

Millet crops

as source of fodder

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India has the largest livestock population, however, the productivity of milk and other livestock product per animal is very low compared to other countries. One of the main reasons for the low productivity and performance of our livestock is malnutrition and under-nutrition owing to inadequate supply of nutritive fodder and feed. The country is highly deficient with respect to availability of green fodder, dry fodder and concentrates. The gaps for fodder supply are partly met by crop residues-straw and stovers. As the millets are the major cereals of dryland crops in arid and semi-arid regions, they form an important source of stover for the livestock of these regions.

Keywords: Fodder, Fodder quality, Green fodder, Millets, Stover

THE farm communities in the semi-arid and arid regions of the country are dependent on crop residues as a major form of roughages for cattle since they neither have the luxuries of green fodder from irrigated forage crop nor can afford to sacrifice the farm area for dedicated one-time green forage. Annually, millets account for 11% of the 30 million tonnes crop residues produced in India. The decision of the farmer to select the crop and variety are greatly influenced by the ability of the crop/variety to meet their fodder requirements from stover (millet plants left after harvesting the earhead). Stover's contain less of protein, total digestible nutrients and are less palatable than green forages. In regions with assured irrigation, exclusive forage producing sorghum (jowar) and pearl millet (bajra) varieties and hybrids are grown which produce superior quality fodder for feeding livestock. Many multi-cut type hybrids are available in these crops which ensure continuous supply of green fodder during *kharif* (rainy) and summer seasons. The perennial forage crop napier-bajra hybrid is popular in dairy farms throughout the country. Green fodder from most of these millets can also be made into silage and used during off-season feeding.

Stover for fodder

Stover from millets is a valued fodder, especially if cut and dried immediately after the heads have been harvested for grain. The heads are hand-harvested as they ripen and the stover is harvested as green as possible after seed harvest, and dried in the field. The nutritive value in terms of nitrogen and cell soluble

nutrients is better in millet stovers as compared to slender straws of paddy and wheat. Improved varieties and hybrids of the millets yield higher, both grain and stover (Table 1). Higher stover yields of 10–15 tonnes can be obtained from sorghum and pearl millet cultivars with good management practices. Other millets produce 3–8 tonnes of fodder depending on cultural conditions. These are mostly *kharif* (rainy)-grown crops, while *rabi* (winter) sorghum and summer pearl millet are also cultivated in several states.

Finger millet stover is considered a good feed in India and Nepal. Under rainfed conditions, finger millet stover yield is about 2–3 t/ha and may reach up to 6–10 t/ha under irrigation. However, the stover obtained from the rainfed crop is relished more by cattle compared to an irrigated crop because stover of irrigated crop is tough and fibrous, and hence is less palatable.

Finger millet stover can be used to feed crossbred dairy cows in diets supplemented with a concentrate mixture (energy and protein). Such diets allow 8 to 9 kg milk yield and a body weight gain of 200–300 g/day. It can be used for growing heifers when supplemented with wheat bran (25%) or groundnut cake. Dry matter intake of stover is about 3.5 kg/day and the daily weight gain is 310–350 g. It can also be made into silage with suitable supplements.

Augmenting stover quality

Stover should not be fed without supplementation because they do not provide enough energy and protein to meet animal's requirements. The livestock rations using millet stovers can be enriched by mixing with

Table 1. Stover yield of recent cultivars of millet crops in India

Crop	Variety/hybrid	Year of release	Grain yield (q/ha)	Fodder yield (q/ha)	Region recommended for cultivation
Sorghum (<i>kharif</i> jowar)	CSH 30	2013	44	141	Maharashtra, Karnataka, Madhya Pradesh, south Gujarat and north Andhra Pradesh
	CSV 20	2006	31	133	All India
	CSV 23	2007	25–30	155	All India
	CSV 27	2012	28	193	All India
	CSV 28	2012	28	170	All India
	CSV 31	2015	32	144	Andhra Pradesh, Telangana, Tamil Nadu, Rajasthan and Gujarat
	CSV 41	2020	32	159	
Sorghum (<i>rabi</i> jowar)	CSV 22R	2006	23–24	70–72	Medium to deep soils of Maharashtra, Karnataka and Andhra Pradesh
	CSV 26R	2012	13–16	45–60	Shallow soils of Maharashtra, Karnataka and Andhra Pradesh
	CSV 29R	2013	25–30	50–75	Medium to deep soils of Maharashtra, Karnataka and Andhra Pradesh
Pearl millet (Bajra)	HHB 67 (improved)	2005	31	88	Haryana
	RHB 223	2018	30	55	Rajasthan, Gujarat and Haryana
	Pusa 1201 (MH 1849)	2018	28	72	Delhi NCR
	AHB 1269Fe	2019	32	74	Rajasthan, Gujarat, Haryana, Punjab, Delhi, Maharashtra and Tamil Nadu
Finger millet (Ragi/Mandika)	ML-365	2009	50–55	65	Karnataka
	Vegavathi (VR 929)	2019	36	77	Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, Telangana, Odisha, Jharkhand, Karnataka and Puducherry
	CFMV 3	2021	32	87	Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu and Telangana
Barnyard millet (Sawan)	Pratap Sanwa 1	2006	15–17	50–55	Rajasthan
Kodo millet	CKMV 1 (ATL 2)	2021	28	70	Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Telangana and Tamil Nadu
Proso millet (Cheena)	GPUP 21	2004	15.7	42	Karnataka and Tamil Nadu
	Pratap Cheena	2006	15–17	48–50	Rajasthan
	TNAU 202	2017	19	37	Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Karnataka, Gujarat, Tamil Nadu and Bihar
Foxtail millet (Kakun)	Pratap Kangni-1	2004	16–18	46–50	Rajasthan
	CO-7	2006	18.6	51	Tamil Nadu
Little millet (Kutki)	Sabara	2004	12–21	52	Orissa, Madhya Pradesh and Chhattisgarh
	CO-4	2007	15.7	58	Tamil Nadu
	DHLM -14-1	2019	16	61	Tamil Nadu, Karnataka, Gujarat, Maharashtra and Odisha
	CLMV 1	2020	16	55	Maharashtra, Andhra Pradesh, Telangana, Tamil Nadu and Puducherry

legume fodder, treatment with urea, etc. to result in better animal health and performance in terms of weight gain and milk production.

Urea treatment: Treating crop residues with 5–10% urea and 25–50% moisture improves their nutritive value by increasing digestibility, palatability and crude protein content. If the stover is wet with rain or with freshly harvested stover containing much green material, urea can be applied without prior adding extra moisture. Treated stover is best kept in airtight condition. The outer (untreated) parts can be fed to animals with lower requirements, such as draught bullocks or dry cows, while the inner part is fed to growing and lactating animals. Treatment time may vary from 1–4 weeks. Temperature and treatment time are inversely correlated

and more time is required in winter or in colder climates. In well-compacted stover, the temperature rises over 10°C after one week. Successful treatment is indicated by change of colour to dark yellow to brown with strong ammonia odour. Treated stover is softer, highly palatable to cattle and results in body weight gain and enhanced milk production in feeding cattle.

Green forage

Single-cut sorghum and multi-cut pearl millet varieties may be cultivated for green fodder or forage (Table 2). In rainfed conditions (*kharif*), single-cut cultivars may be taken up while multi-cut types need assured irrigation (summer and *kharif*) after each cut, to facilitate fresh foliage growth. Pearl millet uses less

Table 2. Recent millet cultivars notified for green forage production

Millet crop	Single-cut /multi-cut	Variety	Year of release	Green fodder yield (q/ha)	Dry fodder yield (q/ha)
Sorghum	Multi-cut	CSH 43MF	2021	965	219
Sorghum	Single-cut	CSH 40F	2018	560	155
Sorghum	Single-cut	CSV 38F	2019	465	145
Sorghum	Single-cut	CSV 35F	2018	529	145
Sorghum	Multi-cut	CSV 33MF	2017	1039	280
Sorghum	Single-cut	CSV 32F	2015	478	156
Sorghum	Single-cut	CSV 30 F	2014	443	140
Sorghum	Multi-cut	CSH 24 MF	2009	914	232
Pearl millet	Single-cut	TSFB 15-8	2020	420	86
Pearl millet	Single-cut	TSFB 15-4	2020	427	85
Pearl millet	Multi-cut	Moti bajra	2016	811	-
Pearl millet	Single-cut	APFB-09-1	2015	302	-
Pearl millet	Single-cut	Nutrifed (PAC 981)	2014	479	107
Pearl millet	Single-cut	NDFB-11	2014	450-500	-
Pearl millet	Single-cut	Anand Forage Bajra-3	2011	500-525	100
Pearl millet	Single-cut	BAIF-Bajra-1	2010	380-400	80-90

water per unit of forage production, tolerates both lower and higher soil pH, higher aluminum concentration, and is rich in minerals as compared to sorghum. However, sorghum has a wider range of adaptability and is more widely grown. The derivatives of sorghum × sudangrass annual multi-cut hybrids are best suited for green fodder. Young plants of sorghum contain HCN and pearl millet contains oxalates which are anti-nutritional factors. Their concentration gradually reduces as the plant growth advances. Latest cultivars of these crops are tested to be safe to feed, as these constituents are far below the threshold limits to cause any toxicity at the stage of cutting for forage.

In finger millet, under irrigation with proper management, 12–14 tonnes of green fodder per hectare can be obtained in about 50–60 days. When cut 2–3 times during the growing season, it can yield up to 33 tonnes green forage per hectare. Green forage from kodo millet is readily eaten by cattle and is highly digestible up to flowering (70–75% dry matter digestibility).

Bajra-Napier hybrid

Round-the-year supply of green fodder has been made possible in India by developing perennial Bajra-Napier hybrids. Bajra-Napier hybrid, an interspecific cross of bajra (*Pennisetum glaucum*) and napier grass (*Pennisetum purpureum*), is a multi-cut fodder and has become highly popular due to its high yield, nutritive value, digestibility, palatability and survivability (perennial) for longer periods. It is a tall and high tillering grass with more dry matter production per day and high regenerability on cutting. The bajra-napier hybrids combine quick re-growth, non-hairiness, narrow long leaves, thin stems, high leaf-stem ratio, high forage quality, low oxalic acid and high forage yield. It is suited for irrigated conditions, specifically in dairy farming situations. It contains 8–10% of crude protein and 28–30% of crude fibre. It is ideal for feeding as green fodder and making silage and hay. With the increasing demand for green fodder, there was an

upsurge in the requirement of bajra-napier hybrid due to its wide acceptability among farmers. Due to absence of seed setting, rooted slips are the sole method of its propagation and about 40,000 rooted slips are required to transplant one hectare area.

Way forward

Since millet stovers are the most important feed resources in the arid and semi-arid regions of India, considerable research effort has gone into improving their nutritional value through crop management and chemical treatment as well as supplementation through high protein oil cakes, and green fodder. However, the on-farm adoption of these technologies has been low due to improper fit of the technology in the farming system, low resource availability and lack of significant and visible economic benefits. The other possibility of improvement in the quality of stover would be to include a legume along with the millet crop itself.

SUMMARY

Stover from millet crops is well suited for feeding the cattle and its quality can be enhanced by treatments. The cost of stover in several millets compensates the cost of inputs in cultivation. Moreover the farmers depend on this by-product to a large extent in maintaining their milch and draught animals. In many instances the farmers are willing to sacrifice grain but not fodder. A short-duration (60–80 days) millet crop can yield up to 15 tonnes of green fodder per hectare of land. This is more appropriate in dryland (rainfed) conditions, including crop rotations systems. Millets as green forage crops assume more importance especially in scarce rainfall years. The small millet grains can also become a good substitutes for other cereal grains in the preparation of concentrate mixture of livestock and poultry, thereby reducing the cost of feed as well.

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