

Fodder beet—

A promising fodder crop for dairy animals

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Fodder beet (Beta vulgaris sub sp. maritima) has potential to produce green fodder (125 million tonne/ha) of excellent quality for the dairy animals during summer (March to June) particularly in North-western parts of India. A study was conducted at Fodder Demonstration Unit, National Dairy Development Board, Anand to evaluate different cultivars of sugar and fodder beet for green fodder yield and quality parameters. The data with respect to green fodder yield harvested during March and June and for quality traits like average soluble sugar, dry matter and crude protein of sugar and fodder beet cultivars were recorded. The highest green fodder yield in cultivars Cauvery and Jamon and highest soluble sugar in 'PAC 60008' and 'Cauvery' were observed during harvesting in March and June, respectively. Highest Crude Protein percentage was recorded in Jauna cultivar during June. Considering huge potential of beet crop for producing excellent quality fodder, dairy farmers may adopt it as an important fodder crop for high yielding milch animals.

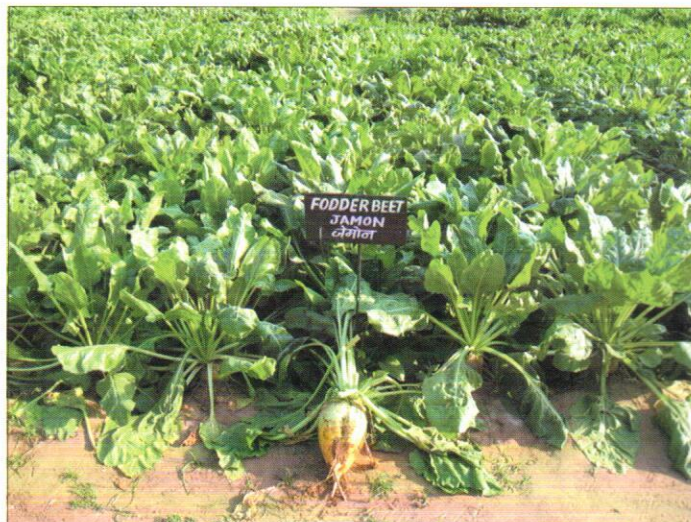
FODDER beet (*Beta vulgaris* sub sp *maritima*) belongs to the family Amaranthaceae, is a temperate

crop grown in many parts of the world mainly for sugar, fodder and vegetable purposes and popularly known as sugar beet, fodder beet & vegetable beet, respectively. Due to its inherent capacity of salt tolerance, this crop can be raised successfully on

saline - alkaline lands also by adopting appropriate management practices. Further, the beet fodder could also be ensiled along with other cereal fodder crops such as maize, oats, sorghum and pearl millet to produce excellent quality of silage.

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Fodder beet hybrid Jamon



De-topped fodder beet crop



Sugarbeet hybrid Calixta



Fresh sugarbeet as green fodder

In India, beet crop was introduced in 1960 as sugar crop but could not get popular like sugarcane due to the suitability of old cultivars to temperate climate only. Now with the introduction of new cultivars suitable for cultivation in tropical or subtropical climate also, the crop can be grown to produce green fodder for animals during summer months (March to June) particularly in north-western parts of India, when forage production from other commonly cultivated multi-cut fodder crops such as oats, berseem and lucerne tends to decline as atmospheric temperature begin to increase. In view of above, a study was conducted to evaluate different cultivars of sugar and fodder beet for fodder yield and important quality parameters at Fodder Demonstration Unit (FDU), National Dairy Development Board (NDDB), Anand. The details of study are:

PRODUCTION TECHNOLOGIES

Selection of beet cultivars

In our country, many improved cultivars of sugar and fodder beets developed by public and private institutions / companies are available in the markets which are suitable for cultivation in tropical / subtropical climate. The selected cultivars for the study are given in Table 1.

Table 1. Beet cultivars used for study

Cultivars	Type	Source of seed	Root colour
Sugarbeet			
IISR Composite-1	Multigerm variety	IISR, Lucknow	White
LS-6	Multigerm variety	IISR, Lucknow	White
Mangnolia	Monogerm hybrid	JK Agri Genetics Ltd, Hyderabad	White
Calixta	Monogerm hybrid	JK Agri Genetics Ltd, Hyderabad	White
Cauvery	Monogerm hybrid	Syngenta India Limited, Pune	White
PAC 60008	Monogerm hybrid	Advanta India Limited, Secunderabad	White
SZ- 35	Monogerm hybrid	Advanta India Limited, Secunderabad	White
Fodder beet			
JK Kuber	Multigerm hybrid	JK Agri Genetics Ltd, Hyderabad	Red
Jauna	Monogerm hybrid	Pioneer Chicory, Anand	Yellow
Monro	Monogerm hybrid	Pioneer Chicory, Anand	Red
Splendide	Monogerm hybrid	Pioneer Chicory, Anand	Orange
Jamon	Monogerm hybrid	Pioneer Chicory, Anand	Yellow-orange

Table 2. Average fodder yield (million tonne/ha) of beet cultivars

Cultivars	16 March 2011			17 June 2011		
	Leaf	Root	Total	Leaf	Root	Total
Sugarbeet						
IISR Composite-1	50.8	64.0	114.8	6.0	52.0	58.0
Cauvery	58.7	106.7	165.4	12.0	65.0	77.0
Mangnolia	53.0	83.8	136.8	16.0	122.0	138.0
LS-6	44.3	70.0	114.3	5.0	80.0	85.0
Calixta	40.8	70.0	110.8	14.0	110.0	124.0
PAC 60008	30.0	80.0	110.0	15.0	115.0	130.0
SZ- 35	25.0	75.0	100.0	25.0	105.0	130.0
Average	43.2	78.5	121.7	13.3	92.7	106.0
Fodderbeet						
Monro	27.0	97.5	124.5	11.0	130.0	141.0
Jamon	43.3	91.0	134.3	13.0	130.0	143.0
Splendide	46.5	81.0	127.5	8.0	120.0	128.0
JK Kuber	27.5	81.5	109.0	8.0	50.0	58.0
Jauna	49.8	103.0	152.8	11.0	120.0	131.0
Average	38.8	90.8	129.6	10.2	110.0	120.2

Land selection and preparation

Beet can be grown successfully on well leveled, deep and well drained lands. It requires a good tilth of soil, free from clods for proper root development. Loam or sandy loam soils, neutral to alkaline in pH with good moisture holding capacity are suitable for its cultivation. One deep ploughing by disc plough followed by three ploughing by disc harrow will give desired tilth in field.

Sowing method

A population of 100,000 plants/ha is required in field to achieve high fodder yield. Around 2.0 - 2.5 kg/ha seed rate is needed to get optimum plant population. The crop was sown in the first fortnight of November. For seed sowing, 15 cm high ridges were made at the distance of 50 cm with the help of ridge maker. On top of the ridges, two seed/hill were hand sown at 3 cm depth and 20 cms apart.

The sowing of beet on ridges gives more root yield when compared to flat sowing method. Ridge sowing and furrow irrigation method also facilitates root digging and irrigations. After sowing, the field is immediately irrigated and care is taken that

Table 3. Average soluble sugar content (%) in roots of beet cultivars

Cultivars	Date of harvest	
	16 March 2011	17 June 2011
	Sugarbeet	
IISR Composite-1	11.5	16.1
Cauvery	10.8	16.8
Mangnolia	10.8	12.4
LS-6	11.5	13.6
Calixta	13.3	14.1
PAC 60008	13.5	14.6
SZ- 35	12.8	16.7
Average	12.0	14.9
	Fodder Beet	
Monro	7.5	7.0
Jamon	6.8	7.2
Splendide	7.0	8.1
Jk Kuber	5.7	7.8
Jauna	7.9	9.6
Average	7.0	7.9

Table 4. Proximate analysis of roots of beet cultivars (%)

Cultivars	DM	CP	Fat	Fiber	AIA	Ca	P
	Sugarbeet						
IISR Composite-1	12.0	8.4	0.6	5.2	1.4	0.1	0.2
Cauvery	11.0	4.9	0.5	7.2	1.7	0.2	0.2
Mangnolia	13.3	6.4	0.6	5.6	1.6	0.2	0.2
LS -6	18.0	4.3	0.7	3.6	1.0	0.1	0.1
Calixta	14.7	6.0	0.6	5.4	1.6	0.1	0.2
PAC 60008	16.0	7.9	0.8	8.7	0.7	0.2	0.2
SZ- 35	22.0	4.4	1.1	4.9	1.5	0.1	0.1
Average	15.3	6.0	0.7	5.8	1.4	0.1	0.2
	Fodder beet root						
Monro	14.0	7.2	0.5	5.8	1.1	0.1	0.2
Jamon	12.7	6.7	0.6	6.6	1.4	0.1	0.1
Splendide	10.7	6.5	1.1	6.0	2.0	0.1	0.2
JK Kuber	17.0	5.7	0.8	3.6	1.4	0.1	0.1
Jauna	10.0	10.9	0.5	6.1	1.8	0.1	0.1
Average	12.9	7.4	0.7	5.6	1.5	0.1	0.1

Table 5. Proximate Analysis of leaves of beet cultivars (%)

Cultivars	DM	CP	Fat	Fiber	AIA	Ca	P
	Sugarbeet						
Mangolia	15.0	19.0	2.9	37.2	3.4	0.6	0.3
Calixta	16.0	19.7	2.9	36.4	4.2	0.7	0.3
Mean value	15.5	19.4	2.9	36.8	3.8	0.6	0.3
	Fodder beet						
JK Kuber	12.0	16.5	2.7	25.0	2.3	0.8	0.2

irrigation water does not flow over the ridges. In north-western part of India, beet can be sown anytime in October and November months.

Fertilizers applications

Beet crop is a heavy feeder of plant nutrients and responds well to fertilizers. Plant nutrients nitrogen (N), phosphorus (P) and potash (K) @ 150:60:60 kg/ha of along with 30 kg sulphur (S) and 15 kg zinc (Zn)/ha were applied to crop. Full doses of phosphorus(p), potash (k), sulphur (s) and zinc (Zn) along with one-third of total nitrogen (N) were given as basal dose before sowing and remaining nitrogen (N) was applied as top-dressing in two equal doses after the two hand weeding operations. Foliar application of boron @ 1 kg/ha was done at 50 and 70 days stage.

Irrigation

First irrigation was provided just

after sowing and subsequent irrigations at three weeks interval as per the need of crop up to March end. Thereafter the crop was irrigated at 15 days interval.

Weeding and gap filling

Pre-emergent herbicide, i.e. Pretalachlor 45 EC @ 1.5 kg a.i. /ha was applied. Manual weeding was done at 25 and 45 days after sowing. Multigermin type cultivars of beet often produce 3 to 4 plants/seed and therefore thinning is necessary during first weeding to produce one robust plant. Growth and development of beet plants is quite slow in first two months therefore timely removal of weeds and extra seedlings helps in reducing unwanted crop competition.

Root rot and pest control

To prevent root rot damage by soil fungus (*Sclerotium rolfsii*), application of *Trichoderma viride* powder @ 1.25 kg/ha was done before sowing. To

control Lepidoptera and other foliage damaging insect's infestation, two foliar sprays of 5 % Neem seed Kernel extract solution was done during first week of April and May months.

De-topping

The leaves of beet plants which are going to be harvested late in May-June can be cut 2 to 3 inches (5 to 7.5 cm) above from root portion (de-topped) and fed to animals during March and April. De-topping provides additional fodder and help in controlling foliage damaging insects. After de-topping additional nitrogen dose @ 25 kg/ha can be given for faster leaf re-growth.

Harvesting

Normally the first uprooting of the fodder beet can be started after 120 days from date of sowing. At this stage the average weight of beet is around 1.5 to 2 kg/plant. The fresh fodder beet including leaf and root can be fed @ 15 to 20 kg/animal/day along with other green and dry fodder materials. The fodder beet crop can be maintained in field up to mid June. The beet cultivars were divided in two categories for study i.e. sugar beet and fodder beet.

Green fodder yield

The green fodder yield was better when cultivars were used when compared with control.

- Among sugar beet cultivars, the 'Cauvery' yielded highest green fodder of 165.4 million tonne/ha at first harvest while among fodder beet cultivars, the 'Jauna' recorded highest forage yield of 152.8 million tonne/ha (Table 1). The forage yield of both these cultivars declined up to second harvest and they were surpassed by the cultivars, 'Mangolia' and 'Jamon' in their respective

category.

- Among sugar beet cultivars 'Mangolia', 'Calixta', 'PAC 60008' and 'SZ 35' showed better heat tolerance and produced more than 120 million tonne/ha of green fodder.
- Among fodder beets, all cultivars produced more than 125 million tonne/ha of green fodder except 'JK Kuber'. Decrease in fodder yield from leaf was observed with advance in date of harvesting due to leaf fall.
- Root yield of cultivars 'IISR Composite 1', 'Cauvery' and 'JK Kuber' declined with increase in harvest duration. This may be due to less tolerance of these cultivars to hot conditions.
- On an average, fodder beet cultivars group produced higher total fodder yield than sugar beet cultivars.

Soluble sugar content

- Highest soluble sugar content was found in sugarbeet cultivars when compared to fodder beets (Table 2).
- Sugar percentage in sugar and fodder beet cultivars increased with advance in harvesting time.
- Among fodder beet cultivars, Jauna recorded highest sugar content. The 'Cauvery' and 'SZ 35' were the sweetest sugar beets on second date of harvest.

Proximate analysis

- Roots of sugar beet cultivar 'SZ 35' and fodder beet cultivar 'JK Kuber' recorded the highest dry matter content in their category (Table 4).
- Overall higher dry matter content was observed in roots of sugar beet cultivars as compared to fodder beets.
- Crude protein (CP) content was more or less same in roots of both

the categories of beet. Fodder beet 'Jauna' recorded highest CP of 10.9 %.

- Overall average fat, fiber, acid insoluble ash (AIA), Ca and P content in roots of both the category of beets were equal (Table 5).

Beet based forage crop rotations

To get high fodder yields following beet based forage crop rotations can be adopted: Sorghum - beet, Fodder maize - beet, maize/ sorghum + cowpea - beet, pearl millet/cluster bean - beet.

SUMMARY

To meet the growing demand of green fodder for dairy animals, enhancing the productivity of existing area under fodder cultivation through introduction of improved high-yielding varieties/hybrids of existing forage crops along with new crops like beet, having potential to produce nutritious green fodder during scarcity period are amongst the best options available. The study shows that with its high biomass production capacity, beet crop can improve green fodder availability in north-western parts of India particularly during summer months. The fodder of beet crop was found to be highly nutritious to the animals. Sugar beet hybrids such as Cauvery, Calixta, 'Mangolia', 'PAC 60008' and 'SZ 35' and fodder beet hybrids such as 'Monro', 'Splendide', 'Jauna' and 'Jamon' may be cultivated for fodder purpose in the country. Although, we could generate keen interest among dairy farmers for adopting the beet as fodder crop through our on farm demonstrations and extension. However, more field studies and demonstrations on large scale are needed to popularize the crop in the country.

Corrigendum

In January 2012 issue (61(10): 10-13) of the Indian Farming in the article, "Fodder beet – a promising fodder crop for dairy animals" following corrections may be read:

- MT/ha has been printed as million tonnes/ha, it may be read as metric tonnes/ha.
- In first paragraph of the article *Betavulgaris* sub sp *maritima* has been published. It may be read as *Beta vulgaris* sub sp *vulgaris*.