

Forage production

from *Moringa oleifera*

S N Ram¹, R V Kumar² and Vipin Kumar Verma³

Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh 284 003

Moringa oleifera, one of the underutilized plants, has been neglected for several years but now is being investigated for its fast growth, good biomass production, higher nutritional attributes and utilization as a fodder crop. It can be grown on marginal lands with high temperatures and low water availability, where it is difficult to cultivate other agricultural crops. *Moringa* leaves are rich in protein, so can be used as a supplemental fodder for livestock. Therefore, in view of these points *moringa* was evaluated for forage production at ICAR-Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh.

Key words: Forage, *Moringa oleifera*, Production, Quality

LIVESTOCK, the main stay of Agricultural community, provides 50% agricultural output globally and one-third in developing countries. India possesses the highest livestock population in the world, which is growing at the rate of 4.8% per year. Accordingly, the country's feed requirement to feed such a large livestock population is also increasing. However, shortage of quality fodder, particularly during lean periods is major factor contributing to lower livestock productivity. Currently, the country faces a net deficit of 35.6% green fodder, 10.95% dry fodder and 44% concentrate feed ingredients. The demand for green and dry fodder will reach 1,012 and 631 million tonnes by 2050, respectively. Therefore, to meet this deficit, fodder supply has to grow at a rate of 1.69% annually to sustain livestock husbandry. Since last two decades, area under cultivated fodder more or less static is only 8.4 m ha (less than 5%). In this context, *Moringa* could be a good option to meet the fodder demand of livestock in areas having a shortage of green fodder.

Moringa oleifera, an important medicinal tree commonly known as

Sabahan, is an underexploited perennial vegetable species, native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. In this region, it is chiefly confined to stream beds and depressions where sufficient moisture is available but the area does not remain waterlogged. It is a perennial

softwood tree with low timber quality and has been advocated for human food, livestock forage, medicinal values, dye, water purification. Its uses also include: alley cropping (biomass production), bioenergy production, animal forage (leaves and treated seedcake), biogas (from leaves), domestic cleaning agent



Moringa planted at 50×50 cm spacing



Cutting of *Moringa oleifera* at 100 cm height



Cutting of *Moringa oleifera* at 50 cm height

(crushed leaves) and blue dye (wood). It performs better under marginal conditions with ample nutritional quality.

Moringa needs complete overhead light for optimum growth. Seedlings are susceptible to drought and prolonged drought increases mortality. Seedlings and saplings are highly susceptible to browsing damage as leaves are an excellent fodder. It coppices and pollards well and can be propagated through cuttings. The pods are collected in May-June, about 8,000 to 9,000 seeds weigh 1 kg. The seeds do not store well and lose viability during the first year of storage.

Moringa leaves contain beta-carotene, protein, vitamin C, calcium, magnesium, iron; as *Moringa* leaves are rich in protein (20-22%), these can be used as supplemental fodder to milch animals. Its leaves contain much higher protein than conventional protein supplements like coconut meal, cotton seed cake, groundnut cake, sesame cake, sunflower cake etc. The nutritional characteristics of the tree are excellent so it can easily be used as a fresh fodder material for cattle. *Moringa* has high productivity of fresh

material per unit area compared to other fodder crops. *Moringa* can be grown as a multi-cut fodder, hedge and fence etc. In dry months, when no other fodder is available and the fodder quality is diminished due to harsh and severe climatic conditions, *Moringa* leaves can be used as a substitute for commercial rations.

Establishment and management of *Moringa*

Moringa is propagated from seed or cuttings. Direct seeding is possible as the germination rate of *M. oleifera* normally ranges between 80-90%. *Moringa* develops more easily and grows stronger with direct sowing. It is sown at the beginning of rainy season to protect it from waterlogging. The young seedlings should be well protected from animals. At least one year old branch is used for stem cuttings planting. Cuttings can be 50-100 cm long and at least one-third of the cutting must be buried in the soil preferably from June to August. FYM or compost is applied in soil to encourage root development and also irrigation is provided to newly transplanted trees immediately after transplanting to promote early root

development. In dry areas, regular irrigation is required in initial two months of establishment. Once established, *Moringa* rarely needs watering. *Moringa* is susceptible to waterlogging and prefers a well drained sandy loam or loamy soil. For intensive fodder production, *Moringa* should be planted at 50 × 50 cm spacing. *Moringa* trees can also be cultivated in alleys, as natural fences with other crops. The distance between *Moringa* rows in agroforestry cultivation are usually between 2 and 4 m.

Moringa trees have deep tap root system when they are grown from seeds and have an adventitious root system when they are grown from stem cuttings. Its roots penetrate deep into soil and may grow fast in a wide range of climatic conditions at a lower level of irrigation and fertilization than other fodder crops. *Moringa* trees do not need much watering. Newly transplanted trees must be irrigated immediately after transplanting to promote early root development. In dry conditions, water should be applied during the first three months of planting and afterwards only when the tree is suffering. The well-rooted tree

Table 1. Effect of cutting intervals and height on green fodder yield (t/ha) of *Moringa oleifera* planted at 50 × 50 cm spacing

Cutting height (cm)	Cutting intervals									
	30 days					45 days				
	1st cut	2nd cut	3rd cut	4th cut	Total	1st cut	2nd cut	3rd cut	4th cut	Total
50	31.2	38.4	15.2	32.0	116.8	42.8	38.0	25.6	22.0	128.4
100	8.4	16.8	17.2	36.0	78.4	20.4	21.6	45.2	17.2	104.4
Mean	21.73	31.07	15.6	33.9	102.3	32.7	29.7	32.8	18.7	113.9

tolerates drought and needs irrigation only when persistent wilting is evident. Intensively cultivated plants demands more regular watering and fertilization. Irrigation is also necessary to produce forage all year long, including during dry seasons.

Moringa trees grow successfully without fertilizers, but, better biomass and yield may be supported with the application of manures and fertilizers. It requires 45:20:25 g NPK/tree. However, once established, the deep and far-reaching root system of *Moringa* can gather its nutrients from the soil efficiently. For maximum fodder yield, it should be harvested at 40-45 days intervals under intensive fodder production system.

Fodder production potential of *Moringa*

The biomass production of *Moringa* varies widely, depending on season, variety, fertilization, irrigation regimes, spacing, cutting height, planting pattern, geometry and cutting frequencies. It yields best under warm, dry conditions with some supplemental fertilizer and irrigation. Forage can be harvested starting from 6 to 12 months after planting, depending on the growth of the tree, the kind of pruning and watering (well pruned and watered trees can be harvested earlier). *Moringa* planted at ICAR-IGFRI, Jhansi at 50×50 cm spacing for intensive fodder production given 4

cuts at 30 and 45 days harvest intervals in 2nd year of planting and yields 80-130 tonnes green forage/ha (Table 1). Cutting at 50 cm height recorded higher green forage yield (122.6 t/ha) as compared to 100 cm height (91.4 t/ha) during 2nd year of planting. In cutting intervals, 45 days harvest intervals recorded maximum green forage yield (114.0 t/ha).

Forage quality of *Moringa*

Macronutrients like P, K, Ca and Mg play key role in balancing the physiological, metabolic and biochemical processes of livestock. Cattle suffer from low blood Mg during lactation, which leads to low milk yield. *Moringa* leaves contain high amount of macronutrients, Mg and K, and can be effectively used to fulfil the dietary and nutritional requirements of livestock animals by mixing of *Moringa* leaves with other fodders or grasses. Low-quality livestock fodders or rations can be improved by adding *Moringa* leaves as a supplement, which increases the dry matter intake (DMI) and the digestibility of the fodder by livestock. *Moringa* leaves contain 21.53% crude protein, 24.07% acid detergent fiber (ADF) and 17.55% neutral detergent fiber (ADF). The leaves are useful supplements for livestock that not only increase the output of products, but also their quality. In dry months, when no other fodder is available and the fodder quality is diminished due to harsh and

severe climatic conditions, *Moringa* leaves can be used as a substitute for commercial rations.

SUMMARY

Moringa is a good alternative for substituting commercial rations for livestock. The relative ease with which *Moringa* can be propagated through both sexual and asexual means and its low demand of soil nutrients and water after being planted, make its production and management comparatively easy. Its high nutritional quality and better biomass production, especially in dry periods, support its significance as livestock fodder. *Moringa* planted at ICAR-IGFRI, Jhansi, at 50×50 cm spacing gave 80-130 tonnes green forage/ha in 4 cuts at 45 days harvest intervals in 2nd year of planting. The leaves contains 21.53% crude protein, 24.07% acid detergent fiber (ADF) and 17.55% neutral detergent fiber (ADF). One of its main attribute is its versatility, because it can be grown as crop or tree fences in alley cropping systems, in agroforestry systems and even on marginal lands with high temperatures and low water availabilities where it is difficult to cultivate other agricultural crops.

¹Principal Scientist, ²Principal Scientist and Head, Grassland and Silviculture Management Division, ³Assistant Chief Technical Officer. Corresponding author e mail: ramshivnath@yahoo.com

Nutrition

No matter how it is defined, nutrition starts with what we eat, the products of the food and agriculture sector.

By working on our food systems, on the way we produce, collect, store, transport, transform and distribute foods, we can improve our diets, our health and our impact on natural resources.

In lack or in excess, problems of nutrition always encompass inappropriate choices and practices. Nutrition education is an important step in empowering the consumer to make healthy food choices.

Good nutrition is our first defence against disease and our source of energy to live and be active. Nutritional problems caused by an inadequate diet can be of many sorts, and when they affect a generation of youngsters, they can lower their learning capacities, thus compromising their futures, perpetuating a generational cycle of poverty and malnutrition, with severe consequences on both individuals and nations.

While young children are the most vulnerable to malnutrition, the right to adequate food is universal and good nutrition is essential for all. Problems of malnutrition – undernutrition, micronutrient deficiencies and obesity – exist in all countries and cut across socio-economic classes.

Emerging challenges, such as climate change, environmental sustainability and rapid technological shifts, are transforming food systems and raising questions about how to feed a growing world population in sustainable ways.

At the same time, uneven economic growth, social and economic transformations and other factors are shaping food systems and diets. As a result, the prevalence of overweight, obesity and related non-communicable diseases are increasing while undernutrition and micronutrient deficiencies persist.

Courtesy: <http://www.iao.org>