. Whereas significantly higher mean leaf : stem ratio was noted by 11th October sowing and 15 days cutting interval in the mean values of all cuts.

Key words : Growth attributes, leaf area, plant height, number of leaves, green forage yield, lucerne

Livestock industry is the traditional and one of the important sources of livelihood of farmers in India. It improves income, employment and thereby acting as a potential tool in alleviating rural poverty especially in arid and semi-arid regions of India where the crop farming has limited possibility. India possesses huge livestock population which is about 15 per cent of world livestock and having a 17 per cent of human population to be sustained on approximately 2 per cent of total geographical areas of the world. The available land is being used for arable farming and food production. This has put themselves pressure on the availability of feed and fodder.

In India, only 4.4 per cent of the cultivated area is under fodder crops with annual total forage production of 846 million tonnes. Whereas the annual green forage requirement is 1061 million tonnes and dry fodder is 589 million tonnes, which contributes 62.8 and 23.5 per cent deficit of forage production, respectively. In Gujarat, the total area under forage crops is about 7.96 thousand hectare. Looking to the scenario from 1995 to 2010, forage production deficit is increasing day by day, so it is very important to improve the production potential of forage crops.

Among the different forage crops, lucerne or alfalfa (*Medicago sativa* L.) is widely cultivated popular forage crop and known as the queen of fodder crops. Lucerne crop can be grown as annually or as a perennial crop. Many times it is grown for green forage yield only or green forage and seed yield. It contains five times as much more protein as sorghum fodder (Das and Khurana, 1964). Lucerne grows well in loamy sand to clayey textured soils. But, it is very sensitive to waterlogging and acidic soil reaction.

Lucerne (*Medicago sativa* L.) is one of the most important protein rich forage crops. It is a seasonal & perennial crop with good ratoonability and yielding ability. It provides a tonnage of nutritive fodder, particularly during the period of scarcity. On an average, it contains 16-17 per cent crude protein. Besides this, it has higher content of minerals & vitamin- A, which makes desirable supplement to other carbonaceous cereal forages and grains.

Lucerne has good production potential, but lack of suitable agro techniques (i.e. seed rate, time of sowing, cutting intervals and fertility level) is responsible for reduction of quantity and quality of lucerne forage yield.

Among these, time of sowing and cutting intervals has prime importance for quality and quantity of green forages. The proper time of sowing determines forage yield of lucerne crop. The optimum time of sowing of lucerne depends upon the nature of variety and the temperature. Now-a-days, the high yielding varieties are most sensitive to time of sowing; hence, optimum time of sowing contributes more towards yield. The early sowing of lucerne varieties Anand-2 and SS-627 (i.e. 2nd week of November) recorded higher yield than late sowing of lucerne crop (Patel *et al.*, 1987). Besides sowing time, temperature is also very important for the germination of lucerne crop. Higher temperature in the month of October may result in poor germination and hence early sowing is not desirable. Generally, irrigated lucerne is cultivated after the harvest of **kharif** crops like bajra, jowar and groundnut. Sometime, cotton fields are available only after November to December. It is, therefore, almost necessary to determine the optimum time of sowing of lucerne crop for good quality and quantity of forage.

The time of cutting intervals and cutting frequency are also a very important agronomic practice for multicut forage crops. The time of first cut after sowing is important to obtain maximum number of cuts as well as green forage yield at each cut. Thus, cutting management not only provides information about the regeneration potential of the crop but also growth peak and yield too. Moreover, the cutting management may be responsible for quality & quantity for multicut forage crops and particularly for lucerne forage yield.

MATERIALS AND METHODS

An experiment on effect of date of sowing and cutting intervals on forage yield of lucerne (*Medicago sativa* L.) under North Gujarat agroclimatic conditions was carried out at the Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during **rabi** season of 2011-12. The soil of experimental field was loamy sand in texture with low in organic carbon (0.16) and available nitrogen (144), medium in available phosphorus (31) and high in potash (283) having pH value of 7.5. Total 20 treatment combinations comprising five dates of sowing in main plot viz., 11th October (D_1), 21st October (D_2), 31st October (D_3), 10th November (D_4) and 20th November (D_5) and four cutting intervals in sub-plot viz., 15 days intervals (C_1), 20 days intervals (C_2), 25 days intervals (C_3) and 30 days intervals C_4) were laid out in split plot design with four replications. The observations were recorded on plant height (cm), number of leaves per plant, leaf area per plant, leaf : stem ratio per plant and forage yield.

RESULTS AND DISCUSSION

Effect of Sowing Dates on Plant Growth Parameters

The plant growth is the function of photosynthetic activity of the plant and it ultimately depends on their capacity to utilize available nutrients. The effects of dates of sowing on growth parameters were found significant.

Plant height (cm)

The effects of date of sowing from fifth to eleventh cuts were not analyzed for all the growth parameters due to variation in number of cuttings taken from individual treatments. At first, third and fourth cuts, sowing of lucerne crop on 10th November recorded taller plant which was 20, 45 and 21 per cent taller than 11th October sowing, respectively (Table 1). At second cut, 20th November sowing recorded taller plant which was to the tune of 47 per cent than that of 11th October sowing.

At fifth and sixth cut, 31st October sowing, at seventh cut, 11th October sowing and at eighth to eleventh cuts, 21st October sowing recorded numerically higher plant height of lucerne crop. Numerically higher plant height was noted by sowing the lucerne crop in the second fortnight of October, which was due to temperature effect on the growth of the lucerne plant after fifth and sixth cuts. It means that these cuts were harvested in the month of March to first fortnight of April. Whereas in case of November sowing, the fifth onwards cut was harvested in the last week of April to May.

In case of mean values, significantly taller plants were noted by 10th November sowing which were to the tune of 19 per cent higher than 11th October sowing. The taller plants in the month of November sowing might be due to favourable temperature effect on the growth of plants. The present findings are in accordance with those of Tulasa Ram (2003) and Sonu Ram (2009). The results of Sonu Ram (2009) showed that the tallest plants of lucerne crop were recorded by November sowing than that of early sowing of lucerne crop.

Number of leaves/plant

10th November sowing produced significantly higher number of leaves per plant which was 10, 91 and 25 per cent higher over 11th October sowing at first, second and fourth cuts, respectively. In case of third cut, 20th November sowing being at par with 10th November sowing produced significantly higher number of leaves per plant which was to the tune of 91 per cent than that 11th October sowing.

In case of mean values, significantly higher number of leaves per plant was noted under 10th November sowing which was to the tune of 21 per cent higher over 11th October sowing. The higher number of leaves per plant might be due to taller plants of lucerne crop and favourable temperature effects (Table 2). The results were closely related with the findings of Shaikh *et al.*(2004) in oat crop. They observed that the 15th November sowing gave highest plant height, number of leaves per plant and number of tillers per plant.

Leaf : stem ratio

A perusal of data on leaf : stem ratio of first and second cuts, date of sowing did not differ significantly at first and second cuts. It means that the weight of leaf and stem increased proportionally during first and second cuts. But at third and fourth cuts of 11th and 21st October sowing recorded significantly higher leaf : stem ratio which was to the magnitude of 27 and 59 per cent higher than that recorded at 10th and 20th November sowing, respectively. This might be due to higher green leaf weight than green stem weight in early sowing at third and fourth cuts.

Looking to the mean values, significantly maximum leaf : stem ratio per plant was noted by October sowing than that of late sowing. This might be due to lower leaf area leading to higher leaf weight per plant (Table 3).

Leaf area/plant

Sowing the lucerne crop on 10th November produced significantly higher leaf area per plant which was 67 and 77 per cent higher over 11st October sowing at first and second cuts, but at third and fourth cuts, 20th November sowing recorded 15 and 22 per cent higher leaf area per plant than that recorded at 11th October sowing, respectively.

In case of mean values, significantly higher leaf area per plant was noted by 10th November sowing which was increased to the tune of 21 per cent than that of 11th October sowing. This might be due to higher number of leaves per plant (Table 4) and higher plant height in mean values of all cuts.

Effect of Cutting Intervals on Plant Growth Parameters

Plant height (cm)

The effect of different cutting intervals was found significant at first to fourth cuts. At first to fourth cuts, significantly taller plants were recorded by cutting interval of 30 days after common cut and it was to the tune of 87, 196, 278 and 296 per cent than 15 days cutting interval, respectively (Table 1). This might be due to the long spell of cutting interval providing enough time for photosynthesis leading to higher growth which ultimately resulted in higher plant height of lucerne crop.

Looking to the mean values, cutting intervals of 30 days after common cut recorded 124 per cent higher plant height than that of 15 days cutting interval after common cut. This might be due to frequent and shorter cutting interval which did not allow the plant to attain the growth which resulted in shorter plant height of lucerne crop. It means that at shorter cutting interval, plants utilized their energy of photosynthesis for the regrowth of tillers and shoots development of the crop. The results were closely related with the findings of Sood and Kumar (1994), Gawali *et al.* (2001), Sharma *et al*. (2001), Midha *et al*. (2005) and Jakhar *et al.* (2009). Jakhar and his co-workers (2009) observed that the plant height of lucerne was higher when the first cut was taken at 50 DAS and subsequent cuts were taken at an interval of 30 days (five cuts).

Number of leaves/plant

Effect of cutting interval after common cut on number of leaves per plant was found significant at first to fourth cuts (Table 2). Significantly the maximum number of leaves per plant was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals. The percentage increase in number of leaves per plant was 183, 361, 486 and 365 than 15 days cutting interval.

In case of mean values, significantly higher

TABLE 1
Plant height of lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Plant height (cm)												
Main plot : Date of sowing (D)	Common cut	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut	8th cut	9th cut	10th cut	11th cut	Mean
D_1 : 11th October	11.37	23.20	26.63	33.47	41.46	47.83	44.72	41.34	33.50	22.65	22.30	19.63	35.13
D_2 : 21st October	14.37	24.36	28.45	38.80	43.49	50.36	45.71	40.56	39.99	37.35	29.25	29.25	37.74
D_3: 31st October	25.18	22.96	26.24	37.41	43.14	54.84	46.72	39.68	33.50	29.23	27.50		38.32
D_4 : 10th November	23.74	27.77	37.40	48.39	50.21	46.72	46.26	40.25	33.50	33.29			41.89
D_5 : 20th November	24.61	26.88	39.15	44.56	48.41	45.32	42.78	41.18	39.18	36.98			41.03
S. Em±	0.35	1.05	0.82	1.13	1.37	0.93							
C. D. (P=0.05)	1.08	3.22	2.52	3.48	4.21	2.86							
C. V. (%)	7.10	16.62	10.37	11.39	12.17	9.58							
Sub-plot : Cutting intervals (C)													
C_1 : 15 days intervals	19.36	17.14	17.24	18.47	18.63	24.81	27.46	28.26	31.11	31.90	26.71	24.44	23.82
C_2 : 20 days intervals	20.27	22.75	24.20	29.93	32.24	42.02	50.23	49.81	48.80				34.68
C_3 : 25 days intervals	19.07	28.24	33.83	43.85	55.69	60.89	67.03	65.65					43.49
C_4: 30 days intervals	20.71	32.02	51.03	69.87	73.81	83.22							53.29
S. Em±	0.26	0.91	0.58	0.61	0.68								0.73
C. D. (P=0.05)	0.74	2.58	1.63	1.72	1.93								2.08
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	5.84	16.11	8.14	6.81	6.74								8.45

Cutting intervals start after common cut at 55 days after sowing. NS–Not Significant.

TABLE 2
Number of leaves per plant of lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Number of leaves/plant												
Main plot : Date of sowing (D)	Common cut	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut	8th cut	9th cut	10th cut	11th cut	Mean
D_1 : 11th October	17	41	43	64	85	94	87	82	70	72	77	104	71
D_2 : 21st October	23	38	42	83	84	92	95	91	91	94	108	110	75
D_3 : 31st October	53	39	46	81	102	95	94	73	70	61	64		78
D_4 : 10th November	38	45	82	91	106	108	91	75	75	115			86
D_5 : 20th November	55	41	76	92	101	100	86	84	117	127			85
S. Em±	0.91	1.19	1.85	2.51	4.75								2.47
C. D. (P=0.05)	2.82	3.67	5.70	7.74	14.65								7.63
C. V. (%)	9.82	11.67	12.75	12.26	19.56								12.55
Sub-plot : Cutting intervals (C)													
C_1 : 15 days intervals	33	23	23	28	34	50	57	56	82	97	89	121	53
C_2 : 20 days intervals	38	31	40	59	78	91	105	89	85				68
C_3 : 25 days intervals	37	44	63	76	123	120	123	157					84
C_4 : 30 days intervals	40	65	106	164	158	147							111
S. Em±	0.61	0.63	0.99	2.00	3.51								1.31
C. D. (P=0.05)	1.74	1.80	2.82	5.70	10.00								3.75
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	7.32	6.92	7.64	10.92	16.16								7.45

Cutting intervals start after common cut at 55 days after sowing. NS–Not Signifcant.

number of leaves per plant was measured under cutting intervals of 30 days after common cut which was to the magnitude of 109 per cent higher than that measured under 15 days cutting interval after common cut. The higher number of leaves per plant was due to favourable temperature effects and higher plant height of lucerne crop. The results were closely related with the findings of Jakhar *et al.* (2009). They observed that the number of leaves per plant of lucerne was higher when the first cut was taken at 50 DAS and subsequent cuts were taken at an interval of 30 days (five cuts).

Leaf : stem ratio

A perusal of data on leaf : stem ratio per plant presented in Table 3 reveals that effect of cutting interval after common cut was found significant. At first to fourth cuts, significantly higher leaf : stem ratio per plant was recorded by cutting interval of 15 and 20 days after common cut than rest of the cutting intervals, respectively. It means that the weight of green leaf was higher than the weight of green stem. While after 30 days cutting interval, weight of green leaf increased proportionally with the weight of green stem.

In case of mean values, leaf : stem ratio per plant measured under cutting intervals of 15 days after common cut was higher and it was to the tune of 18 per cent higher than that of 30 days cutting interval after common cut. The results were closely related with the findings of Sharma and Verma (2006) and Jakhar *et al.* (2009).

Leaf area/plant

The effect of cutting interval after common cut on leaf area per plant was found significant. At first to fourth cuts, significantly the higher leaf area per plant was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals and it was to the tune of 125, 244, 344 and 313 per cent higher than 15 days cutting interval (Table 4). This might be due to the long spell of cutting interval which gave more time for the growth of lucerne plant leading to higher plant height as well as number of leaves per plant which ultimately resulted in higher leaf area per plant of lucerne crop.

Looking to the mean values, significantly higher leaf area per plant was noted by cutting intervals of 30 days after common cut which was to the tune of 149 per cent higher than that of 15 days cutting interval after common cut. This might be due to frequent and maximum number of cutting turned down plant height and number of leaves per plant which ultimately lowered mean leaf area per plant at 15 days cutting interval. The results were closely related with the findings of Sharma and Verma (2006) and Jakhar *et al.* (2009). Jakhar *et al.* (2009) observed that the leaf area per plant of lucerne crop was higher when the first cut was taken at 50 DAS and subsequent cuts were taken at an interval of 30 days (five cuts).

Interaction Effect on Plant Growth Parameters

The combined effect of date of sowing and cutting intervals on different growth parameters viz., plant height, number of leaves per plant and leaf : stem ratio was found non-significant. But in case of mean value of leaf area per plant, it was found significant.

Significantly the maximum leaf area per plant was observed under treatment combination of 10th November sowing along with 30 days cutting interval as compared to rest of all the treatment combinations. The lowest leaf area per plant was recorded by treatment combination of 11th October sowing with 15 days cutting interval. This might be due to favourable temperature effects and longer time of cutting intervals increased the growth parameters of the lucerne i. e. plant height and number of leaves per plant.

Effect of date of sowing on yield

Sowing the lucerne crop on 10th November produced significantly highest green forage yield which was to the tune of 277, 32 and 32 per cent higher over of 11th October sowing at first, third and fourth cuts, respectively. But at second cut, 20th November sowing produced higher green forage yield. The percentage increase in green forage yield was 167 over 11th October sowing. The higher per cent in case of first and second cuts might be due to temperature effects leading to very lower yield of lucerne crop at 11th October sowing. At fifth, sixth and seventh cuts, 31st October sowing and at eighth to eleventh cuts, 21st October sowing recorded numerically higher green forage yield than rest of the sowing dates, respectively.

Looking to the mean values, significantly higher green forage yield was noted by 10th November sowing which increased to the tune of 40 per cent over 11th October sowing. The higher green forage yield was due

TABLE 3
Leaf : stem ratio per plant of lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Leaf : stem ratio												
Main plot : Date of sowing (D)	Common cut	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut	8th cut	9th cut	10th cut	11th cut	Mean
D_1 : 11th October	0.79	0.69	0.70	0.71	0.66	0.88	0.58	0.75	0.78	0.81	0.73	0.71	0.71
D_2 : 21st October	0.51	0.69	0.66	0.56	0.81	0.70	0.75	0.79	0.64	0.63	0.77	0.72	0.66
D_3: 31st October	0.73	0.67	0.66	0.62	0.64	0.68	0.73	0.78	0.80	0.77	0.72		0.68
D_4 : 10th November	0.66	0.68	0.59	0.56	0.51	0.61	0.77	0.68	0.65	0.76			0.62
D_5 : 20th November	0.76	0.64	0.64	0.64	0.51	0.58	0.74	0.61	0.61	0.68			0.62
S. Em±	0.03	0.02	0.04	0.03	0.02								0.01
C. D. (P=0.05)	0.08	NS	NS	0.08	0.07								0.04
C. V. (%)	15.24	9.41	21.25	16.88	14.92								8.53
Sub-plot : Cutting intervals (C)													
C_1 : 15 days intervals	0.72	0.72	0.62	0.66	0.70	0.89	0.73	0.78	0.68	0.71	0.74	0.71	0.71
C_2 : 20 days intervals	0.71	0.64	0.74	0.57	0.64	0.59	0.68	0.64	0.69				0.63
C_3 : 25 days intervals	0.66	0.66	0.73	0.60	0.53	0.56	0.61	0.56					0.63
C_4 : 30 days intervals	0.68	0.67	0.51	0.64	0.48	0.59							0.60
S. Em.±	0.02	0.01	0.03	0.02	0.02								0.01
C. D. (P=0.05)	0.05	0.03	0.07	0.07	0.05								0.02
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	10.74	6.05	16.99	16.59	13.62								5.82

Cutting intervals start after common cut at 55 days after sowing. NS–Not Significant.

TABLE 4
Leaf area per plant of lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Leaf area per plant (cm^2)												
Main plot : Date of sowing (D)	Common cut	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut	8th cut	9th cut	10th cut	11th cut	Mean
D_1 : 11th October	8.2	39.7	48.5	77.5	84.3	92.1	83.2	81.9	77.1	53.2	52.7	41.1	68.8
D_2 : 21st October	17.5	37.1	47.1	77.4	83.5	92.8	93.9	72.8	71.1	71.0	63.2	49.0	69.3
D_3: 31st October	35.7	43.5	50.3	76.8	83.9	91.1	98.4	68.8	48.8	39.3	36.1		70.1
D_4 : 10th November	33.6	66.4	85.8	88.3	102.3	94.9	83.5	79.3	61.9	46.6			83.3
D_5 : 20th November	49.7	48.7	85.4	89.1	102.8	96.5	85.1	63.8	62.4	50.2			82.7
S. Em±	0.91	1.43	1.78	2.70	2.71								2.05
C. D. (P=0.05)	2.81	4.40	5.49	8.33	8.36								6.32
C. V. (%)	12.62	12.13	11.23	13.12	11.87								10.97
Sub-plot : Cutting intervals (C)													
C_1 : 15 days intervals	26.5	30.8	32.0	33.0	34.2	40.5	55.1	48.0	57.1	52.1	50.6	45.1	41.9
C_2 : 20 days intervals	28.5	36.7	45.5	58.9	76.3	86.5	98.3	94.7	91.9				67.1
C_3 : 25 days intervals	28.7	51.5	66.1	89.0	113.7	127.7	132.3	132.3					86.0
C_4 : 30 days intervals	32.1	69.2	110.2	146.4	141.3	135.1							104.4
S. Em±	0.50	0.70	0.93	2.11	1.50								1.02
C. D. (P=0.05)	1.43	1.94	2.64	6.02	4.28								2.92
Interaction (D x C)	NS	NS	NS	NS	NS								
C. V. (%)	7.78	6.45	6.53	11.55	7.35								6.14

Cutting intervals start after common cut at 55 days after sowing. NS–Not Significant.

to higher growth and yield attributing characters (Table 5). The results were closely related with the findings of Singh *et al.* (1980), Patel *et al.* (1987), Taneja *et al.* (1987), Patel *et al.* (1990), Narwal and Sardana (2000), Jain and Poonia (2002), Tulasa Ram (2003), Shaikh *et al.* (2004), Tandon and Patel (2009) and Jakhar *et al.* (2009). Jakhar *et al*. (2009) observed that the 14th November sowing of lucerne (var. Anand-2) gave higher green forage yields.

The 10th November sowing produced significantly highest dry forage yield which was to the magnitude of 284, 52 and 57 per cent higher over 11th October sowing at first, third and fourth cuts, respectively. But at second cut, 20th November sowing produced higher dry forage yield which was to the tune of 199 per cent higher over 11th October sowing. At fifth, sixth and seventh cuts, 31st October sowing and at eighth to eleventh cuts, 21st October sowing recorded numerically higher dry forage yield than rest of the sowing dates, respectively.

In case of mean values, significantly higher dry forage yield was recorded by 10th November sowing which was to the tune of 50 per cent over 11th October sowing. This might be due to that the dry forage yield was positively correlated with the green forage yield of lucerne crop. The results were closely related with the findings of Taneja *et al.* (1987), Harb and Hattab (1994), Tulasa Ram (2003), Patel *et al.* (2003), Sheoran *et al.* (2003), Shaikh *et al.* (2004) and Jakhar *et al.* (2009). Shaikh *et al.* (2004) reported the highest fresh and dry forage yield of oat crop by the sowing on 15 November.

Effect of cutting intervals on yield

Effect of cutting intervals on green forage yield was found significant at first to fourth cuts (Table 5). Significantly the highest green forage yield was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals. The percentage increase in green forage yield was 177, 362, 294 and 369 than 15 days cutting interval.

At fifth cut, green forage yield measured at cutting interval of 30 days after common cut was numerically higher than 15 days cutting interval. At sixth and onwards cuts, the green forage yield was numerically higher with cutting interval of shorter days. This might be due to temperature effect at the time of cutting intervals to each cut, respectively, and there was no green forage yield after 30 days cutting interval.

In case of mean values, significantly the higher green forage yield was measured under cutting intervals of 30 days after common cut which was to the magnitude of 99 per cent higher than that measured by 15 days cutting interval after common cut. The higher green forage yield was the resultant effect of higher green leaf weight per plant and green forage yield per plant (Table 6). The results were closely related with the findings of Kumar (1978), Kafawin *et al.* (1995), Sidhu *et al.* (1997), Barik and Tiwari (1998), Shah and Hasan (1999), Gawali *et al.* (2001), Jain and Poonia (2002), Patel *et al*. (2003), Tomar and Chandrakar (2009) and Patel *et al*. (2009). Patel *et al*. (2009) observed that the first common cut was taken at 55 DAS and subsequent four cuts were taken at an interval of about 25 to 30 days up to May which gave higher green forage yield of lucerne.

Effect of cutting interval on dry forage yield was found significant at first to fourth cuts. Significantly higher dry forage yield was recorded by cutting interval of 30 days after common cut than rest of the cutting treatments. The percentage increase in dry forage yield was 210, 580, 354 and 466 than 15 days cutting interval.

At fifth cut, dry forage yield measured at cutting interval of 30 days after common cut was numerically higher than 15 days cutting interval. At sixth and onwards cuts, the dry forage yield was numerically higher with cutting interval of shorter days. This might be due to temperature effect at the time of cutting intervals to each cut, respectively.

Looking to the mean values, total dry forage yield was higher under cutting intervals of 30 days after common cut which was to the magnitude of 124 per cent higher than that measured by 15 days cutting interval after common cut. The results were closely related with the findings of Kumar (1978), Kafawin *et al.* (1995) and Sharma and Verma (2006). Kumar (1978) reported that the highest fresh fodder yield and dry matter yield were recorded when lucerne was cut at 30 days interval followed by 20 and 40 days intervals.

Interaction effect on yield

At common cut, significantly higher green forage yield was observed by the treatment combination of 20th November sowing with 20 days cutting interval as compared to rest of the treatment combinations and the lowest green forage yield was recorded by the combination of 11th October sowing and 25 days cutting interval (Table 5).

TABLE 5
Green forage yield of lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Green forage yield (q/ha)												
Main plot : Date of sowing (D)	Common cut	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut	8th cut	9th cut	10th cut	11th cut	Total
D_1 : 11th October	2.70	12.13	25.21	52.89	53.56	53.73	26.18	21.32	11.19	6.48	3.50	3.52	244.82
D_2 : 21st October	9.08	16.73	40.69	46.55	48.75	51.01	36.79	25.45	21.53	16.84	16.54	13.89	275.71
D_3: 31st October	20.55	32.39	44.05	49.45	51.99	58.47	36.86	26.00	9.51	9.32	8.16		304.41
D_4 : 10th November	25.62	45.74	59.65	69.65	70.49	54.27	31.15	25.35	8.21	6.50			343.78
D_5 : 20th November	27.20	41.95	67.21	60.50	58.01	32.08	26.54	19.30	17.78	13.81			304.03
S. Em±	0.48	0.89	1.49	1.56	1.64								8.14
C. D. (P=0.05)	1.48	2.76	4.60	4.81	5.07								25.10
C. V. (%)	11.33	12.07	12.62	11.20	11.66								11.06
Sub-plot : Cutting intervals (C)													
C_1 : 15 days intervals	16.38	16.17	17.40	24.29	22.11	29.72	21.32	17.39	12.48	10.59	9.40	8.71	196.99
C_2 : 20 days intervals	17.79	25.78	39.15	45.30	42.72	42.11	34.55	29.89	19.27				279.00
C_3 : 25 days intervals	16.32	32.33	52.51	58.01	57.72	60.07	45.18	30.32					310.14
C_4 : 30 days intervals	17.64	44.87	80.38	95.64	103.69	84.12							392.69
S. Em±	0.27	0.49	0.91	0.97	0.96		4.47						
C. D. (P=0.05)	0.77	1.42	2.61	2.76	2.75		12.75						
Interaction (D x C)	SIG	SIG	SIG	SIG	SIG		SIG						
C. V. (%)	7.14	7.49	8.66	7.77	7.65		6.79						

Cutting intervals start after common cut at 55 days after sowing.

TABLE 6
Dry forage yield of lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Dry forage yield (q/ha)												
Main plot : Date of sowing (D)	Common cut	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut	8th cut	9th cut	10th cut	11th cut	Mean
D_1 : 11th October	0.48	2.01	4.37	8.91	9.14	9.70	4.71	3.90	2.04	1.18	0.64	0.66	42.72
D_2 : 21st October	1.78	2.62	6.44	8.21	9.76	9.93	6.85	4.55	3.99	3.22	3.22	2.61	50.45
D_3: 31st October	3.90	5.51	7.34	8.49	10.57	12.10	6.91	5.08	1.80	1.77	1.62		56.88
D_4 : 10th November	3.38	7.71	11.01	13.55	14.32	10.67	5.88	4.99	1.68	1.29			64.14
D_5 : 20th November	4.59	6.89	13.07	12.50	11.89	6.61	5.38	3.83	3.57	2.74			59.12
S. Em±	0.07	0.14	0.27	0.31	0.36		1.30						
C. D. (P=0.05)	0.22	0.43	0.85	0.95	1.11		4.00						
C. V. (%)	10.22	11.52	13.15	12.03	12.99		9.52						
Sub-plot : Cutting intervals (C)													
C_1 : 15 days intervals	2.61	2.47	2.30	4.17	3.75	5.69	3.82	3.31	2.39	2.04	1.83	1.64	34.28
C_2 : 20 days intervals	3.02	3.95	6.41	7.13	8.21	8.10	6.42	5.64	3.59				49.17
C_3 : 25 days intervals	2.70	5.72	9.42	11.09	11.35	11.84	8.90	5.68					58.59
C_4 : 30 days intervals	2.97	7.66	15.64	18.93	21.23	17.01							76.61
S. Em±	0.04	0.08	0.18	0.17	0.21		0.78						
C. D. (P=0.05)	0.13	0.23	0.51	0.49	0.62		2.24						
Interaction (D x C)	Sig.	Sig.	Sig.	Sig.	Sig.		Sig.						
C. V. (%)	7.29	7.47	9.59	7.57	8.75		6.44						

Cutting intervals start after common cut at 55 days after sowing. Sig.–Significant.

At first, second, third, fourth and in total green forage yield of all the cuts, significantly higher green forage yield was observed by the treatment combination of 10th November sowing with 30 days cutting interval as compared to rest of all the combinations and significantly the lowest green forage yield was recorded by the combination of 11th October sowing and 15 days cutting interval.

At first, fourth cut and total dry forage yield of all the cuts, significantly higher dry forage yield was observed by treatment combination of 10th November sowing with 30 days cutting interval as compared to rest of all the combinations and significantly lowest dry forage yield was recorded by the combination of 11th October sowing with 15 days cutting interval.

At common, second and third cuts, significantly higher dry forage yield was observed by the combination of 20th November sowing with 30 days cutting interval as compared to rest of all the combinations. More or less similar results were reported by the findings of Taneja *et al.* (1987) and Taneja *et al*. (1990).

CONCLUSION

On the basis of one year experimentation, the maximum green forage yield, net realization and benefit : cost ratio can be achieved by sowing the lucerne crop on 10th November (second week) and 30 days cutting interval after common cut (55 DAS) under the loamy sand soil of North Gujarat agro-climatic conditions.

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