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Effect of date of sowing and cutting intervals on yield attribute, yield, quality and soil fertility of Lucerne [*Medicago sativa* L.] under North Gujarat agroclimatic conditions

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Abstract
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 agroclimatic conditions. The results of yield attributing characters indicated that significantly higher green leaf weight was recorded by 10th November sowing and 30 days cutting interval after common cut in the mean values of all cuts. Similarly, the mean green stem weight, green forage yield per plant and dry forage yield per plant was 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, numerically higher crude protein content was noted by 20th November sowing and 25 days cutting interval in the mean values of all cuts. The effect of different date of sowing and cutting intervals on available nitrogen, phosphorous and potash was found non-significant after harvesting of the crop.

Keywords: Yield attributes, green leaf weight, green stem weight, crude protein, crude fiber, soil fertility, green forage yield, Lucerne

Introduction
Agriculture and animal husbandry in India are interwoven with the intricate fabric of the society in cultural, religious and economical ways as mixed farming and livestock rearing forms an integral part of rural living. 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 percent of world livestock and having a 17 percent of human population to be sustained on approximately two percent 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.

The fodder supply situation in India is extremely precarious and the gap is very wide. The chronic shortage of feed and fodder resources during the last few decades indicates that most of the livestock were underfed. Such shortage of feed and fodder resources could be attributed to the growing livestock population, low productivity and less emphasis on forage cultivation by the livestock owners. In India, only 4.4 percent 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 are 589 million tonnes, which contributes 62.8 percent and 23.5 percent deficit of forage production, respectively. In Gujarat, the total area under forage crops is about 7.96 thousand hectare.

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) [2]. Lucerne grows well in loamy sand to clayey textured soils. But, it is very sensitive to water logging and acidic soil reaction.

Lucerne (*Medicago sativa* L.) is one of the most important protein rich forage crop. 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. Beside 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) are responsible for reduction of quantity and quality of Lucerne forage yield.

Among these, time of sowing and cutting intervals has prime important for quality and quantity of green forages. The proper time of sowing determine forage yield of Lucerne crop. The optimum time of sowing of Lucerne depends upon the nature of variety and the temperature. Now a day, 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 variety Anand-2 and SS-627 (*i.e.* 2nd week of November) recorded higher yield than late sowing of Lucerne crop (Patel *et al.,* 1987) [12]. Besides, sowing time, temperature is also very important for the germination of Lucerne crop. Higher temperature in the month of October may results 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. Some time, 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 twenty treatment combinations comprising five date 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.

Result and Discussion

Effect of date of sowing on yield attributes and yield

Green leaf weight per plant (g)

The data presented in Table 1 showed that the effect of date of sowing on green leaf weight per plant was found significant at common cut, first to fourth cuts as well as in mean values of all the cuts. At first and second cut, 10th November sowing produced significantly higher green leaf weight per plant and it was followed by 20th November and 31st October sowing. But sowing of Lucerne crop on 20th November recorded significantly higher green leaf weight per plant during common cut, third cut and fourth cut but it was closely followed by 10th November in third cut and 31st October sowing in fourth cut being at par with 10th November sowing. In case of mean values, significantly the higher green leaf weight per plant was recorded by sowing the crop on 10th November but was found statistically at par with the sowing of Lucerne crop on 20th November and it was followed by 31st October sowing. Significantly the lowest green leaf weight per plant was recorded by 11th October sowing.

At first and second cut, 10th November sowing had produced significantly higher green leaf weight per plant and which was to the tune of 46 and 57 per cent higher over 11th October sowing. But, at third and fourth cut, 20th November sowing produced significantly higher green leaf weight per plant and which was to the magnitude of 15 and 7 per cent higher over 11th October sowing, respectively. In case of mean values, significantly higher green leaf weight per plant was noted by 10th November sowing and which was increased to the tune of 16 per cent over 11th October sowing. This might be due to higher growth parameters values due to 10th November sowing

Green stem weight per plant (g)

Data presented in Table 2 showed that the effect of date of sowing on green stem weight per plant was found significant at common to fourth cut as well as in mean values of all the cuts. From first to fourth cuts, sowing of Lucerne crop on 10th November produced significantly higher green stem weight per plant being at par with 20th November sowing except in first cut. But in case of common cut, 20th November sowing produced significantly higher green stem weight per plant.

In case of mean values, significantly higher green stem weight per plant was recorded under the 10th November sowing being at par with 20th November sowing than rest of the sowing dates. Significantly the lowest green stem weight per plant was recorded by 11th October sowing. Significantly higher green stem weight per plant was produced by sowing the crop on 10th November. The percentage increases of green stem weight per plant were 54, 90, 38 and 41 per cent over 11th October sowing at first to fourth cuts, respectively. In case of mean values, significantly higher green stem weight per plant was noted by 10th November sowing which was increased to the tune of 36 per cent over 11th October sowing. This might be due to higher growth parameter values due to 10th November sowing.

Green forage yield per plant (g)

The data presented in Table 3 showed that the effect of date of sowing on green forage yield per plant of Lucerne was found significant at common cut to fourth cuts and in the mean values of all cuts. At first to fourth cuts, sowing the Lucerne crop on 10th November produced significantly higher green forage yield per plant but at third and fourth cut of 10th November sowing was found statistically at par with 20th November sowing. Significantly the lowest green forage yield per plant was noted by 11th October sowing. But in case of common cut, 20th November sowing produced higher green forage yield per plant than rest of the sowing dates.

In case of mean values, significantly higher green forage yield per plant was recorded by 10th November sowing and it was statistically at par with 20th November sowing. Significantly the lowest green forage yield per plant was recorded by 11th October sowing. Sowing the Lucerne crop on 10th November was produced significantly highest green forage yield per plant and which was to the tune of 50, 76, 24 and 25 per cent higher over 11th October sowing, respectively at first to fourth cuts. In case of mean values, significantly higher green forage yield per plant was noted by 10th November sowing which

was increased to the tune of 28 per cent over 11th October sowing. This might be due to higher plant height, number of leaves per plant, green leaf weight and green stem weight per plant

Dry forage yield per plant (g)

The data presented in Table 4 showed that the effect of different date of sowing on dry forage yield per plant of Lucerne crop was found significant at common cut to fourth cuts and in the mean values of all the cuts. From first to fourth cuts, sowing of Lucerne crop on 10th November was produced significantly higher dry forage yield per plant and it was found statistically at par with 31st October sowing at second and third cut and with 21st October sowing at fourth cut. But in case of common cut, 20th November sowing produced higher dry forage yield per plant than rest of sowing dates.

In case of mean values, significantly highest dry forage yield per plant was recorded by 10th November sowing being at par with 20th November sowing. Significantly the lowest dry forage yield per plant was recorded by 11th October sowing. Sowing of the Lucerne crop on 10th November were produced significantly highest dry forage yield per plant and which was 38, 46, 16 and 7 per cent higher as compared to 11th October sowing at first to fourth cuts, respectively.

In case of mean values, significantly higher dry forage yield per plant was noted by 10th November sowing and which was to the tune of 15 per cent higher over 11th October sowing. The higher dry weight per plant was might be due to higher green forage yield per plant

Green forage yield (q ha^{-1})

The data presented in Table 5 showed that the effect of different date of sowing on green forage yield of Lucerne was found significant at common cut to fourth cuts and in the total green forage yield of all the cuts. The green forage yield increased linearly up to fourth or fifth cut and later on it decreased gradually. Green forage yield was significantly higher under sowing the crop on 10th November but it was followed by 20th November sowing at first, third and fourth cut. But in case of common cut and second cut, sowing the Lucerne on 20th November gave significantly higher green forage yield and it was followed by 10th November.

The results of total green forage yield of all the cuts indicated that sowing the Lucerne crop on 10th November recorded significantly the highest green forage yield than rest of the sowing dates and it was followed by 31st October and 20th November sowing being at par with each other. The effect of date of sowing on yield attributes and yield were found significant. Green leaf weight per plant, green stem weight per plant, green forage yield per plant, dry matter yield per plant, green forage yield and dry forage yield measured at common cut to fourth cuts and in the mean values was found significant.

Sowing the Lucerne crop on 10th November was produced significantly highest green forage yield and which was to the tune of 277, 32 and 32 per cent higher over of 11th October sowing at first, third and fourth cut, 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 percent in case of first and second cut might be due to temperature effects leading to very lower yield of Lucerne crop at 11th October sowing.

Looking to the mean values, significantly higher green forage yield was noted by 10th November sowing which was increased to the tune of 40 per cent over 11th October sowing. The higher green forage yield was might be due to higher growth and yield attributing characters. The results were closely related with the findings of Jakhar *et al.* (2009) [6], Singh *et al.* (1980) [20], Patel *et al.* (1987) [12], Taneja *et al.* (1987) [24], Patel *et al.* (1990) [13], Narwal and Sardana (2000) [10], Jain and Poonia (2002) [5], Tulasa Ram (2003) [26], Shaikh *et al*. (2004) [16] and Tandon and Patel (2009) [23]. Jakhar *et al.* (2009) [6] observed that the 14th November sowing of Lucerne (var. Anand-2) gave higher green forage yields.

The 10th November sowing had 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 cut, respectively. But at second cut, 20th November sowing had produced higher dry forage yield which was to the tune of 199 per cent higher over 11th October sowing. 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 is positively correlated with the green forage yield of Lucerne crop. The results were closely related with the findings of Shaikh *et al.* (2004) [16], Taneja *et al.* (1987) [24], Harb and Hattab (1994) [4], Tulasa Ram (2003) [26], Patel *et al.* (2003) [11], Sheoran *et al.* (2003) [18] and Jakhar *et al.* (2009) [6] reported the highest fresh and dry forage yield of oat crop by the sowing on 15 November.

The effect of date of sowing from fifth to eleventh cut were not analyzed for yield attributes and yield due to variation in number of cuttings taken from individual treatments.

Effect of cutting intervals on yield attributes and yield

Green leaf weight per plant (g)

It is evident from the data presented in Table 1 that the effect of cutting interval after common cut on green leaf weight per plant was found significant from common cut to fourth cuts and in the mean values of all cuts. At common cut and first to fourth cuts, cutting interval of 30 days produced significantly higher green leaf weight per plant and it was closely followed by 25, 20 and 15 days cutting interval after common cut. Significantly the lowest green leaf weight per plant was recorded by 15 days cutting interval.

Looking to the mean values, significantly higher green leaf weight per plant was recorded by cutting the Lucerne crop at 30 days interval after common cut and it was followed by cutting intervals of 25, 20, and 15 days after common cut. Significantly the lowest green leaf weight per plant was recorded by 15 days cutting interval after common cut. The effect of different cutting interval was found significant at first to fourth cut. At first to fourth cuts, significantly higher green leaf weight per plant was recorded by cutting interval of 30 days after common cut and it was to the tune of 153, 307, 664 and 338 per cent higher than 15 days cutting interval, respectively. This might be due to the long spell of cutting interval provide the enough time for photosynthesis leading to higher green leaf weight per plant of Lucerne crop.

Looking to the mean values, cutting intervals of 30 days after common cut was recorded 194 per cent higher green leaf weight per plant than that of 15 days cutting interval after common cut. These were might be due to higher plant height and number of leaves of Lucerne crop at 30 days cutting interval.

Green stem weight per plant (g)

Data presented in Table 2 revealed that the effect of cutting interval on green stem weight per plant was found significant

from common cut to fourth cuts. From common cut, first to fourth cuts, cutting interval of 30 days produced significantly higher green stem weight per plant than that recorded under the cutting intervals of 25, 20 and 15 days after common cut.
Looking to mean values, green stem weight per plant was significantly highest at cutting interval of 30 days after common cut and it was closely followed by cutting intervals of 25, 20, and 15 days after common cut. Significantly the lowest green stem weight per plant was recorded by cutting the Lucerne crop at 15 days interval. Effect of cutting interval after common cut on green stem weight per plant was found significant at first to fourth cut (Table 2). Significantly the higher green stem weight per plant was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals. The percentage increase in green stem weight per plant was 177, 391, 630 and 537 percent than 15 days cutting interval.
In case of mean values, significantly higher green stem weight per plant was measured under cutting intervals of 30 days after common cut which was to the magnitude of 276 per cent higher than that measured by 15 days cutting interval after common cut.

Green forage yield per plant (g)
The results of green forage yield per plant indicated that the cutting interval days after common cut were found significant from common cut to fourth cuts as well as in mean value of all the cuts (Table 3). At common cut and first to fourth cuts, cutting intervals of 30 days recorded significantly higher green forage yield per plant as compared to cutting interval of 25, 20 and 15 days after common cut.
In case of mean values, significantly the highest green forage yield per plant was recorded by cutting interval of 30 days after common cut and it was closely followed by cutting intervals of 25, 20, and 15 days after common cut. Significantly the lowest green forage yield per plant was recorded by 15 days cutting interval after common cut. Effect of cutting interval on green forage yield per plant was significant at first to fourth cuts (Table 3). Significantly higher green forage yield per plant was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals. The percentage increase in green forage yield per plant was 167, 361, 642 and 456 percent than 15 days cutting interval.
Looking to the mean values, significantly the highest green forage yield per plant was noted by cutting intervals of 30 days after common cut which was to the magnitude of 245 per cent higher than that measured by 15 days cutting interval after common cut. The higher green forage yield per plant might be due higher green leaf weight and green stem weight per plant (Table 1 and 2).

Dry forage yield per plant (g)
Dry forage yield per plant significantly influenced by cutting intervals during common cut and first to fourth cuts as well as in mean values of all the cuts. At common cut and first to fourth cuts, cutting interval of 30 days recorded significantly higher dry forage yield per plant as compared to cutting intervals of 25, 20 and 15 days after common cut.
Looking to mean values, dry forage yield per plant was significantly higher at cutting interval of 30 days after common cut and it was closely followed by cutting intervals of 25, 20 and 15 days after common cut. Significantly the lowest dry forage yield per plant was recorded by cutting interval of 15 days after common cut. Effect of cutting interval on dry forage yield per plant was found significant at first to fourth cut (Table 4). Significantly higher dry forage yield per plant was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals. The percentage increase in dry forage yield per plant was 169, 417, 538 and 559 percent than 15 days cutting interval.
In case of mean values, significantly the highest dry forage yield per plant was measured under cutting intervals of 30 days after common cut and which was to the tune of 242 per cent higher than that measured under 15 days cutting interval after common cut.

Green forage yield (q ha^{-1})
Green forage yield of Lucerne crop due to the cutting interval days after common cut was found significant at common cut, first cut to fourth cuts and also in total green forage yield of all cuts. In case of first to fourth cuts, significantly higher green forage yield was recorded by 30 days cutting interval after common cuts and it was followed by cutting intervals of 25, 20 and 15 days after common cut. But in case of common cut, significantly higher green forage yield was recorded by 20 days cutting interval.
In case of total green forage yield, significantly the highest total green forage yield was noted by 30 days cutting interval after common cut and it was followed 25, 20, and 15 days after common cut. Significantly the lowest green forage yield was recorded by 15 days cutting interval. Effect of cutting interval on green forage yield was found significant at first to fourth cut (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 percent than 15 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 and 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, green forage yield per plant (Table 1 and 3). The results were closely related with the findings of Kumar *et al.* (1978) [8], Sood and Kumar (1994) [22], Kafawin *et al.* (1995) [7], Sidhu *et al.* (1997) [19], Barik and Tiwari (1998) [1], Shah and Hasan (1999) [15], Gawali *et al.* (2001) [3], Jain and Poonia (2002) [5], Patel *et al.* (2003) [11], Tomar and Chandrakar (2009) [25] and Patel *et al.* (2009) [23] 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 gave higher green forage yield of Lucerne.

Interaction effect on yield attributes and yield
The interaction effect of date of sowing and cutting intervals on green leaf weight per plant and green stem weight per plant was found non-significant in all cuts and its mean values.

Green forage yield per plant (g)
The interaction effect of date of sowing and cutting intervals was found significant during fourth cut and in mean values of all the cuts.At fourth cut, significantly higher green forage yield per plant was recorded by the combination of 10th November sowing with cutting interval of 30 days after common cut and it was at par with combination of 20th November sowing with cutting interval of 30 days after common cut. Significantly the lowest green forage yield per plant was recorded by the combination 21th October sowing

with cutting interval of 15 days and it was found statistically at par with 11th October sowing with 15 days cutting intervals after common cut.

In mean values, significantly higher green forage yield per plant was produced by the combination of 10th November sowing having cutting interval of 30 days after common cut and it was at par with the combination of 20th November sowing with 30 days cutting interval after common cut. Significantly the lowest green forage yield per plant was recorded by the combination of 11th October sowing with 15 days cutting interval after common cut.

Dry forage yield per plant (g)

The interaction effect of date of sowing and cutting intervals was found significant in mean values of all the cuts only. Data presented in Table 4 indicated that significantly higher dry forage yield per plant with combination of 10th November sowing with cutting interval of 30 days and it was at par with the combination of 31st October sowing and cutting interval of 30 days. Significantly the lowest dry forage yield per plant was recorded with the combination of 11th October sowing with cutting interval of 15 days after common cut.

Green forage yield (q ha^{-1})

The interaction effect of date of sowing and cutting intervals was found significant during common cut, first, second, third and fourth cut and in the total forage yield of all cuts. Data presented in Table 5 indicated that the treatment combination of 20th November sowing with cutting interval of 20 days at common cut recorded significantly higher green forage yield but it was equally effective with the combination of 20th November sowing with cutting interval of 30 days. Significantly the lowest green forage yield was recorded by combination of 11th October sowing with cutting interval of 25 days and it was at par with 11th October sowing with 15 days cutting interval.

At first cut, significantly higher green forage yield was produced by the combination of 10th November sowing having cutting interval of 30 days after common cut and it was followed by combination of 20th November sowing with 30 days cutting interval after common cut. Significantly the lowest green forage yield was recorded by the combination 11th October sowing with 15 days cutting interval after common cut (Table 5.1).

At second and third cut, significantly higher green forage yield was produced by the combination of 20th November sowing with 30 days cutting interval after common cut and it was at par with the combination of 10th November sowing with 30 days cutting interval after common cut in case of third cut. Significantly the lowest green forage yield was noted by the combination of 11th October sowing with 15 days cutting interval after common cut (Table 5.2 and 5.3). At fourth cut, significantly the highest green forage yield was produced by the combination of 10th November sowing with 30 days cutting interval after common cut and it was followed by the combination of 20th November sowing with 30 days cutting interval after common cut. Significantly the lowest green forage yield was recorded by the combination of 11th October sowing with 15 days cutting interval after common cut (Table 5.4).

In case of total green forage yield, significantly the highest green forage yield was noted by the combination of 10th November sowing with 30 days cutting interval after common cut and it was followed by the combination of 20th November sowing with 30 days cutting interval after common cut. Significantly the lowest green forage yield was recorded by the combination of 11th October sowing with 15 days cutting interval after common cut (Table 5.5). The combined effect of date of sowing and cutting interval on different yield attributes and yield *viz*., green leaf weight per plant, green stem weight per plant and dry forage yield per plant did not differ significantly. But the green forage yield per plant at fourth cut and in mean value, green and dry forage yield from common to fourth cuts as well as total values of all the cuts were found significant.

At fourth cut, significantly higher green forage yield per plant was observed by the treatment combination of 10th November sowing with 30 days cutting interval as compared to rest of the treatment combinations. Significantly the lowest green forage yield per plant was recorded by the combination of 21st October sowing and 15 days cutting interval, but it was equally effective with treatment combination of 11th October sowing with 15 days cutting interval. In case of mean values, significantly higher green and dry forage yield per plant was observed by the treatment combination of 10th November sowing with 30 days cutting interval as compared to rest of the treatment combinations. Significantly the lowest green and dry forage yield per plant was recorded by the treatment combination of 11th October sowing and 15 days cutting interval.

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. 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 combination and significantly the lowest green forage yield was recorded by the combination of 11th October sowing and 15 days cutting interval.

Effect of date of sowing on quality parameters

Crude protein content (%)

The data presented in Table 6 revealed that the crude protein content of Lucerne did not differ significantly due to different date of sowing. However, at first and ninth to eleventh cuts, 21st October sowing, at common cut, second and third cuts, 31st October sowing, at fourth and fifth cuts, 11th October and 10th November sowing and at sixth to eighth cuts, 20th November sowing recorded numerically higher crude protein content than that of other date of sowing.

In case of mean values of crude protein content, sowing the crop on 31st October gave numerically higher crude protein content than other sowing dates. The protein content is the genetically character of the plants. So that its values were varied non-significantly with the date of sowing and also according the growth of the plants at all the cuts and in mean values of all the cuts.

In case of mean values, numerically higher crude protein content was noted by 31st October sowing. More or less similar results were reported by the findings of Patel *et al.* (1987) [12], Narwal and Sardana (2000) [10] and Tandon and Patel (2009) [23].

Protein yield (kg ha^{-1})

The data presented in Table 7 showed that the effect of different date of sowing on crude protein yield of Lucerne was found significant from common cut to fourth cuts and in the total crude protein yield of all the cuts. At common cut,

first and second cut, sowing of Lucerne crop on 20th November produced significantly higher crude protein yield than that of 10th November sowing and it was at par with 10th November sowing at first cut only. But in case of third and fourth cut, 10th November sowing gave significantly higher crude protein yield and it was followed by 20th November sowing.

In case of total crude protein yield, sowing the Lucerne crop on 10th November recorded significantly the highest total crude protein yield and it was statistically at par with 20th November and 31st October sowing. Protein yield is the resultant effect of protein content and forage yield of Lucerne crop. The protein yield is proportionally increased with increase in forage yield. Sowing of Lucerne crop on 20th November produced higher crude protein yield and which was to the tune of 247 and 187 per cent higher than 11th October sowing at first and second cut, respectively. But, at third and fourth cut, 10th November sowing produced significantly higher crude protein yield which was to the tune of 41 and 50 per cent higher over 11th October sowing, respectively.

At fifth cut and onward cuts, the protein yield varied as per date of sowing and temperature effect on growth and yield attributing characters of the Lucerne crop (Table 1, 2 and 3). In case of mean values, sowing the crop on 10th November recorded higher crude protein yield and which was increased to the tune of 47 per cent than 11th October sowing. Almost similar results were reported by the findings of Patel *et al.* (1987) [12], Shaikh *et al.* (2004) [16] and Tandon and Patel (2009) [23] recorded that the sowing on 15th November gave the highest crude protein yield.

Crude fibre content (%)

The data presented in Table 8 revealed that crude fibre content of Lucerne did not differ significantly due to different date of sowing. The effect of different date of sowing on crude protein content and crude fiber content was found non significant. But protein yield was significantly affected by different date of sowing from common cut to fourth cuts as well as in the total values of all the cuts (Table 6, 7 and 8). The effect of date of sowing from fifth to eleventh cut were not analyzed for all the quality parameters due to variation in number of cuttings taken from individual treatments.

More or less same trend was observed in case of fibre content of Lucerne plant. However, in case of mean values, 31st October sowing recorded higher crude fibre content and which was increased to the tune of 8 per cent than 10th November sowing. These results were in accordance with the Harb and Hattab (1994) [4] and Tandon and Patel (2009) [23]. Harb and Hattab (1994) [4] observed that the crude protein and crude fibre content were not affected by different sowing date and seed rate.

Effect of cutting intervals on quality parameters

Crude protein content (%)

The data presented in Table 6 revealed that the effect of cutting interval days after common cut did not differ significantly in case of crude protein content during all cuts and also in mean values of all the cuts. From first to seventh cuts, cutting interval of 25 days and at eighth cut, cutting interval of 20 days after common cut recorded numerically higher crude protein content. From ninth to eleventh cuts, the crude protein content was recorded only from the cutting interval of 15 days after common cut.

Looking to the mean crude protein content, cutting the crop at 25 days after common cut recorded numerically higher crude protein content than that recorded from cutting intervals of 30, 20, and 15 days after common cut. Looking to the mean values, crude protein content measured by cutting intervals of 25 days after common cut was 10 per cent higher than that measured by 15 days cutting interval after common cut. More or less similar results were reported by Kumar *et al.* (1978) [8], Kafawin *et al.* (1995) [7], Singh *et al.* (1999) [21], Shah and Hasan (1999) [15], Midha *et al*. (2005) and Sharma and Verma (2006). Kumar *et al.* (1978) [8] reported that the crude protein content of Lucerne crop was increased by 20 and 40 days cutting intervals.

Protein yield (kg ha^{-1})

The data on crude protein yield of Lucerne revealed that cutting interval days after common cut recorded significant effect from common cut, first cut to fourth cuts and total crude protein yield of all cuts (Table 7). From first to fourth cuts, cutting the Lucerne crop at 30 days interval after common cut recorded significantly higher crude protein yield and it was followed by cutting the crop at 25 days interval as compared to cutting intervals of 25, 20 and 15 days after common cut. But in case of common cut, 20 days cutting interval produced higher protein yield.

Looking to the total crude protein yield, cutting the Lucerne crop at 30 days interval after common cut recorded significantly higher crude protein yield and it was followed by 25 days cutting interval. Significantly the lowest crude protein yield was recorded by cutting the crop at 15 days interval. The effect of cutting interval on crude protein yield was significant at first to fourth cuts (Table 7). Significantly higher crude protein yield was recorded by cutting interval of 30 days after common cut than rest of the cutting intervals.

In case of mean values, crude protein yield measured under cutting intervals of 30 days after common cut was increased to the tune of 121 per cent than that of 15 days cutting interval after common cut. The higher protein yield of Lucerne crop was might be due to higher dry forage yield of the Lucerne crop because the protein yield is directly related to dry forage yield of the crops. More or less similar results were reported by Singh *et al.* (1999) [21]. They found that the herbage as well as crude protein yield of oat were significantly increased with the increase in cutting intervals from one to two months.

Crude fibre content (%)

Data presented in Table 8 revealed that the effect of cutting interval days after common cut on crude fibre content did not differ significantly. The effect of cutting interval on crude protein content and fiber content at all the cuts and in the mean values of all the cuts was found non significant. Looking to the mean values, maximum crude fiber content was recorded by cutting intervals of 30 days after common cut which was to the tune of 8 per cent higher than that measured by 15 days cutting interval after common cut.

Interaction effect on quality parameters

Crude protein content (%) and Crude fiber content (%)

The interaction effect of date of sowing and cutting intervals was found non-significant.

Protein yield (kg ha^{-1})

The interaction effect between date of sowing and cutting intervals was found significant at common cut, first, second, third and fourth cut as well as in total values of all the cuts. At common cut, significantly higher crude protein yield was produced by the combination of 20th November sowing with

cutting interval of 30 days after common cut and it was at par with the combination of 20th November sowing with cutting interval of 20 days after common cut. Significantly the lowest crude protein yield was recorded by the combination of 11th October sowing with cutting interval of 25 days after common cut being at par with 11th October sowing with 15 days after common cut.

At first cut, significantly higher crude protein yield was produced by the combination of 10th November sowing with cutting interval of 30 days after common cut and it was followed by the combination of 20th November sowing with cutting interval of 30 days after common cut. Significantly the lowest crude protein yield was recorded by the combination of 11th October sowing with cutting interval of 15 days after common cut. At second and third cut, significantly higher crude protein yield was produced by the combination of 20th November sowing with cutting interval of 30 days after common cut and it was followed by the combination of 10th November sowing with cutting interval of 30 days after common cut. Significantly the lowest crude protein yield was recorded by the combination of 11th October sowing with cutting interval of 15 days after common cut.

At fourth cut, significantly the highest crude protein yield was produced by the combination of 10th November sowing with cutting interval of 30 days after common cut and it was followed by the combination of 20th November sowing with cutting interval of 30 days after common cut. Significantly the lowest crude protein yield was recorded by the combination of 11st October sowing with cutting interval of 15 days after common cut. Significantly higher total crude protein yield was produced by the combination of 20th November sowing with cutting interval of 30 days after common cut and it was at par with the combination of 10th November sowing with cutting interval of 30 days after common cut. Significantly the lowest crude protein yield was recorded by the combination of 11th October sowing with cutting interval of 15 days after common cut.

Effect of date of sowing and cutting intervals on soil fertility

The effect of date of sowing on soil fertility *i.e*. the available nitrogen, phosphorous and potash after harvesting of the Lucerne crop were found non- significant (Table 9). All interaction effect on soil fertility was found non-significant.

Table 1: Green leaf weight per plant of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Green leaf weight plant^{-1} (g)												
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	0.22	0.85	1.18	1.77	1.79	1.89	1.61	1.48	1.18	0.91	0.71		1.40
D_2 : 21st October	0.38	0.79	0.99	1.64	1.71	1.90	1.76	1.38	1.24	1.22	1.18	0.66	1.40
D_3: 31st October	0.67	0.93	1.20	1.33	1.81	1.93	1.90	1.03	0.85	0.74	0.66	0.90	1.42
D_4 : 10th November	0.67	1.24	1.85	1.85	1.76	1.75	1.60	1.43	1.20	0.90			1.63
D_5 : 20th November	0.99	1.00	1.51	2.04	1.91	1.65	1.63	1.26	0.95	0.83			1.61
S. Em.±	0.02	0.04	0.05	0.06	0.05								0.06
C.D. at 5 %	0.08	0.11	0.16	0.17	0.15								0.11
C. V. (%)	16.59	14.83	15.79	12.87	10.68								9.68
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	0.49	0.60	0.57	0.44	0.63	0.80	1.13	0.91	1.08	0.91	0.85	0.78	0.77
C_2 : 20 Days intervals	0.59	0.76	1.01	1.27	1.57	1.52	1.76	1.67	1.37				1.27
C_3 : 25 Days intervals	0.58	0.98	1.50	1.84	2.21	2.32	2.47	1.97					1.67
C_4: 30 Days intervals	0.68	1.52	2.32	3.36	2.76	3.30							2.26
S. Em.±	0.01	0.03	0.04	0.04	0.03								0.02
C.D. at 5 %	0.04	0.08	0.10	0.12	0.09								0.05
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	9.54	12.31	12.08	10.80	8.15								6.44

Note: Cutting interval start after common cut at 55 days after sowing

Table 2: Green stem weight per plant of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Green stem weight plant^{-1}(g)												
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	0.28	1.23	1.74	2.53	2.93	3.13	2.63	2.10	1.53	1.13			2.17
D_2 : 21st October	0.78	1.18	1.70	2.75	2.87	2.56	2.52	2.24	2.13	1.99	0.97	0.94	2.24
D_3: 31st October	0.92	1.40	1.88	2.61	2.94	3.15	2.69	1.31	1.07	0.97	1.58	1.25	2.28
D_4 : 10th November	1.02	1.89	3.31	3.49	4.14	3.08	2.25	2.11	2.10	1.22	0.92		2.96
D_5 : 20th November	1.29	1.61	3.15	3.19	3.85	3.26	2.29	2.16	1.52	1.19			2.88
S. Em.±	0.03	0.03	0.07	0.11	0.12								0.07
C.D. at 5 %	0.08	0.10	0.23	0.34	0.38								0.21
C. V. (%)	11.93	8.77	12.51	15.11	14.64								10.89
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	0.71	0.83	1.00	0.74	0.91	0.90	1.54	1.17	1.60	1.29	1.16	1.09	1.09
C_2 : 20 Days intervals	0.83	1.21	1.41	2.27	2.47	2.57	2.59	2.61	1.98				2.03
C_3 : 25 Days intervals	0.90	1.50	2.10	3.24	4.18	4.12	4.07	3.52					2.82
C_4: 30 Days intervals	1.00	2.30	4.91	5.40	5.80	5.58							4.10
S. Em.±	0.02	0.03	0.06	0.10	0.09								0.04
C.D. at 5 %	0.05	0.08	0.18	0.28	0.27								0.11
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	8.22	8.59	11.85	14.93	12.61								6.70

Note: Cutting interval start after common cut at 55 days after sowing

Table 3: Green forage yield per plant of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Green forage yield plant^{-1} (g)											
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	0.50	2.08	2.93	4.30	4.73	5.04	4.18	3.62	2.71	2.04	1.68		3.59
D_2 : 21st October	1.16	1.97	2.69	4.38	4.54	4.55	4.23	3.51	3.45	3.21	2.76	1.60	3.64
D_3: 31st October	1.59	2.34	3.08	3.94	4.75	5.08	4.60	2.34	1.92	1.72	1.58	2.15	3.70
D_4 : 10th November	1.70	3.12	5.17	5.35	5.90	4.79	3.89	3.50	3.42	2.09			4.61
D_5 : 20th November	2.29	2.61	4.66	5.23	5.76	4.90	3.95	3.48	2.42	1.97			4.49
S. Em.±	0.03	0.05	0.09	0.12	0.14								0.07
C.D. at 5 %	0.10	0.14	0.27	0.38	0.43								0.22
C. V. (%)	9.15	7.64	9.53	10.59	10.80								7.18
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	1.20	1.43	1.57	1.18	1.54	1.70	2.67	2.09	2.68	2.20	2.01	1.88	1.85
C_2 : 20 Days intervals	1.42	1.96	2.42	3.54	4.04	4.08	4.35	4.28	3.34				3.28
C_3 : 25 Days intervals	1.49	2.48	3.60	5.08	6.40	6.44	6.54	5.49					4.51
C_4: 30 Days intervals	1.68	3.82	7.23	8.76	8.56	8.88							6.38
S. Em.±	0.02	0.04	0.08	0.11	0.12								0.05
C.D. at 5 %	0.05	0.11	0.22	0.30	0.33								0.15
Interaction (D x C)	NS	NS	NS	NS	SIG								SIG
C. V. (%)	6.20	7.07	9.24	10.08	10.04								6.13

Note: Cutting interval start after common cut at 55 days after sowing

Table 4: Dry forage yield per plant of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Dry forage yield plant^{-1} (g)												
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	0.16	0.77	1.01	1.45	1.76	1.59	1.37	1.25	0.93	0.71			1.26
D_2 : 21st October	0.39	0.67	0.81	1.46	1.86	1.60	1.43	1.27	0.98	0.96	0.60	0.58	1.27
D_3: 31st October	0.52	0.77	1.30	1.60	1.61	1.62	1.47	0.91	0.68	0.58	0.93	0.77	1.32
D_4 : 10th November	0.60	1.06	1.47	1.68	1.89	1.50	1.23	1.14	0.90	0.73	0.56		1.45
D_5 : 20th November	0.76	0.88	1.24	1.49	1.72	1.61	1.36	1.19	0.95	0.83			1.36
S. Em.±	0.01	0.03	0.05	0.04	0.05								0.03
C.D. at 5 %	0.03	0.09	0.14	0.13	0.17								0.10
C. V. (%)	8.98	14.50	15.84	11.12	12.44								9.23
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	0.40	0.49	0.42	0.47	0.49	0.64	0.87	0.74	0.84	0.76	0.69	0.68	0.62
C_2 : 20 Days intervals	0.47	0.66	0.72	1.08	1.16	1.55	1.44	1.54	1.06				1.08
C_3 : 25 Days intervals	0.53	0.86	1.35	1.60	2.17	2.07	2.12	1.74					1.51
C_4: 30 Days intervals	0.55	1.32	2.17	3.00	3.23	2.65							2.12
S. Em.±	0.01	0.02	0.03	0.02	0.03								0.02
C.D. at 5 %	0.03	0.05	0.08	0.07	0.09								0.07
Interaction (D x C)	NS	NS	NS	NS	NS								SIG
C. V. (%)	8.21	8.48	10.53	7.11	7.84								8.09

Note: Cutting interval start after common cut at 55 days after sowing

Table 5: Green forage yield of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Green forage yield (q ha^{-1})												
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			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	3.50	3.52	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	16.54	13.89	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	8.16		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. at 5 %	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. at 5 %	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

Note: Cutting interval start after common cut at 55 days after sowing

Table 5.1: Green forage yield (q ha^{-1}) of Lucerne crop as influenced by interaction effect of sowing date and cutting intervals at first cut

Date of sowing (D)	Cutting intervals (C)			
	C_1	C_2	C_3	C_4
D_1	4.15	10.31	11.52	22.55
D_2	13.97	14.50	16.79	21.66
D_3	14.75	22.35	42.20	50.25
D_4	25.26	37.43	42.39	77.87
D_5	22.74	44.29	48.76	52.01
S. Em. ±	1.11			
C.D.at 5 %	3.17			
C. V. (%)	7.49			

Table 5.2: Green forage yield (q ha^{-1}) of Lucerne crop as influenced by interaction effect of sowing date and cutting intervals at second cut

Date of sowing (D)	Cutting intervals (C)			
	C_1	C_2	C_3	C_4
D_1	5.51	18.12	22.64	54.58
D_2	15.45	39.86	52.62	54.81
D_3	21.35	32.09	50.00	72.75
D_4	28.33	38.38	65.46	106.44
D_5	16.37	67.28	71.84	113.33
S. Em. ±	2.05			
C.D.at 5 %	5.84			
C. V. (%)	8.66			

Table 5.3: Green forage yield (q ha^{-1}) of Lucerne crop as influenced by interaction effect of sowing date and cutting intervals at third cut

Date of sowing (D)	Cutting intervals (C)			
	C_1	C_2	C_3	C_4
D_1	17.53	44.09	53.20	96.75
D_2	22.69	27.79	44.91	90.82
D_3	21.82	52.98	54.46	68.55
D_4	36.37	55.32	76.39	110.53
D_5	23.06	46.30	61.11	111.55
S. Em. ±	2.16			
C.D.at 5 %	6.17			
C. V. (%)	7.77			

Table 5.4: Green forage yield (q ha^{-1}) of Lucerne crop as influenced by interaction effect of sowing date and cutting intervals at fourth cut

Date of sowing (D)	Cutting intervals (C)			
	C_1	C_2	C_3	C_4
D_1	16.54	27.98	56.16	113.60
D_2	17.92	42.50	47.25	87.31
D_3	23.27	52.09	60.19	72.40
D_4	29.66	46.36	73.83	132.11
D_5	23.18	44.65	51.16	113.05
S. Em. ±	2.16			
C.D.at 5 %	6.16			
C. V. (%)	7.65			

Table 5.5: Total green forage yield (q ha^{-1}) of Lucerne crop as influenced by interaction effect of date of sowing and cutting intervals

Date of sowing (D)	Cutting intervals (C)			
	C_1	C_2	C_3	C_4
D_1	135.41	200.00	274.90	368.95
D_2	216.08	255.66	267.29	363.80
D_3	203.37	303.86	352.05	358.36
D_4	231.46	334.06	355.29	454.32
D_5	198.62	301.41	301.15	418.52
S. Em. ±	10.01			
C.D.at 5 %	28.51			
C. V. (%)	6.79			

Table 6: Crude protein content of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Crude protein content (%)												
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	21.0	22.3	23.3	22.3	21.5	20.3	19.2	18.4	18.4	17.9	17.8		20.9
D_2 : 21st October	22.4	23.2	22.2	21.1	21.2	20.0	20.7	18.9	20.8	21.4	21.0	17.4	21.3
D_3: 31st October	22.5	21.8	24.6	25.2	21.1	20.3	20.3	18.7	17.9	17.4	17.3	19.0	21.8
D_4 : 10th November	20.1	20.4	21.5	20.8	20.2	21.0	19.5	18.0	18.5	18.9			20.3
D_5 : 20th November	19.4	22.5	22.2	21.0	20.8	20.4	21.3	19.1	21.6	19.4			21.0
S. Em.±	0.55	0.32	0.92	0.72	0.68								0.32
C.D. at 5 %	NS	NS	NS	NS	NS								NS
C. V. (%)	10.39	5.72	11.13	12.62	12.65								5.93
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	21.1	22.0	23.0	22.0	20.6	19.8	19.4	18.0	19.2	19.0	18.7	18.2	20.2
C_2 : 20 Days intervals	21.1	22.4	22.9	22.6	21.4	20.6	20.4	18.9	20.2				21.3
C_3 : 25 Days intervals	21.3	22.9	23.9	23.0	22.1	21.4	21.0	19.7					22.2
C_4: 30 Days intervals	20.7	20.9	21.3	20.7	19.8	19.2							20.5
S. Em.±	0.19	0.25	0.15	0.18	0.16								0.25
C.D. at 5 %	NS	NS	NS	NS	NS								NS
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	4.05	4.99	3.00	3.56	3.50								5.22

Note: Cutting interval start after common cut at 55 days after sowing

Table 7: Protein yield of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Protein yield (kg ha^{-1})												
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	10.13	44.56	100.05	198.61	191.32	196.16	92.06	70.86	43.04	20.78			896
D_2 : 21st October	39.66	60.43	138.47	165.36	203.68	196.05	143.67	86.29	83.95	70.04	12.44	11.46	1044
D_3: 31st October	88.19	135.86	159.19	208.56	221.84	249.30	137.89	96.30	32.02	30.63	68.09	50.21	1235
D_4 : 10th November	68.04	153.55	235.15	279.69	287.74	231.48	115.81	91.67	31.50	23.93	28.29		1315
D_5 : 20th November	88.93	154.56	286.74	261.03	246.36	136.73	115.91	72.57	77.89	53.64			1249
S. Em.±	1.25	2.78	4.64	5.82	6.14								27.65
C.D. at 5 %	3.87	8.59	14.31	17.95	18.94								85.21
C. V. (%)	8.52	10.16	10.10	10.47	10.68								9.64
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	55.78	56.24	50.29	89.19	76.54	114.52	75.05	59.19	48.13	39.80	36.28	30.84	699
C_2 : 20 Days intervals	63.12	88.89	142.18	159.69	174.34	167.45	130.49	107.28	77.38				1042
C_3 : 25 Days intervals	56.62	132.83	217.50	255.69	250.93	255.55	185.54	108.45					1302
C_4: 30 Days intervals	60.45	161.21	325.08	386.02	418.95	327.66							1548
S. Em.±	0.97	1.72	3.16	3.37	3.72								16.18
C.D. at 5 %	2.76	4.90	9.01	9.60	10.59								46.08
Interaction (D x C)	SIG	SIG	SIG	SIG	SIG								SIG
C. V. (%)	7.37	7.01	7.70	6.77	7.23								6.30

Note: Cutting interval start after common cut at 55 days after sowing

Table 8: Crude fiber content of Lucerne crop as influenced by date of sowing and cutting intervals

Treatments	Crude fiber content (%)												
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	28.0	28.1	29.8	30.9	31.5	32.2	32.9	34.4	34.3	35.4			31.6
D_2 : 21st October	28.8	28.2	29.4	29.3	30.7	33.0	33.4	33.4	33.9	33.6	36.6	37.0	31.3
D_3: 31st October	32.9	31.5	32.1	32.2	33.1	32.8	32.6	32.5	32.7	33.5	35.2	36.1	32.8
D_4 : 10th November	31.4	27.3	29.4	29.8	30.1	29.4	30.8	31.6	35.5	35.9	34.4		30.5
D_5 : 20th November	26.1	28.6	28.1	28.9	26.6	26.6	27.9	29.3	31.0	32.2			28.2
S. Em.±	0.67	0.86	0.81	0.48	0.43								0.55
C.D. at 5 %	NS	NS	NS	NS	NS								NS
C. V. (%)	8.82	11.72	10.89	6.29	5.59								7.26
Sub plot : Cutting Intervals (C)													
C_1 : 15 Days intervals	27.7	26.4	27.2	27.4	28.2	29.1	30.6	31.5	33.2	34.1	35.4	36.5	30.0
C_2 : 20 Days intervals	28.7	27.6	29.0	29.1	29.5	30.3	31.7	33.4	34.8				29.9
C_3 : 25 Days intervals	29.7	29.7	30.6	31.6	31.0	31.8	34.2	36.5					31.1
C_4: 30 Days intervals	31.7	31.3	32.2	32.9	33.0	34.8							32.4
S. Em.±	0.25	0.28	0.32	0.22	0.18								0.26
C.D. at 5 %	NS	NS	NS	NS	NS								NS
Interaction (D x C)	NS	NS	NS	NS	NS								NS
C. V. (%)	3.67	4.25	4.71	3.28	2.62								3.89

Note: Cutting interval start after common cut at 55 days after sowing

Table 9: Available nitrogen, phosphorus and potash of the soil after harvest of Lucerne crop as influenced by date of sowing and cutting intervals

Treatment	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potash (kg ha^{-1})
Main plot : Date of Sowing (D)			
D_1 : 11th October	165.5	24.94	274.25
D_2 : 21st October	163.8	24.06	271.31
D_3: 31st October	160.3	22.63	269.06
D_4 : 10th November	148.2	21.96	268.63
D_5 : 20th November	148.6	22.14	269.13
S. Em.±	4.82	0.74	3.85
C.D.at 5 %	NS	NS	NS
C. V. (%)	12.28	12.74	5.69
Sub plot : Cutting Intervals (C)			
C_1 : 15 Days intervals	153.8	22.77	268.60
C_2 : 20 Days intervals	157.4	22.94	269.75
C_3 : 25 Days intervals	157.9	23.04	270.65
C_4: 30 Days intervals	159.9	23.84	272.90
S. Em.±	2.49	0.57	3.16
C.D.at 5 %	NS	NS	NS
Interaction (D x C)	NS	NS	NS
C. V. (%)	7.09	10.95	5.24

Conclusion

On the basis of one year experimentation, it can be concluded that maximum yield attributing characters yield, green forage yield and protein yield 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 agroclimatic conditions.

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