The Triple 'f' (food, fodder and fuel) Crop Sweet Potato [Ipomoea batatas (L.) Lam.]

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Introduction:

Sweet potato is a staple food in several tropical countries. It is one of the world's highest yielding crops with the total food production per unit area exceeding that of rice and having greater food value. It is an important food crop in tropical and sub-tropical countries and grown in large scale in Mexico, Central America, South America, Mediterranean regions of Europe, Africa, India, China, Japan, South East Asia, East Indies and the Pacific Islands. It is a major source of carbohydrate for millions of people, especially in developing countries. The plant is grown for its edible tuberous roots that contain about 27% carbohydrate and high concentrations of Vitamin A Vitamin C, Calcium and Iron. Fresh sweet potatoes provide about 50% more calories than Irish potatoes. The leaves is used as leaf vegetable as well as good fodder value and much more industrial value. Sweet potatoes are packed with nutrition. They are a great source of minerals such as manganese, folate, copper, and iron. The darker-coloured variety is a great source of carotenes (precursor of vitamin A), vitamins C, B2, B6, E and biotin. Sweet potatoes are also a fantastic source of dietary fibre. Here are nine reasons you should be eating more sweet potatoes:

Nine Reasons Why You Should Eat Sweet Potatoes

1. Sweet potatoes are high in antioxidants, which work in the body to prevent inflammatory problems like asthma, arthritis, gout, and many more.

2. Sweet potatoes are an excellent source of carbohydrates for those with blood sugar problems. These fibrous root vegetables can help regulate blood sugar levels and prevent conditions like insulin resistance.

3. Sweet potatoes are healthy for the digestive tract. Being rich in digestive fibre, especially when the skin is also consumed, it helps to relieve constipation and may prevent colon cancer.

4. Sweet potatoes are good for those who are pregnant or trying to conceive because they

are high in folate, which is essential for the healthy development of fetal cell and tissue.

5. Packed with important vitamins and other nutrients, eating sweet potatoes can boost immunity by supporting the needs of the body.

6. Sweet potatoes are good for preventing heart disease. High in potassium, sweet potatoes can help prevent the onset of heart attack and stroke. Potassium also helps to maintain fluid and electrolyte balance in the body, which is important for stabilizing blood pressure and regulating heart function.

7. Sweet potatoes are good for alleviating muscle cramps. Potassium deficiencies are a leading cause of muscle cramps, as well injuries. By making sweet potatoes a regular part of your diet (along with proper exercise), you can expect an energy boost and fewer muscle cramps and injuries.

8. Sweet potatoes are good for treating stress-related symptoms. The body tends to use a lot of potassium and other important minerals when it is under stress. Sweet potatoes provide important minerals that will help maintain balance throughout the body during times of stress.

9. Sweet potatoes ranked number one in nutrition out of all vegetables by the Centre for Science in the Public Interest because they are

such a rich source of dietary fibre, natural sugars, complex carbohydrates, protein, carotenoids, vitamin C, iron and calcium.

Uses:

a) The tubers are usually eaten boiled or baked, candied with syrup, or purred.

b) They can also be used for canning, and as a source of starch glucose, syrup and alcohol.

c) The tuber and green vegetative part can also be used as feed for livestock.

d) Older vines are sometimes used as fodder for cattle, swine and fish.

e) Because of their vine vigorous growth habit, some cultivars have ornamental value as ground cover or in hanging baskets and planters.

F) The tuber is used as raw material for ethanol production.

Sweet potato is believed to have origin in the countries like Mexico, South America, Central America and Asia. From a study of the general characteristics of the plant, historical and archaeological records, its current distribution, and

historic linguistics, it was concluded that sweet potato originated somewhere in central America or North west South America in about 3000 B.C. The introduction of sweet potato into Africa, North America, Europe, India, China, Japan, Phillippines, etc, was primarily the result of Spanish, Portuguese and British trade[3], exploration and colonization. In Asia, sweet potato is the most important root tuber crop. The total area in India is about 16 lakh hectares with an annual production of about 83 lakh tonnes. Orissa has the largest area followed by Bihar, Uttar Pradesh, Assam, Madhya Pradesh, West Bengal and Maharashtra. In India, sweet potato is considered as 'poor man's food'. In Sikkim, recent statistical data relating to the crop is lacking. However, it is a crop found in almost at sub-tropical and lower temperate areas of the state. An average yield of 10,000 kg of fresh tuber and 16,200 kg of fodder per hectare with local variety was recorded at Heegaon (elevation of 1200m) in West Districts (1982). The quality of the fodder was considered to be quite good.

Harvesting:

Sweet potato crop matures three and a half to four and a half month after planting. Harvesting sweet potato 120 days after planting is normally recommended. Delay in harvesting invites attack of sweet potato weevil. Maturity of the crop is indicated when the leaves turn yellow and begin to fall. The harvesting stole is also determined by cutting one of the sweet potatoes. If the cut surface dries white, and does not turn greenish – black round the edge, the sweet potato is fit to eat. If a milky juice exudes which on exposure to air turns black, the sweet potato is not mature enough. The vines should be removed before harvesting. Harvesting is usually done by hand labour and with the help of spades. For easing the harvesting operation, light irrigation is to be provided 2-3 days before digging of tubers. Care should be taken to avoid injuries and bruises on tubers. Early cultivars can be harvested 90-105 days after planting, whereas medium-maturing 110 days after planting. Late harvesting is practiced in diara land as the soil is sandy.

Yield:

By adopting recommended varieties and improved cultural practices, a yield up to 30 tonnes/ha can be obtained. Average yield of sweet is around 10-20 tonnes/ha.

Post Harvesting:

For marketing of fresh tubers, cleaning and grading should be done to get better prices. After harvest, tubers are spread in partial shade for 5-6 days, for healing and curing. They should be stored in semi-dark condition in a well ventilated room. Such storage invites infestation of pests and diseases. The shrinkage of tubers is

also recorded due to dehydration. In some parts of the country, tubers are stored in a layer of dry sand or soil after curing under ambient conditions. For storing, graded tubers free from sweet potato weevil and bruises should be selected. Farmers store the graded tubers by keeping in a pit shade and covering the pit with paddy straw. Finally, the heap is plastered with mud or cow dung slurry. Tribal farmers of some parts of Odisha store their produce by heaping tubers in a corner of their huts and covering the heap with a thin layer of paddy straw. This heap is plastered with soil cow dung paste.

Market and Export Potential:

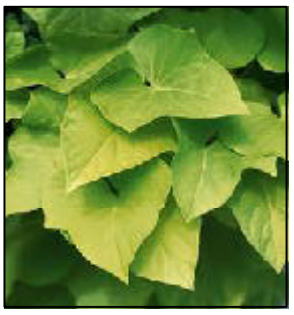
Sweet potato roots are usually washed and graded before being shipped to market. In western countries the tubers are waxed before transit if requested by the buyer. The product is marketed in consumer – perforated film bags or overwrapped trays and in mesh bags. Most of the crop is marketed through sales brokers and shipping point buyers. Selling brokers are located near production areas and arrange sales between grower – shippers and terminal market buyers. Much scope is there for this crop as the tuber has much potential with reference to its multidimensional industrial uses such as flour manufacturing, manufacture of alcohol etc.

Food in any substance is consumed to provide nutritional support for the body. It contains essential nutrient, such as carbohydrates, fats, proteins, vitamins, or minerals. The substance is ingested by an organism and assimilated by the organism's cells in an effort to produce energy, maintain life, and/or stimulate growth. Food safety and food security are monitored by agencies like the International Association for Food Protection, World Resources Institute, World Food Programme, Food and Agriculture Organization, and International Food Information Council. They address issues such as sustainability, biological diversity, climate change, nutritional economics, population growth, water supply, and access to food. The right to food is a human right derived from the International Covenant on Economic, Social and Cultural Rights (ICESCR), recognizing the "right to an adequate standard of living, including adequate food", as well as the "fundamental right to be free from hunger".

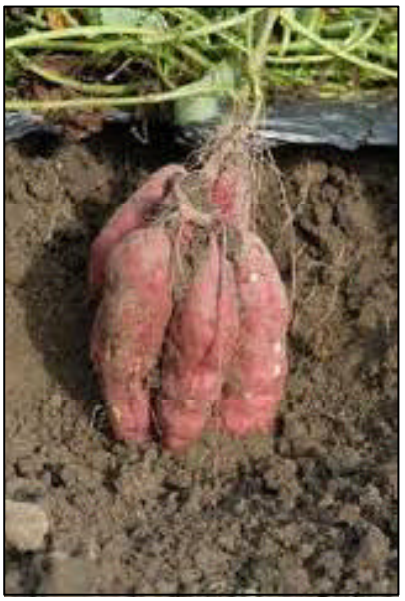
Fodder : An act of giving food, especially to animals or a baby, or of having food given to one.

Fuel : Supply or power (an industrial plant, vehicle, or machine) with fuel. That is burned to produce heat or power.

Fodder or **animal feed** is any agricultural foodstuff used specifically to feed domesticated livestock such as cattle, goats, sheep, horses, chickens and pigs. Most animal feed is from plants but some are of animal origin. "Fodder" refers particularly to food given to the animals (including plants cut and carried to them), rather than that which they forage for themselves (see forage). It includes hay,



straw, silage, compressed and pelleted feeds, oils and mixed rations, and also sprouted grains and legumes. The world-wide animal feed industry consumed 635 million tonnes of feed (compound feed equivalent) in 2006, with an annual growth rate of about 2%. The use of agricultural land to grow feed rather than human food can be controversial; some types of feed, such as corn (maize), can also serve as human food; those that cannot, such as grassland grass, may be grown on land that can be used for crops consumed by humans. Some agricultural by-products which are fed to animals may be considered unsavoury by human consumers. Fuel is any material that stores energy that can later be extracted to perform mechanical work in a controlled manner. Most fuels used by humans undergo combustion, a redox reaction in which a combustible substance releases energy after it ignites and reacts with the oxygen in the air. Other processes used to convert fuel into energy include various other exothermic chemical reactions and nuclear reactions, such as nuclear fission or nuclear fusion. Fuels are also used in the cells of organisms in a process known as cellular respiration, where organic molecules are oxidized to release usable energy. Hydrocarbons are by far the most common source of fuel used by humans, but many other substances, such as radioactive metals, are currently used as well.



Dairy cattle rearing are an important subsidiary occupation for the farmers. Milk production and profit in dairy farming depends upon feeding and management practices. During the recent years, prices of various feed ingredients like groundnut cake, wheat bran, maize etc., have increased which is a major constraint for profitable milk production. Feeding natural grasses and green fodder will help to reduce the expenditure on concentrate feeding. Quality of green fodder and hay can be further improved through enrichment and preservation techniques.Sweet potato [*Ipomoea batatas* (L.) Lam.] is a widely cultivated crop in Nigeria, from southern part through the northern part (Tewe et al 2003). The fodder has long been identified and used as supplement to low plane feeding in smallholder livestock producing (but extensive crop producing) areas of Asia, sub-Saharan Africa and Latin America (Devendra 1989). The nutritive value of forage depends on several factors such as variety, foliage components, voluntary intake, digestibility and production of meat or milk per unit of the forage consumed either as sole or supplemented diet (Coleman and Moore 2003). Thus, assessing the quality of sweet potato foliage components (whole-plant tops, leaf-blade, leaf-petiole and stem) would enable the selection of desirable varieties that exhibit high proportions of the more digestible foliage components with higher foliage and root yields. Although some work have been done on the nutritional evaluation of sweet potato fodder, only little has been reported on the rumen degradation characteristics of the foliage components at different stages of growth (Ffoulkes et al 1978; Orodho et al 1996).

The nylon bag (*in situ*) degradability of forage has been described as a very useful means

for assessing differences in nutritive value between crop cultivars (Verbic et al 1995; von Keyserlingk et al 1996). Similarly, crude protein (CP) content and rumen degradation characteristics have been identified as important determinants of forage quality and are useful parameters for estimating both feed intake and performance of ruminants that are also influenced by stage of maturity of forage (Orskov et al 1988; Blümmel and Orskov 1993; Ingvartsen 1994). In tropical roughages, it has been demonstrated that *in sacco* degradation gave better predictions of voluntary intake than *in vivo* digestibility (Ibrahim et al 1995). An understanding of the differences in degradation pattern of the botanical fractions in forages or crop residues would enhance the development of varieties/cultivars with more digestible forage and crop residues through breeding and selection. Therefore, the paper reports the findings from a study aimed at determining CP, NDF and rumen DM degradation characteristics of sweet potato foliage components as influenced by stage of growth.

IMPORTANCE OF GREEN FODDER

Green grass is a good source of vitamin A which is present in the form of carotene. One kg of green grass provides 50mg of vitamin A. This vitamin is necessary to maintain the health and reproduce status of the animal. Grasses are also good source of protein. One kg of green fodder gives 15 to 20g protein to the animal. Cowpea, beans, subabul leaves etc. give 30 to 40g of protein.

HOW TO PRESERVE SWEET POTATO SILAGE

Cut the grass at the early flowering stage. Dry the grass in the field for about 4 to 5 hours. Cut into small bits of 10 to 15cm length with a chaff cutter or a knife. Add 5 kg of chopped semi dry sweet potato. Prepare molasses solution in a bucket by dissolving 5 kg molasses in 20 litres of water. Dissolve one kg salt in five litres of water. Make a circular pit in an elevated area away from water source. The size of the pit should be at least one meter in depth and one meter in diameter. Every one cubic meter of pit can hold 600 kg of green grass. Cover the bottom and sides of the pit with dry leaves or straw. Fill the pit with grass for about one foot height and press it well. Sprinkle molasses over it. Add another one foot layer of grass. Sprinkle salt solution with the help of a rose can. Repeat the filling in the same way till the entire pit is filled. Press the grass well to remove any air space inside. On the top, cover the grass with a layer of dry leaves. Cover the pit with mud for about one foot height to protect the pit from air and water. Care should be taken to protect the pit from rain water. To protect the pit from rain, the top portion should be covered with polyethene sheet or tarpaulin. Silage will be ready after two months. Pit can be opened even after four months. If silage is prepared in November, it can be taken out in Feb / March (summer) to feed the animals. Feeding silage helps to reduce concentrate feeding and to maintain the health of the animals.

FEED & FODDER REQUIREMENTS FOR MILK PRODUCTION IN INDIA

Livestock production is backbone of Indian Agriculture and source of employment in rural areas for centuries. This sector has been the primary source of energy for agriculture operation and major source of animal protein for the masses. Therefore India has been house to major draught, milch and dual-purpose breeds of cattle. Our whole system of rural economy has revolved around livestock production.

However, there has been a rapid change in the way agriculture operations are carried out like;

- Agriculture production i.e. cropping system, water resources, diversification of crops, intensification of agriculture.

- Increasing use of mechanical power V/S bullock power

- Transformation from sustenance farming to market oriented farming

- Changing food habits

All this has its impact on animal husbandry practices including breed character requirements of Indian farmer and thus their feeding. India is house to 15% world cattle population and 16% of human population to be sustained and Progressed on 2% of total geographical areas. Due to ever increasing population pressure of human, arable land is mainly used for food and cash crops, thus there is little chance of having good quality arable land available for fodder production, until milk production is remunerative to the farmer as compared to other crops.

SCENARIO OF FEED AND FODDER REQUIREMENT & AVAILABILITY:

There is tremendous pressure of livestock on available feed and fodder, as land available for fodder production has been decreasing. Scenario of feed and fodder availability till 2025 is as below: -

(In million tonnes)

Year	Supply		Demand		Deficit as % of demand (actual demands)	
	Green	Dry	Green	Dry	Green	Dry
1995	379.3	421	947	526	59.95 (568)	19.95 (105)
2000	384.5	428	988	549	61.10 (604)	21.93 (121)
2005	389.9	443	1025	569	61.96 (635)	22.08 (126)
2010	395.2	451	1061	589	62.76 (666)	23.46 (138)
2015	400.6	466	1097	609	63.50 (696)	23.56 (143)
2020	405.9	473	1134	630	64.21 (728)	24.81 (157)
2025	411.3	488	1170	650	64.87 (759)	24.92 (162)

Source: Draft report of the working group on animal husbandry and dairying for five-year plan (2002-2007, Govt. of India, Planning Commission, August – 2001).

According to another estimate by NDDB for an expected production of 86 million of milk by the end of 9th Plan, annual requirement of green fodder will be to the tune of 1064 million T and dry fodder to the tune of 585 million T. The current availability, however is estimated at 570 million T and 400 million T respectively.

Feed Production:

(in million tonnes)

	2002-03	2003-04	2004-05	2005-06	2006-07
Concentrates available	41.96	43.14	44.35	45.63	48.27
Concentrates required	117.44	120.52	123.59	127.09	130.55
Concentrates Deficit	64.27	64.21	64.12	64.10	63.03

Source: Draft report of the working group on animal husbandry and dairying for five-year plan (2002-2007, Govt. of India, Planning Commission, August – 2001).

Quality of feed & Fodder:

Livestock rearing in India is changing with the requirement of time as is also evident that demand for milch breed of cattle is going up as compared to dual or draught breed. Population of indigenous breed like Haryana, Nagori, Khilar i.e. dual & draught purpose breeds has declined more than milch breeds. In this globalize / market economy dependent agri-economy, milk production has to compete for growing fodder on good or arable land. Thus milch animals have to be of high productivity and reproductive efficiency.

Role of cultivated fodders:

i) Feed & fodder cost constitute about 60-70% of cost of milk production thus cultivated fodder has an important role in meeting requirement of various nutrients and roughage in our country to produce milk most economically as compared to concentrates.

ii) It needs feed, which not only meet nutrient requirement but fills the rumen to satisfy the animal.

iii) In view of microbial digestion system, feeds have to meet requirement of cattle maintenance, production and requirement of microbes to promote digestion.

Cultivated fodder crops have a place of importance for feeding of ruminants in view of the following aspects: -

a) In view of the peculiar digestive system, provided by nature, ruminants need feeds, which not only meet their nutritional requirements but also fill the rumen and satisfy the animal.

b) In view of microbial digestion system the feeds have to meet requirements of the animal, its production as well as the needs of microbes for promoting digestion.

c) The fodder crops meet these requirements very effectively and hence are important for ruminant production system. As evident from reports that mixed with coarse roughages, like wheat straw, its intake and digestion are improved.

Fodder crops provide all the critical elements like highly digestible protein, carbohydrates, fats and minerals. Green fodders are a very good source of B-carotene (precursor of vitamin A).

i) Common cereal fodder crops like Maize, Sorghum and Oats are rich in energy and the leguminous crops like Lucerne, Berseem & Cowpea are rich in proteins.

ii) Leguminous crops, like Berseem, Lucerne & Cowpea, are a good source of major &micro minerals, so critical for rumen microbes as well as animal system.

iii) Fodder cultivation has been traditional in most parts of the country since farmers feel that the fodder crops have some factor, which keeps the animal healthy and productive. And hence since generations farmers have marked out certain varieties and crops for fodder production and cultivate these, depending on availability of land and water.

The green fodder crops are known to be cheaper source of nutrients as compared to concentrates and hence useful in bringing down the cost of feeding and reduce the need for purchase of feeds/ concentrates from the market. The stage of harvest of crop has profound effect on the nutrient contents of the fodder crop. The moisture and nutrient contents of the crop decreases and fibre content increases with maturity and hence harvesting at proper stage is crucial. Fodder production programme should aim at selecting crops and varieties, which

produce highest quantities of ' Nutrients per unit of land and time period' and hence a continuous search for improved varieties is crucial. High yielding produces good quality fodder and multipurpose utility. In case surplus fodder is available in some season it can be stored in form of silage or hay for lean season.

5. Role of common property resources in meeting feed requirement of livestock:

It has been tradition in India to have community pasture land in each village, which has been an important source of feed for cattle particularly of weaker sections like landless / small / marginal farmers. Each family has equal access to these resources in the village. In the past, group of villagers were taking care of such lands and maintaining them, but after abolition of this system, these properties became nobody's property and are now in denuded condition and encroached upon by influential or sold by Panchayats to mobilize resources.

Sweet potatoes (*Ipomoea batatas*), raw,Nutrition value per 100 g. (Source: USDA National Nutrient data base)

Principle	Nutrient Value	Percentage of RDA
Energy	86 Kcal	4%
Carbohydrates	20.12 g	15.5%
Protein	1.6 g	3%
Total Fat	0.05 g	<0.5%
Cholesterol	0 mg	0%
Dietary Fibre	3 g	8%
Vitamins		
Folates	11 µg	3%
Niacin	0.557 mg	3.5%
Pantothenic acid	0.80 mg	16%
Pyridoxine	0.209 mg	15%
Riboflavin	0.061 mg	5.5%
Thiamine	0.078 mg	6.5%
Vitamin A	14187 IU	473%
Vitamin C	2.4 mg	4%
Vitamin E	0.26 mg	2%
Vitamin K	1.8 µg	1.5%
Electrolytes		
Sodium	55 mg	3.5%
Potassium	337 mg	7%
Minerals		
Calcium	30 mg	3%
Iron	0.61 mg	7.5%
Magnesium	25 mg	6%
Manganese	0.258 mg	11%
Phosphorus	47 mg	7%
Zinc	0.30 mg	3%
Phyto-nutrients		
Carotene-a	7 µg	—
Carotene-ß	8509 µg	—
Crypto-xanthin-ß	0 µg	—

Ethanol Sweet-Potatoes-Bio-based Fuel, a bio-based fuel made from sweet potatoes. A lot of terms are being bandied about these days. Ethanol, cellulosic feedstocks, biomass, methyl tertiary butyl ether (MTBE), flexible fuel vehicles (FFV), E10, E85, switchgrass, bio-based fuels, sustainable renewable fuels, green energy, net energy balance, inedible sweet potatoes, "25 by 25" plan, and the list goes on and on.

With a growing fuel crisis in the USA and other countries, both developed and developing, the race is on to produce fuels substitutes for petroleum. Sweet potatoes are one of the major crops being studied, harvested and tested for Ethanol, an additive and gasoline fuel-replacement. Ethanol production is experiencing tremendous growth in the USA and around the world. There are huge world-wide opportunities for producing this bio-based fuel from crops, like inedible sweet potatoes, that do not compete with crop resources needed to feed people.

Currently, corn is the major crop being used in the USA to make Ethanol (Brazil, the world's largest producer of Ethanol, uses

sugarcane). However, sweet potato can be the major crop for south-eastern states that produce the most of this vegetable. And, sweet potatoes can and will play a major role in biofuel production for other countries, like China, that have large crop production. (See Global Impact)

Why Ethanol? This biofuel has many benefits including: it makes the air cleaner by reducing the levels of carbon monoxide spewing from car tailpipes, it can displace petroleum on a 1:1 ratio, and it is renewable and sustainable, has a positive net energy balance,blends easily with gasoline, is nontoxic, is biodegradable, and it helps reduce greenhouse gas emissions.

We can get all these wonderful improved-quality-of-life benefits from Ethanol because of crops like sweet potatoes :

This vegetable will have new possibilities over the next 5-10 years, and for of course, generations to come. Farmers will be encouraged to grow more, many new jobs will be created and our environment should be cleaner and healthier.

The current biofuel craze may have environmental repercussions we are unaware of. Presently, the primary source of ethanol are **corn** and **sugarcane**. Increased commercial production of the fuel alternative can have the following impacts:

1. Poisoning of the soil, water tables, and streams due to increased use of chemical fertilizers;

2. Reducing food production due to conversion of fertile and prime farmlands to ethanol production; and

3. Encroaching on and clearing of remaining tropical rainforests for sugarcane plantations.

Fortunately, a crawling vine may provide a solution to the ethanol fuel dilemma, **sweet potato** (*Ipomoea batatas)* or yam. This lowly plant's ethanol-relevant feature are its large, starchy, and sweet roots. At least a fourth of each tuber is composed of **carbohydrate**, mostly starch and some glucose. They convert easily to **alcohol**. The following characteristics make sweet potato almost perfect for ethanol production:

1. It can be grown in **tropical**, **subtropical**, and **warm temperate** regions and in any terrain (*That's almost everywhere*);

2. The plant can be grown in a variety of **soil** except for heavy clay-types where the roots don't have much chance of development;

3. It does not require much **fertilizer** and has little **maintenance**. They don't need additional fertilizers in fertile soil since the plant will produce mostly greens;

4. Sweet potato has a short maturity period of **3.5** to **4 months**; and

5. The tubers can be stored for **3 months** after a seven-day cure in any open space (*try that with sugarcane*).

Flexible fuel vehicles (FFVs) are designed to run on gasoline or a blend of up to 85% ethanol (E85). Except for a few engine and fuel system modifications, they are identical to gasoline-only models. FFVs experience no loss in performance when operating on E85. However, since ethanol contains less energy per volume than gasoline, FFVs typically get about 25-30% fewer miles per gallon when fuelled with E85.FFVs have been produced since the 1980s, and dozens of models are currently available. Since FFVs look just like gasoline-only models, you may be driving an FFV and not even know it.

Conclusion

Mixed crop–livestock systems have a crucial role to play in meeting the agricultural production challenges of smallholder farmers in India. Sweet potato is seen as a potential remedial crop for these farmers because of its high productivity and low input requirements, while its usefulness for both food and feed (dual-purpose) make it attractive in areas where land availability is declining. Socio-economic and bio-physical data on farmers' land use allocation, production, and input and output use. Spatially heterogeneous characteristics of the current system regarding resources and productivity are analyzed to assess the profitability of substituting dual-purpose sweet potato for other crops currently grown for food and feed. Results indicate that a substantial number of farmers in the study area could benefit economically from adopting dual-purpose sweet potato. Depending on assumptions made, the adoption rate, expressed as the percentage of the total land under adopting farms, is between 55% and 80%. The analysis shows that the adoption rate is likely to vary positively with the average total yield of dual-purpose sweet potato, the harvest index (the ratio between tuber and fodder yields), the price of milk, and the nutritional value of available fodder. This study demonstrates the usefulness of the minimum-data methodology and provides evidence to support the hypothesis that dissemination of the dual-purpose sweet potato could help improve the livelihoods of smallholder farmers operating in mixed crop–livestock systems in India.

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Nine Reasons Why You Should Eat Sweet Potatoes:http://www.naturalnews.com/031543_sweet_potatoes_minerals.html#ixzz1alTjI98T

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