

## LUCERNE GENOTYPES PERFORMANCE FOR FODDER YIELD AND ITS ATTRIBUTES WITH QUALITY PARAMETERS AT HISAR AND ALL-INDIA LEVEL

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### SUMMARY

A varietal evaluation trial on lucerne (perennial) (*Medicago sativa*) was conducted at nine locations under three different agro-ecological zones viz., North-western (NW), Central (CT) and South (SO) Zones of India during 2007-08 to 2009-10. Three entries of lucerne (BAIF Lucerne-1, Anand-21 and Anand-22) were evaluated along with two national checks viz., RL-88 and Anand-2 for assessing their fodder yield potential and quality parameters at CCSHAU, Hisar. The same set of entries was also tested at eight different locations distributed in the three zones for fodder trial. The highest green fodder yield pooled over three years (1067.3 q/ha) was recorded at Coimbatore in south zone followed by Rahuri (996.4 q/ha) and Urulikanchan (967.1 q/ha) in the central zone, whereas the highest pooled dry matter yield (216.7 q/ha) was recorded at Coimbatore in south zone followed by Rahuri (203.3 q/ha) and Urulikanchan (182.8 q/ha) in the central zone. Highest per day production of green fodder pooled over three years was recorded at Rahuri and Hisar (GFY, q/ha/day – 4.8 and 3.0, respectively) followed by Ludhiana (2.6 q/ha/day). The genotype BAIF Lucerne-1 gave a slight increase of 3.1 per cent for green fodder yield and 2.0 per cent increase for dry matter yield as compared to the best check RL-88 over three years. The highest crude protein yield pooled over three years was obtained at Coimbatore (40.9 q/ha) followed by Rahuri (35.6 q/ha) and Urulikanchan (28.8 q/ha). Lucerne genotype Anand-22 gave high *in vitro* dry matter digestibility per cent (IVDMD%) pooled over two years (68.2%) as compared to the best check Anand-2 (67.7%). The lucerne genotype BAIF Lucerne-1 gave NDF per cent (43.8%) as compared to the best check RL-88 (45.2%), whereas BAIF Lucerne-1 gave ADF per cent (33.5%) as compared to the best check RL-88 (38.3%). Genotype BAIF Lucerne-1 gave high DDM yield (81.5 q/ha) which was comparable to the best check RL-88 (80.5 q/ha). Data revealed that southern zone represented by Hyderabad, Coimbatore and Mandya gave higher green fodder and dry matter yields, plant height and production efficiency thereby indicating that climatic and edaphic conditions are very suitable for lucerne as compared to Central Zone and North West Zone.

**Key words :** Lucerne, alfalfa, green fodder, dry matter, quality parameters

Lucerne is one of the most important cultivated fodder crops in the world. Lucerne was introduced in India from north-west around 1900. It has now become very popular forage crop. In India, lucerne is cultivated in about one mha mostly in irrigated areas of Punjab, Haryana, Uttar Pradesh, Gujarat, Maharashtra and Tamil Nadu. Lucerne, also known as alfa-alfa, is a perennial plant and is capable of providing green fodder continuously for 3-4 years from the one sowing.

Adequately termed also as “Queen of Forages” lucerne is highly nutritious and palatable with green fodder containing about 16-25 per cent crude protein and 20-30 per cent fibre. It is a deep rooted perennial forage legume that can extract water from deep zones of the soil adapted to a wide range of climates. Hence, it can be better utilized in those areas where water supply is not adequate enough for berseem as it requires a lot of water. There is a chronic shortage of green as well as

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dry fodder throughout the country. Increasing fodder production is one such possible recourse as lucerne supplies green fodder for a longer period (November-June) in comparison to berseem (December-April). Thus, adopting perennial crops which are multicut in nature can also resolve the problem to some extent.

## MATERIALS AND METHODS

Three entries of lucerne (perennial) (BAIF Lucerne-1, Anand- 21 and Anand-22) contributed by various Coordinating Centers under AICRP (FC) were evaluated along with two national checks viz., checks RL-88 and Anand-2 for assessing their fodder yield potential in trials during **rabi** 2007-08 to **rabi** 2009-10 at CCSHAU, Hisar. The same set of entries was also tested at nine different locations distributed in the three different agro-ecological zones viz., North-western (NW), Central (CT) and South (SO) Zones of India during this period for fodder trial (Anonymous, 2008, 2009, 2010).

The experiment was sown at the research farm area of Forage Section, CCSHAU, Hisar in **rabi** season during October, 2007 with three replications. The plot size was 4.0 x 3.0 m, with row to row distance of 30 cm. The data of green fodder yield, plant height and leaf : stem ratio were recorded at 50 per cent flowering. Dry matter yield was recorded after drying the green fodder samples; production efficiency was calculated by dividing the green fodder or dry matter yield by number of days to harvesting. The samples of dry fodder were analyzed for quality parameters using standard protocols. Total nitrogen in the samples was estimated by conventional Micro-kjeldahl's method and nitrogen content was converted to crude protein per cent by multiplication of a factor 6.25. *In vitro* dry matter digestibility was determined by the method of Tilley and Terry (1963) as modified by Barnes *et al.* (1971). Structural carbohydrates viz., neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined by the method of Goering and Van-Soest (1970). The data so obtained were statistically analyzed. The results of the experiment are presented in Tables 1, 2, 3 and 4.

## RESULTS AND DISCUSSION

### Green Fodder Yield (GFY)

At Hisar, lucerne genotype BAIF Lucerne-1

(Table 1) gave highest pooled green fodder yield (GFY 712.6 q/ha) as compared to the best check RL-88 (639.5 q/ha). At All-India level also, BAIF Lucerne-1 (Table 1) gave highest pooled green fodder yield (GFY 783.1 q/ha) as compared to the best check RL-88 (759.8 q/ha). The mean GFY at Hisar (599.0 q/ha) was lower than the mean GFY at All-India level (676.6 q/ha).

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the highest green fodder yield pooled over three years (1067.3 q/ha) was recorded at Coimbatore in south zone followed by Rahuri (996.4 q/ha) and Urulikanchan (967.1 q/ha) in the central zone. The genotype BAIF Lucerne-1 gave a slight increase of 3.1 per cent for green fodder yield and 2.0 per cent increase for dry matter yield as compared to best check RL-88 over three years. The highest green fodder yield was due to characters like plant height, regeneration capacity and leaf : stem ratio. Similar results were also reported by Yunus *et al.* (2000) and Shashikanth *et al.* (2013).

### Dry Matter Yield (DMY)

At Hisar, lucerne genotype BAIF Lucerne-1 (Table 1) gave significantly high dry matter yield pooled over three years (DMY 146.9 q/ha) as compared to the best check RL-88 (130.9 q/ha). At All-India level also, BAIF Lucerne-1 (Table 1) gave highest pooled dry matter yield (DMY 162.7 q/ha) as compared to the best check RL-88 (159.5 q/ha). The mean DMY at Hisar (125.1 q/ha) was also lower than the mean DMY at All-India level (141.4 q/ha).

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the highest dry matter yield pooled over three years (216.7 q/ha) was recorded at Coimbatore in south zone followed by Rahuri (203.3 q/ha) and Urulikanchan (182.8 q/ha) in the central zone. The highest dry matter yield was due to characters like plant height and leaf : stem ratio. Similar results were also reported by Wandera *et al.* (2000) and Vanlauwe (2004).

### Production Efficiency

At Hisar, lucerne genotype BAIF Lucerne-1 and Anand 22 (Table 1) gave highest per day production of green fodder pooled over three years (3.44 and 3.07 q/ha/day, respectively) as compared to the best check RL-88 (3.03 q/ha/day). However, at All-India level, the

TABLE 1  
Performance of lucerne genotypes for fodder yield during **rabi** 2007-08 to 2009-10 at CCSHAU, Hisar

| Genotypes      | GFY (q/ha) |         |         |        |           |         |         |        | DMY (q/ha) |         |         |        |           |         |         |        |
|----------------|------------|---------|---------|--------|-----------|---------|---------|--------|------------|---------|---------|--------|-----------|---------|---------|--------|
|                | Hisar      |         |         |        | All-India |         |         |        | Hisar      |         |         |        | All-India |         |         |        |
|                | 2007-08    | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled | 2007-08    | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled |
| Anand-2 (C)    | 411.7      | 789.3   | 335.3   | 512.1  | 460.9     | 904.1   | 535.4   | 633.5  | 94.4       | 157.1   | 74.3    | 108.6  | 100.8     | 184.6   | 115.4   | 133.6  |
| RL-88 (C)      | 379.4      | 916.3   | 622.7   | 639.5  | 415.5     | 1068.3  | 795.7   | 759.8  | 75.1       | 180.0   | 137.7   | 130.9  | 93.1      | 218.2   | 167.2   | 159.5  |
| BAIF Lucerne-1 | 469.6      | 1047.5  | 620.6   | 712.6  | 447.2     | 1097.2  | 804.8   | 783.1  | 98.4       | 202.7   | 139.7   | 146.9  | 97.6      | 223.1   | 167.4   | 162.7  |
| Anand-21       | 514.0      | 810.10  | 289.5   | 537.9  | 457.5     | 846.60  | 465.9   | 590.0  | 104.5      | 163.9   | 64.6    | 111.0  | 97.8      | 170.9   | 95.7    | 121.5  |
| Anand-22       | 554.4      | 876.7   | 347.8   | 593.0  | 460.4     | 900.6   | 488.6   | 616.5  | 123.6      | 180.1   | 80.7    | 128.1  | 98.7      | 186.0   | 105.0   | 129.9  |
| Mean           | 465.8      | 888.0   | 443.2   | 599.0  | 448.3     | 963.4   | 618.1   | 676.6  | 99.2       | 176.8   | 99.4    | 125.1  | 97.6      | 196.6   | 130.1   | 141.4  |
| C. D. (P=0.05) | 38.0       | NS      | 29.7    | 33.9   |           | 8.3     | NS      | 6.7    | 7.5        |         |         |        |           |         |         |        |
| C. V. (%)      | 5.2        | 3.6     | 4.3     | 4.4    |           | 5.4     | 3.4     | 4.3    | 4.4        |         |         |        |           |         |         |        |

  

| Genotypes      | GFY (q/ha/day) |         |         |        |           |         |         |        | DMY (q/ha/day) |         |         |        |           |         |         |        |
|----------------|----------------|---------|---------|--------|-----------|---------|---------|--------|----------------|---------|---------|--------|-----------|---------|---------|--------|
|                | Hisar          |         |         |        | All-India |         |         |        | Hisar          |         |         |        | All-India |         |         |        |
|                | 2007-08        | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled | 2007-08        | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled |
| Anand-2 (C)    | 3.24           | 3.07    | 1.37    | 2.56   | 2.20      | 3.16    | 1.11    | 2.16   | -              | -       | -       | -      | 0.42      | 0.63    | 0.65    | 0.57   |
| RL-88 (C)      | 2.99           | 3.57    | 2.54    | 3.03   | 1.94      | 3.93    | 2.31    | 2.73   | -              | -       | -       | -      | 0.38      | 0.82    | 0.45    | 0.55   |
| BAIF Lucerne-1 | 3.70           | 4.08    | 2.53    | 3.44   | 2.13      | 4.12    | 2.30    | 2.85   | -              | -       | -       | -      | 0.38      | 0.83    | 0.45    | 0.55   |
| Anand-21       | 4.05           | 3.15    | 1.18    | 2.79   | 2.23      | 2.81    | 1.05    | 2.03   | -              | -       | -       | -      | 0.37      | 0.52    | 0.21    | 0.37   |
| Anand-22       | 4.37           | 3.41    | 1.42    | 3.07   | 2.34      | 3.11    | 1.12    | 2.19   | -              | -       | -       | -      | 0.37      | 0.59    | 0.24    | 0.40   |

genotype BAIF Lucerne-1 (2.85 q/ha/day) was just at par with the national check RL-88 (2.73 q/ha/day). The mean GFY (q/ha/day) at Hisar (2.98) was slightly higher than the mean GFY (q/ha/day) at All-India level (2.39 q/ha/day).

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the highest per day production of green fodder pooled over three years was recorded at Rahuri and Hisar (GFY q/ha/day 4.8 and 3.0, respectively) followed by Ludhiana (2.6 q/ha/day).

Almost same trend was observed for per day production of dry matter (q/ha/day).

### Plant Height

At Hisar, all genotypes (Table 2) gave similarly tall plants pooled over three years (59.2-61.1 cm) of lucerne as compared to the best check Anand-2 (60.8 cm). At All-India level also the same trend was observed. The mean plant height at Hisar (60.1 cm) was slightly lower than the mean plant height at All-India level (62.1 cm).

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the tallest plants pooled

over three years (74.2 cm) were recorded at Urulikanchan followed by Rahuri (64.0 cm) and Mandya (60.7 cm). More height of the plants was mainly due to the high input intake by the lucerne plants. Similar reports were also reported by Zewdu *et al.* (2002), Tessema *et al.* (2003).

### Leaf : Stem Ratio

At Hisar, all the lucerne genotypes (Table 2) were at par for leaf : stem ratio (range 0.75-0.80) with the best check Anand 2 (0.80) pooled over three years. At All-India level BAIF Lucerne 1 gave slightly high leaf : stem ratio (0.97) which was at par with the best check Anand-2 (0.91). The mean leaf : stem ratio at Hisar (0.77) was much lower than the mean leaf : stem ratio at All-India level (0.91).

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the leaf : stem ratio (pooled over three years) of 1.30 recorded at Hyderabad followed by Urulikanchan (1.28) and Ludhiana (1.03). Leaf : stem ratio increased mainly due to increase in the foliage that had utilized the solar energy in the production of photosynthates ending in higher biomass production.

Similar results were reported by Gupta (1995) and Shashikanth *et al.* (2013).

### Forage Quality Parameters

The nutritive value or quality of forage (i. e. content of CP, NDF and extent of digestibility) is important for animal consumption and productivity (Abdalla *et al.*, 2007). Plant cell wall is an important source of energy for the ruminant. Its main components are structural carbohydrates i. e. neutral detergent fibre and acid detergent fibre. Digestibility of structural carbohydrates and amount of energy released depend largely on the degree of lignification of the tissue and tend to decline as plant age increases (Said *et al.*, 1979). Large amount of cell wall carbohydrates remains undigestible even with a relatively small amount of lignin. A strong negative correlation exists between lignin concentration and digestibility of tropical forages (Ford *et al.*, 1979).

### Crude Protein Yield (q/ha)

At Hisar, lucerne genotype BAIF Lucerne-1

(Table 2) gave high crude protein (26.0 q/ha) as compared to the best check RL-88 (23.3 q/ha). At All-India level also, both the genotypes showed the same trend (BAIF Lucerne-1 29.2 q/ha and RL-88-27.5 q/ha) for crude protein yield pooled over three years. The mean crude protein yield at Hisar (22.4 q/ha) was lower than the mean at All-India level (24.6 q/ha) for this character. Higher crude protein yields may be due to increased photosynthetic activities leading to higher cell division and elongation of the cells that resulted in accumulation of more photosynthates, leading to higher dry matter production which ultimately resulted in higher crude protein production. These results are also in line with the findings of Sood (1995) and Wandera *et al.* (2000).

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the highest crude protein yield pooled over three years was obtained at Coimbatore (40.9 q/ha) followed by Rahuri (35.6 q/ha) and Urulikanchan (28.8 q/ha).

### Crude Protein (%)

At Hisar, all the lucerne genotypes (Table 2) gave

TABLE 2

Performance of lucerne genotypes for morphological traits and the quality parameters during **rabi** 2007-08 to 2009-10 at CCSHAU, Hisar

| Genotypes      | Plant height (cm) |         |         |        |           |         |         |        | Leaf : Stem ratio |         |         |        |           |         |         |        |
|----------------|-------------------|---------|---------|--------|-----------|---------|---------|--------|-------------------|---------|---------|--------|-----------|---------|---------|--------|
|                | Hisar             |         |         |        | All-India |         |         |        | Hisar             |         |         |        | All-India |         |         |        |
|                | 2007-08           | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled | 2007-08           | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled |
| Anand-2 (C)    | 58.3              | 66.9    | 57.1    | 60.8   | 64.2      | 62.9    | 57.7    | 61.6   | 0.74              | 0.9     | 0.77    | 0.80   | 1.06      | 0.87    | 0.81    | 0.91   |
| RL-88 (C)      | 56.2              | 66.6    | 54.9    | 59.2   | 63.0      | 66.1    | 61.1    | 63.4   | 0.80              | 0.8     | 0.74    | 0.78   | 1.06      | 0.85    | 0.84    | 0.92   |
| BAIF Lucerne-1 | 58.1              | 66.2    | 55.5    | 59.9   | 61.7      | 65.9    | 64.0    | 63.9   | 0.76              | 0.8     | 0.75    | 0.77   | 1.16      | 0.86    | 0.89    | 0.97   |
| Anand-21       | 57.1              | 65.8    | 56.5    | 59.8   | 63.2      | 60.9    | 56.9    | 60.3   | 0.72              | 0.8     | 0.76    | 0.76   | 1.01      | 0.82    | 0.91    | 0.91   |
| Anand-22       | 59.8              | 67.2    | 56.2    | 61.1   | 63.8      | 61.8    | 57.9    | 61.2   | 0.68              | 0.8     | 0.77    | 0.75   | 0.98      | 0.9     | 0.86    | 0.91   |
| Mean           | 57.9              | 66.5    | 56.0    | 60.1   | 63.2      | 63.5    | 59.5    | 62.1   | 0.74              | 0.9     | 0.77    | 0.80   | 1.06      | 0.87    | 0.81    | 0.91   |

  

| Genotypes      | Crude protein yield (q/ha) |         |         |        |           |         |         |        | Crude protein (%) |         |         |        |           |         |         |        |
|----------------|----------------------------|---------|---------|--------|-----------|---------|---------|--------|-------------------|---------|---------|--------|-----------|---------|---------|--------|
|                | Hisar                      |         |         |        | All-India |         |         |        | Hisar             |         |         |        | All-India |         |         |        |
|                | 2007-08                    | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled | 2007-08           | 2008-09 | 2009-10 | Pooled | 2007-08   | 2008-09 | 2009-10 | Pooled |
| Anand-2 (C)    | 19.1                       | 24.8    | 15.6    | 19.8   | 21.4      | 29.3    | 15.9    | 22.2   | 21.4              | 20.5    | 21.6    | 21.2   | 19.6      | 18.5    | 18.9    | 19.0   |
| RL-88 (C)      | 15.4                       | 26.3    | 28.3    | 23.3   | 19.5      | 34.1    | 28.8    | 27.5   | 22.1              | 20.6    | 21.0    | 21.2   | 19.7      | 18.3    | 19.3    | 19.1   |
| BAIF Lucerne-1 | 19.7                       | 29.5    | 28.9    | 26.0   | 20.7      | 36.0    | 30.9    | 29.2   | 21.0              | 20.8    | 20.5    | 20.8   | 19.7      | 18.8    | 18.8    | 19.1   |
| Anand-21       | 19.7                       | 26.5    | 13.3    | 19.8   | 20.7      | 27.5    | 15.0    | 21.1   | 20.4              | 20.4    | 20.7    | 20.5   | 19.6      | 19.0    | 19.5    | 19.4   |
| Anand-22       | 24.9                       | 26.8    | 16.6    | 22.8   | 22.0      | 30.4    | 16.5    | 23.0   | 21.0              | 19.3    | 19.8    | 20.0   | 20.5      | 19.0    | 20.0    | 19.8   |
| Mean           | 19.8                       | 26.8    | 20.5    | 22.4   | 20.9      | 31.5    | 21.4    | 24.6   | 21.2              | 20.3    | 20.9    | 20.8   | 19.8      | 18.7    | 19.3    | 19.3   |

TABLE 3  
Performance of Lucerne genotypes for quality parameters during **rabi** 2007-08 to 2009-10 at CCSHAU, Hisar

| Genotypes      | IVDMD (%) |         |        | NDF (%) | ADF (%) | DDM (q/ha) |
|----------------|-----------|---------|--------|---------|---------|------------|
|                | 2008-09   | 2009-10 | Pooled | 2008-09 | 2008-09 | 2009-10    |
| Anand-2 (C)    | 67.3      | 68.0    | 67.7   | 46.0    | 39.3    | 43.9       |
| RL-88 (C)      | 59.4      | 67.7    | 63.6   | 45.2    | 38.3    | 80.5       |
| BAIF Lucerne-1 | 62.0      | 67.3    | 64.7   | 43.8    | 33.5    | 81.5       |
| Anand-21       | 66.4      | 66.4    | 66.4   | 45.2    | 36.3    | 37.8       |
| Anand-22       | 70.2      | 66.2    | 68.2   | 45.4    | 34.2    | 46.7       |
| Mean           | 65.1      | 67.1    | 66.1   | 45.1    | 36.3    | 58.1       |

almost similar crude protein percent pooled over three years (range 20.0-21.2%) as compared to both checks (21.2%). At All-India level Anand-22 and Anand-21 gave crude protein (19.8 and 19.4%) which was at par with the best check RL-88 (19.1%). The mean crude protein per cent at Hisar (20.8%) was slightly higher than the mean at All-India level (19.3%) for this character.

Location-wise performance of the varietal trial on lucerne (Table 4) revealed that the highest crude protein per cent pooled over three years was obtained at Ludhiana (21.6%) followed by Hisar (20.7%) and Hyderabad (20.2%). Higher crude protein per cent might be due to more nitrogen accumulation and its conversion to the protein in the particular genotype.

#### ***In vitro* Dry Matter Digestibility (IVDMD%)**

At Hisar, the lucerne genotype Anand-22 (Table 3) gave IVDMD per cent pooled over two years (68.2%) as compared to the best check Anand-2 (67.7%). Higher IVDMD per cent was desirable and it was mainly due to less lignin content in Anand-22 (34.2%) than the best check Anand-2 (39.3%) as observed in ADF per cent. Moreover, IVDMD primarily depends upon the concentration of cellulose and hemicelluloses, which in turn is influenced by the degree of lignification, silicification (Van-Soest and Jones, 1968) and fibre components (Luthra *et al.*, 1988). A strong negative correlation existed between lignin concentration and digestibility of tropical forages (Ford *et al.*, 1979).

#### **Neutral Detergent Fiber (NDF%)**

At Hisar, the lucerne genotype BAIF Lucerne-1 (Table 3) gave NDF per cent (43.8%) as compared to the best check RL-88 (45.2%). Lower NDF per cent was desirable and it might be due to low hemicellulose

and less lignifications of the tissues. Further, high leaf to stem ratio also contributes to low NDF content as leaves are generally less lignified than stem.

#### **Acid Detergent Fiber (ADF%)**

At Hisar, the lucerne genotype BAIF Lucerne-1 (Table 3) gave ADF per cent (33.5%) as compared to the best check RL-88 (38.3%). Lower ADF per cent was desirable and it might be due to low lignin content.

#### **Dry Digestible Matter (DDM q/ha)**

At Hisar, the lucerne genotype BAIF Lucerne-1 (Table 3) gave high DDM yield (81.5 q/ha) which was comparable to the best check RL-88 (80.5 q/ha). Higher DDM was desirable and it might be due to high IVDMD (64.7%) and dry matter yield (146.9 q/ha) in BAIF Lucerne-1 genotype.

Multipurpose fodder trees that had NDF and ADF content below 30 and 40 per cent, respectively, were believed to have high digestibility (Norton, 1994; Kaitho *et al.*, 1996; Solomon, 2002). The NDF, ADF and CP contents of lucerne were comparable to findings of Canbolat *et al.* (2006) and Kiraz (2011). NDF digestion can be attributed to lignin which in association with cell walls limits microbial degradation. In addition, lignin, being a component of the cell wall, influences directly its digestibility and hence forage digestibility (Jung and Allen, 1995).

A close look at the data reveals that Southern Zone represented by Hyderabad, Coimbatore and Mandya gave higher green fodder and dry matter yields, plant height and production efficiency thereby indicating that climatic and edaphic conditions are very suitable for lucerne as compared to Central Zone and North West Zone.

TABLE 4  
Location-wise performance of lucerne varietal trial for fodder yield during **rabi** 2007-08 to 2009-10

| S. Locations across<br>No. the country | GFY (q/ha) |         |         |        | DMY (q/ha) |         |         |        | GFY (q/ha/day) |         |         |        | DMY (q/ha/day) |         |         |        |
|--|------------|---------|---------|--------|------------|---------|---------|--------|----------------|---------|---------|--------|----------------|---------|---------|--------|
|  | 2007-08    | 2008-09 | 2009-10 | Pooled | 2007-08    | 2008-09 | 2009-10 | Pooled | 2007-08        | 2008-09 | 2009-10 | Pooled | 2007-08        | 2008-09 | 2009-10 | Pooled |
| 1. Ludhiana                            | 403.2      | 740.5   | 333.5   | 492.4  | 75.7       | 149.9   | 54.6    | 93.4   | 2.00           | 4.11    | 1.56    | 2.6    | 0.37           | 0.83    | 0.42    | 0.5    |
| 2. Bikaner                             | 195.8      | 503.1   | 698.5   | 465.8  | 44.3       | 148.6   | 192.8   | 128.6  | 1.04           | -       | 1.36    | 1.2    | 0.24           | -       | 0.38    | 0.3    |
| 3. Hisar                               | 465.8      | 888.0   | 443.2   | 599.0  | 99.2       | 176.8   | 99.4    | 125.1  | 3.67           | 3.46    | 1.81    | 3.0    | -              | -       | -       | -      |
| 4. Rahuri                              | 723.8      | 1419.2  | 846.1   | 996.4  | 156.1      | 275.3   | 178.4   | 203.3  | -              | 4.75    | -       | 4.8    | -              | 0.92    | -       | 0.9    |
| 5. Urulikanchan                        | 764.1      | 1170.0  | -       | 967.1  | 158.7      | 206.8   | -       | 182.8  | -              | -       | -       | -      | -              | -       | -       | -      |
| 6. Anand                               | 576.6      | 160.2   | -       | 368.4  | 131.6      | -       | -       | 131.6  | 2.84           | 1.38    | -       | 2.1    | 0.65           | -       | -       | 0.7    |
| 7. Hyderabad                           | 156.2      | -       | -       | 156.2  | 32.5       | -       | -       | 32.5   | 1.30           | -       | -       | 1.3    | 0.27           | -       | -       | 0.3    |
| 8. Coimbatore                          | 547.2      | 1612.1  | 1042.6  | 1067.3 | 108.8      | 338.1   | 203.3   | 216.7  | -              | -       | -       | -      | -              | -       | -       | -      |
| 9. Mandya                              | 202.1      | 410.6   | 344.7   | 319.1  | 71.4       | 80.6    | 52.4    | 68.1   | -              | -       | -       | -      | -              | -       | -       | -      |
| Average                                | 448.3      | 963.4   | 618.1   | 676.6  | 97.6       | 196.6   | 130.1   | 141.4  | 2.17           | 3.42    | 1.58    | 2.4    | 0.38           | 0.68    | 0.40    | 0.5    |

  

| S. Locations across<br>No. the country | Plant height (cm) |         |         |        | Leaf : stem ratio |         |         |        | Crude protein yield (q/ha) |         |         |        | Crude protein (%) |         |         |        |
|--|-------------------|---------|---------|--------|-------------------|---------|---------|--------|----------------------------|---------|---------|--------|-------------------|---------|---------|--------|
|  | 2007-08           | 2008-09 | 2009-10 | Pooled | 2007-08           | 2008-09 | 2009-10 | Pooled | 2007-08                    | 2008-09 | 2009-10 | Pooled | 2007-08           | 2008-09 | 2009-10 | Pooled |
| 1. Ludhiana                            | 43.5              | 64.1    | 62.7    | 56.8   | 1.46              | 0.72    | 0.90    | 1.03   | 17.3                       | 31.8    | 11.5    | 20.2   | 22.7              | 21.2    | 20.9    | 21.6   |
| 2. Bikaner                             | 52.0              | 63.0    | 57.5    | 57.5   | 0.89              | -       | 0.92    | 0.91   | -                          | 26.5    | -       | 26.5   | -                 | 18.1    | -       | 18.1   |
| 3. Hisar                               | 57.9              | 66.5    | 56.0    | 60.1   | 0.74              | 0.82    | 0.76    | 0.77   | 19.8                       | 26.8    | 20.5    | 22.4   | 21.2              | 20.3    | 20.6    | 20.7   |
| 4. Rahuri                              | 67.9              | 63.0    | 61.2    | 64.0   | 0.84              | 0.90    | 0.70    | 0.81   | 23.7                       | 50.1    | 33.0    | 35.6   | 15.2              | 18.2    | 18.5    | 17.3   |
| 5. Urulikanchan                        | 77.9              | 75.9    | 68.8    | 74.2   | 1.28              | 1.31    | 1.25    | 1.28   | 32.3                       | 37.1    | 17.1    | 28.8   | 20.4              | 17.9    | 19.1    | 19.1   |
| 6. Anand                               | 59.9              | 58.4    | -       | 59.2   | -                 | -       | -       | -      | 25.2                       | 5.3     | -       | 15.3   | 19.5              | 16.5    | -       | 18.0   |
| 7. Hyderabad                           | 49.8              | -       | -       | 49.8   | 1.30              | -       | -       | 1.30   | 6.5                        | -       | -       | 6.5    | 20.2              | -       | -       | 20.2   |
| 8. Coimbatore                          | -                 | -       | -       | -      | -                 | -       | -       | -      | 21.2                       | 63.6    | 37.9    | 40.9   | 19.5              | 18.8    | -       | 19.2   |
| 9. Mandya                              | 77.6              | 53.7    | 50.9    | 60.7   | 0.86              | 0.55    | 0.64    | 0.68   | -                          | 10.5    | 8.5     | 9.5    | -                 | -       | 17.4    | 17.4   |
| Average                                | 63.2              | 63.5    | 59.5    | 62.1   | 1.05              | 0.86    | 0.86    | 0.92   | 20.9                       | 31.5    | 21.4    | 24.6   | 19.8              | 18.7    | 19.3    | 19.3   |

Locations : 1-3 : North West Zone; 4-6 : Central Zone and 7-9 : South Zone.

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