*Indian Journal of Agronomy* **50** (3) : 181–183 (September 2005)

# Performance of jujube (*Ziziphus mauritiana*)-based hortipasture system in relation to pruning intensities and grass–legume associations under rainfed conditions

**S.N. RAM, SUNIL KUMAR AND M.M. ROY**

*Grassland and Silvopasture Management Division, Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh 284 003*

Received: March 2004

## ABSTRACT

An experiment was conducted during 2001–02 and 2002–03 on sandy-loam soil to study the productivity of ber or jujube (*Ziziphus mauritiana* Lamk.)-based hortipasture system in relation to pruning intensities and grass – legume associations under rainfed conditions. Pruning of secondary branches of trees at 20 cm length from base recorded significantly higher dry matter and crude protein yields of pasture than pruning at 60 cm length. However, dry leaf forage yield, fruit yield and fuel wood were significantly increased when pruning of secondary branches was done at 40 cm length than 20 cm length. Intercropping of Guinea grass *(Panicum maximum* Jacq.) with Caribbean stylo (*Stylosanthes hamata* Taub.) gave significantly higher dry forage and crude protein yields compared to other grass-legume combinations.Dry leaf forage yield and fuel wood production were not significantly influenced with different pasture combinations. However, significantly higher fruit yield was recorded under natural pasture than other grass–legume intercroppings.

***Key words :*** Ber, Pasture, Pruning, Fruit, Forage, Fuel wood yield, Rainfed

In India, about 158 million ha area has been categorized as wastelands. Out of total wastelands, a large area is available under rainfed semi-arid regions which are not suitable for agricultural crops. Soils of these areas are characterized by poor fertility, structural degradation, undulating physiography and shallow depth. Soil erosion is a serious problem in rainfed areas because of lack of appropriate vegetative cover. Development of such wastelands through hortipasture system would stop the degradation of land and also meet the deficit of forage and fuel wood of increasing livestock and human population. In this context, ber or jujube can withstand prolonged drought and can be grown successfully in degraded lands. Ber fruits are borne in the axils of leaves on young growing shoots of current year. Hence, regular pruning is essential to provide a maximum fruit-bearing area on the tree (Bajwa *et al.,* 1988). The interspaces of fruit trees offer scope for raising pasture in order to meet forage requirement of the farmers (Singh,1996). An information on pruning management to ber trees and forage production with grass–legume combination from interspaces of trees is meagre. In view of this, present investigation was conducted to ascertain the productivity of ber-based hortipasture system in relation to pruning intensities and grass–legume associations under rainfed conditions.

## MATERIALS AND METHODS

A field experiment was conducted during 2001–02 and 2002-03 on 10 years old fully established ber plantation of cultivar 'Gola' at Central Research Farm of the Indian Grassland and Fodder Research Institute, Jhansi. The soil was sandy loam, low in organic carbon, available nitrogen and phosphorus and medium in available potash. The total rainfall received during 2001–02 and 2002–03 was 1,215 mm and 546 mm in 57 and 29 rainy days respectively. There were 12 treatment combinations, replicated thrice, in factorial randomized block design. The treatments comprising 3 pruning length from the base of secondary branches of ber trees, viz. 20, 40 and 60 cm, and 4 pasture combinations, viz. Guinea grass + Caribbean stylo, Guinea grass + Caribbean stylo + perennial Dinanath grass (*Pennisetum pedicellatum* Trin.) + Caribbean stylo + Dinanath grass + Caribbean stylo and natural pasture. The reason for having Guinea grass + Caribbean stylo + Dinanath grass + Caribbean stylo treatment in this study was to make the pasture diversified to maintain the stability in productivity by growing more number of species together. Rooted slips from old tussock of Guinea grass and Dinanath grass were transplanted in July at 100 cm row-to-row distance and seeds of Caribbean stylo @ 4 kg/ha was sown in line between 2 rows of grass. Plant-

ing of Guinea grass + Caribbean stylo and Dinanath grass + Caribbean stylo treatment was done in alternate row at 50 cm distance as done in grass + legume treatment. The ber trees were planted 6 m apart. Pruning of trees was done in April during both the years. The trees were given uniform cultural practices and care. Recommended doses of nitrogen (20 kg N/ha), phosphorus (30 kg $P_2O_5$/ha) and potash (30 kg $K_2O$/ha) were applied to the experimental plots. Ten kg FYM was also applied to each tree. One cutting in the first year and 2 cuttings in the second year of pasture, top a height of 12 cm from soil surface, were taken at 60 days interval. Fresh samples (50 g) were collected randomly from each plot and dried in hot-air oven at 70$^0$ C till constant weight for dry-matter estimation.

## RESULTS AND DISCUSSION

### *Effect of pruning length*

The total dry forge, crude protein dry leaf forage and fruit yields and fuel wood varied significantly with different pruning treatments (Tables 1, 2). Pruning of secondary branches of trees at 20 cm length from base recorded significantly higher total dry forage and crude protein yields than pruning at 60 cm length, and it was at par with pruning at 40 cm length. The possible cause of higher pasture yield might be owing to lesser growth and canopy of trees when secondary branches pruned at 20 cm length from base. The increase in dry matter under severe pruning (20 cm length) may be valid reason of higher crude protein yield under this treatment.

The dry leaf forage yield and fuel wood recorded after completion of fruiting in mid-April. The medium pruned trees (40 cm length) gave significantly higher dry leaf forage yield and fruit yield of ber compared with severe (20 cm length) pruned trees. The difference in fruit yield with pruning at 40 cm and 60 cm length was also significant. The increase in dry leaf forage yield of ber under 40 cm length pruning treatment might be due to higher growth parameters, viz. tree height, canopy and number of tertiary branches, under this treatment. Pruning of secondary branches of trees at 40 cm length from base resulted in

**Table 1.** Effect of pruning levels of ber and grass – legume combinations on dry forage and crude protein yield of pasture

| Treatment | Dry forage yield (tonnes/ha) | | | | | | | Crude protein yield (kg/ha) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001–02 | | | 2002–03 | | | | 2001–02 | | | 2002–03 | | | |
| | G | L | T | G | L | T | Mean | G | L | T | G | L | T | Mean |
| *Pruning length (cm)* | | | | | | | | | | | | | | |
| 20 | 3.48 | 0.62 | 4.10 | 3.74 | 0.75 | 4.49 | 4.29 | 245.6 | 77.8 | 323.5 | 252.6 | 86.6 | 339.3 | 331.4 |
| 40 | 3.25 | 0.59 | 3.84 | 3.53 | 0.72 | 4.25 | 4.05 | 237.4 | 73.9 | 311.3 | 235.0 | 82.4 | 317.5 | 314.4 |
| 60 | 3.17 | 0.56 | 3.73 | 3.31 | 0.70 | 4.01 | 3.87 | 221.8 | 68.6 | 290.4 | 219.6 | 80.0 | 299.7 | 295.1 |
| CD (P=0.05) | 0.25 | 0.04 | 0.28 | 0.37 | 0.05 | 0.43 | | 15.8 | 5.6 | 20.4 | 18.6 | 5.7 | 24.2 | |
| *Grass–legume combinations* | | | | | | | | | | | | | | |
| $G_1$ + L | 4.75 | 0.65 | 5.40 | 5.53 | 0.82 | 6.35 | 5.87 | 337.2 | 78.8 | 416.1 | 374.2 | 92.7 | 467.0 | 441.6 |
| $G_1$ + L + $G_2$ + L | 3.97 | 0.69 | 4.66 | 4.69 | 0.84 | 5.53 | 5.10 | 280.9 | 85.5 | 366.4 | 315.9 | 96.3 | 412.2 | 389.3 |
| $G_2$ + L | 3.40 | 0.79 | 4.19 | 2.87 | 0.97 | 3.84 | 4.01 | 251.5 | 99.5 | 351.0 | 199.0 | 111.8 | 310.9 | 330.9 |
| N Pasture | 1.06 | 0.24 | 1.30 | 1.06 | 0.24 | 1.27 | 1.29 | 54.7 | 30.0 | 84.8 | 53.8 | 31.3 | 85.2 | 85.0 |
| CD (P=0.05) | 0.30 | 0.06 | 0.35 | 0.48 | 0.08 | 0.50 | | 20.7 | 7.1 | 24.7 | 7.4 | 7.4 | 29.7 | |

$G_1$, Guinea grass; $G_2$, Dinanath grass; L, Caribbean Stylo; N, natural

**Table 2.** Effect of pruning levels and grass–legume combinations on dry leaf forage, fruit and fuel wood yield of ber

| Treatment | Dry leaf forage yield (tonnes/ha) | | | Fruit yield (kg/tree) | | | Fuel wood (kg/tree) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2001–02 | 2002–03 | Mean | 2001–02 | 2002–03 | Mean | 2001–02 | 2002–03 | Mean |
| *Pruning length (cm)* | | | | | | | | | |
| 20 | 0.87 | 0.77 | 0.82 | 21.8 | 17.5 | 19.7 | 23.8 | 26.2 | 25.0 |
| 40 | 1.05 | 0.96 | 1.01 | 33.0 | 25.0 | 29.0 | 29.5 | 31.6 | 30.5 |
| 60 | 1.03 | 0.94 | 0.99 | 28.3 | 23.1 | 24.5 | 33.5 | 35.0 | 34.2 |
| CD (P=0.05) | 0.07 | 0.05 | | 1.2 | 1.9 | | 4.2 | 4.4 | |
| *Grass–legume combinations* | | | | | | | | | |
| $G_1$ + L | 0.96 | 0.88 | 0.92 | 27.8 | 20.9 | 24.4 | 27.0 | 28.2 | 27.6 |
| $G_1$ + L + $G_2$ + L | 0.94 | 0.85 | 0.90 | 26.8 | 19.4 | 23.1 | 28.6 | 29.3 | 28.9 |
| $G_2$ + L | 0.99 | 0.89 | 0.94 | 26.5 | 21.4 | 24.0 | 29.1 | 29.7 | 29.4 |
| N pasture | 1.02 | 0.92 | 0.97 | 29.6 | 25.9 | 27.8 | 31.0 | 31.5 | 31.2 |
| CD (P=0.05) | NS | NS | | 1.3 | 2.2 | | NS | NS | |

$G_1$, Guinea grass; $G_2$, Dinanath grass; L, Caribbean stylo; N, natural

47.61 and 18.50% increase in mean fruit yield over pruning at 20 cm and 60 cm length respectively. The lower fruit yield in light and severe pruned trees might be due to reduction on number of shoots tree. Bajwa and Sarowa (1977) reported that medium pruning of ber gave higher fruit yield. The average fruit yield was higher in the first year than the second year, may be due to higher rainfall in that year.

Though pruning of secondary branches at 60 cm length from base statistically at par with pruning at 40 cm length, it produced significantly higher fuel wood than pruning at 20 cm length. This may be attributed to the fact that in severely pruned trees (20 cm length), lesser nodes were available for production of coppice shoots, as such subsequent fuel wood production declined. Dwivedi *et al.* (1998) obtained similar results from pruning of Ber.

### *Performance of grass-legume combinations*

Different grass–legume combinations had significant influence on total dry forage yield, crude protein yield and fruit yield (Tables 1, 2). Intercropping of Guinea grass with Caribbean stylo resulted in significantly higher dry forage and crude protein yields compared to Guinea grass+ Caribbean stylo + Dinanath grass + Caribbean stylo, Dinanath grass + caribbean stylo and natural pasture during both the years. The higher dry forage yield of Guinea grass + Caribbean stylo might be due to better shade tolerant capacity of Guinea grass than Dinanath grass. These results corroborate the findings of Prasad (1991) and Singh *et al.* (2001). Lowest dry forage yield was obtained from the natural pasture. Dogra *et al.* (1997) also reported higher crude protein yield of introduced species than naturally growing species.

The dry leaf forage yield and fuel wood of ber was not significantly influenced by different pasture combinations. However, significantly higher fruit yield was recorded in ber + natural pasture compared to ber + sown pastures treatments. Mean fruit yield increased by 20.28, 15.78 and 13.97% in natural pasture treatment over sown pastures of Guinea grass + Caribbean stylo + Dinanath grass + Caribbean stylo, Dinanath grass + Caribbean stylo and Guinea grass + Caribbean stylo respectively. This might be due to lesser growth of natural pasture, resulting in lower requirement of nutrients and moisture than sown pastures which favoured trees.

The effect of interaction between pruning length from the base of secondary branches of ber trees and pasture combinations was found to be non-significant. Thus on degraded, undulated and shallow depth soil of rainfed semi-arid regions facing twin problems of moisture scarcity and poor fertility, it is advisable to grow Guinea grass + Caribbean stylo in interspaces of ber planted at 6 m × 6 m spacing and pruning their secondary branches at 40 cm length from the base for obtaining higher productivity and profit from the system.

## REFERENCES

Bajwa, G.S., Sandhu, H.S. and Bal, J.S. 1988. Effect of different pruning intensities on growth, yield and quality of ber (*Zizyphus mauritiana* L.). *Haryana Journal of Horticulture Science* **16**(3–4) : 209–213.

Bajwa, M.S. and Sarowa, P.S. 1977. Training and pruning of ber. *Punjab Horticultural Journal* **17**(1-2) : 52–53.

Dogra, K.K., Katoch, B.S., Sood, B.R. and Singh, G. 1997. Production potential of silviherbage system vis-a-vis natural grasslands in the humid sub-tropics of Himachal Pradesh. *Range Management and Agroforestry* **18**(2): 165–169.

Dwivedi, R.N., Singh, M., Tomer, P.S. and Kumar, Sunil, 1998. Ber as MPTS at farmer field in Bundelkhand. (In) *Proceedings of National Symposium on MPTS for Agroforestry system*, held at the NRCAF, Jhansi, during 11–13 July 1998, p. 132.

Prasad,L.K. 1991. Type Agros-4, a perennial Dinanath grass *(Pennisetum pedicellatum* Trin.) for forage. *Range Management and Agroforestry* **12**(2) : 153–157.

Singh, M.M., Singh, S.P. and Singh, A.K. 2001. Response of Guinea grass varieties to nitrogen and spacing under saline sodic soil. *Range Management and Agroforestry* **22** (2) : 212–215.

Singh, R.P. 1996. Alternate land use system for sustainable development. *Range Management and Agroforestry* **17**(2): 155–157.