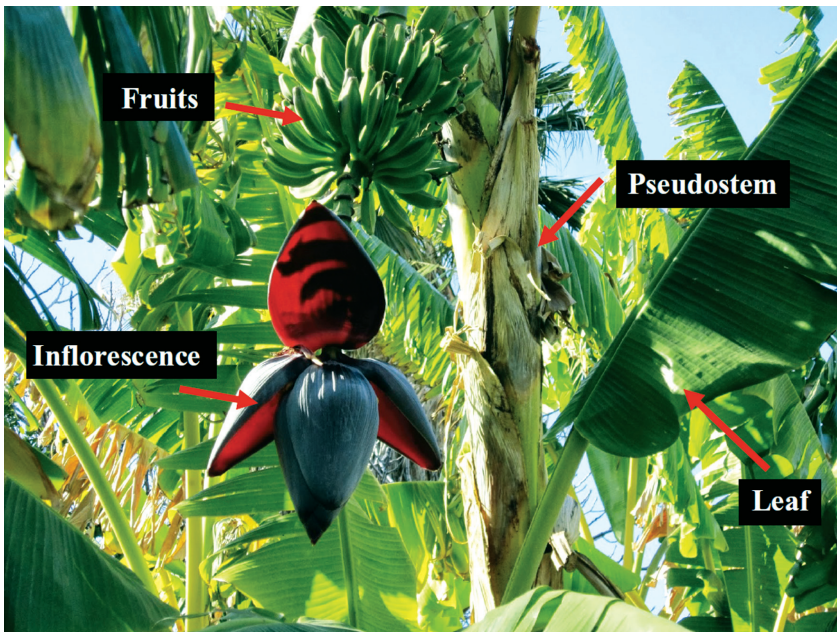
Raghavendra H R*, Chirag Desai,
Varun M Hiremath, Tejukumar B K
and Udaya T V

Kalpatharu: A plant with virtues

The concept of waste valorisation has been precisely defined as the process of converting waste materials into useful products. Waste valorisation relies on the assumption that even after efficient intended use, the waste still contains untapped sources that can be converted into other useful forms. Apart from the development of technologies, waste valorisation has several advantages like, reduction of volume of produce, recovery of more space and mainly amelioration of environmental pollution. As banana fruit is considered, it is the cheapest, plentiful and most nutrient fruit which is having great economic significancy in our country. In India it is so predominant crop and popular among people that it is liked by both poor and rich alike. It is an important source of fibre, fodder, food, beverages, fermented sugars, medicines, flavourings, silage, rope, cordage, garlands, shelter, clothing, making house roofs and wall linings. By considering all these multifaceted uses, it is referred to as Kalpatharu. The banana industry produces a large volume of waste which is neglected and left to decompose in an uncontrolled way. Hence the application of valorisation would save hindrances to the industrial development.

BANANA is commercially fourth important global food commodity after paddy, wheat and milk in terms of gross value of production and great socio-economic significance. It is an herbaceous, monocarpic plant belongs to the family Musaceae which originated from the tropical region of South-East Asia. India is also considered as one of the centre of origin. Banana is one of the oldest crop of fruits which was earlier mentioned in the epics of Ramayana in 2020 BC and Kautilya's Arthashastra in 300-400 BC. It is the cheapest, plentiful nutritive fruit having great economic significance in India and many research findings showed as one of the man's first food. It is one of the most delicious fruit which contributes to livelihood through production, processing and marketing. It is deeply interwoven with the Indian cultural heritage that its leaves, pseudostem and fruits are considered very auspicious in all celebrations of the festivals.

Banana ranks first in terms of production and productivity among all fruit crops and covers 12% of the total area under fruits which contributes nearly one third of total production. It can be grown all over India is varied climatic regions. In India, about 7.1 lakh ha area is under banana crop with the total fruit production of 26.2 million MT contributing 14.7% of global the technological development in banana cultivation, its productivity is also showing rising trend. Apart from fruit, banana crop also generate huge quantity of biomass in the form of pseudostem, leaves, suckers, etc. For disposing purpose, farmers spending ₹ 8,000 to 10,000/ha used as dumping on field bunds and burning, disposing in natural drains which causing environmental problems. Hence the application of valorisation of waste would save hindrances to the industrial development.



Parts of banana plant

Valorisation of plant waste

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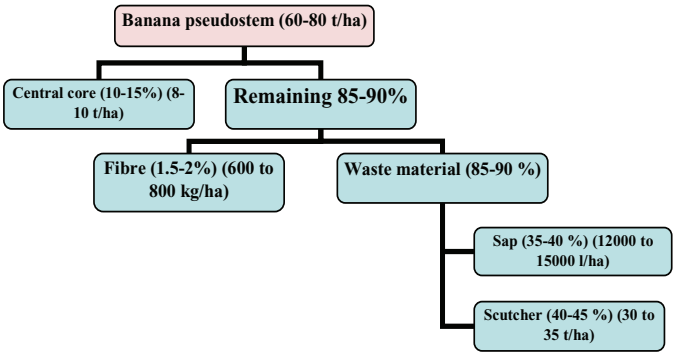

Components of banana pseudostem

I. Fibre based products

a) Fabrics

As earlier mentioned, banana plant not only provides the delicious fruit but also provides textile fibres, the banana fibre. Banana fibre can be extracted from the sheath of pseudostem either by hand or machine. The natural fibre has multifaceted uses in making various value added products. The banana fibres can be blended with cotton and jute fibres to make good eco-friendly fabrics. It is used as an alternative for garment which is commonly made from silk, so that when it comes to accessories banana fibre is frequently used for making scarves, hats and gloves as sustainable, organic products become increasingly popular. It is an eco-friendly substitute in textile industry in the place of hazardous synthetic fibres.

b) Quality grade paper

Now a days, use of polythene has grown in a larger extent because of its widely application in storage of food. But polythene is a non-biodegradable material and does not decompose when it gets buried in soil and causes accumulation of toxic substances. Banana pseudostem contains potential source of cellulose and lignocellulose which can be used for making paper. Among extracted banana fiber (EBF) and waste banana fiber (WBF), WBF are quite acceptable for handmade paper. It has many advantages such as low density; stiffness and good mechanical properties with highly disposability and renewability. It also creates employment opportunity in rural area.

c) MCC

Microcrystalline cellulose (MCC) is purified, partially de-polymerized, non-fibrous cellulose. MCC can be extracted from fibre of banana pseudostem using alkali hydrolysis process followed by further treatment with peracetic acid which is used for many pharmaceutical drugs. Also it has huge application in bakery, beverages and other health products.

d) Handicraft

Various handicraft items are prepared using banana fibre which is extracted from pseudostem. These fibrous strings can be hand-woven into various decorative bags, baskets, mats, hats, ornamental baskets, picture frame, wall hangings, table mat, pillow, dolls, etc. Especially women's can engage in this activity through self-help groups can increase their social and economic conditions.

Quality grade paper made from pulp

Extraction of fibre from pseudostem

Fabrics made from fibre

II. Sap based products

a) Liquid fertilizers and nutrient spray

The fresh sap of pseudostem can be enriched with essential plant promoting substances viz., gibberellic acid (GA) and cytokinin which can be used for plant liquid fertilizer for different crops like banana, papaya, sugarcane, etc. which may saving of about 20-40% recommended dose of fertilizers along with improving yield. Also along with sap vermiwash (1:1) can be sprayed on seedlings of vegetables crops which resulted in higher fruit setting. After long years research, NAU, Navsari developed the innovative product called as NAUROJI Novel Organic Liquid Fertilizer which contains all nutrients such as Nitrogen, Phosphorus, Potassium, Zink, Iron, Boron, Mn, Mg, Ca, S, Cu, etc. Not only these, but it also contains plant growth hormones like Gibberellic acid and Cytokines. Novel also contains bacteria which can improve soil health.

b) Mordant

The pseudostem contains tannins which are polyphenolic in nature having capacity of fixing dyes and produce crosslinks which provides excellent fastness properties. Banana sap which is extracted from the pseudostem can be used as mordant to dye silk fabric along with natural dyes like manjistha and annatto. It also has potential of dyeing cotton fabrics with stability to sunlight and slight fading.

III. Central core based products

a) Candy

The inner and most tender portion of pseudostem which is edible in nature i.e. central core can be utilized to various value added products that can be help to various self-help groups to improve their social and economic conditions. Navsari Agricultural University has developed and standardized the process of making of candy from central core which was tested by CFTRI, Mysuru. This candy has nutritionally advantageous as it contains iron and vitamins. It has opened doors for institutional suppliers like Government's mid-day meal scheme and nutrition improvement programs of UNDP and WHO.

Handicrafts made from banana fibre

NOVEL liquid fertilizer

Candy made from central core

b) Pickles

Being tender in nature, central core is used as a vegetable and also made into various pickle as alone or mix with other vegetables which improves palatability and also controls constipation.

c) Banana Pseudostem Juice

CFTRI, Mysuru and NAU, Navsari has developed 100% natural juice extracted from the pseudostem or may be juice blended with other fruits like mango, pineapple, aloevera, noni, etc, which having many health benefits like helping kidney, reduce hyper acidity, relieves constipation and cleans the urinary tract.

Vermiwash used as a fish feed

Pickle, natural juice extracted from central core

IV. Scutcher based products

a) Vermicompost and fish feed

Large quantity of about 30 to 35 t/ha is generated during the extraction of fibre. In order to utilize this many value added products have been standardized. Vermicompost can be prepared from Scutcher using cow dung and biodegradable bacterial consortium. NAU, Navsari has standardized the preparation with ratio of 70:30 of scotching waste and cow dung which is marketed in the trade name of NAUROJI. The pseudostem Scutcher was also utilized as a fish feed as cattle feed in fish culture cost high. Hence scutcher based vermicompost used as a fish feed by partially substituting with the cattle feed.

Vermicompost prepared from scutcher

Conclusion

Banana is considered such a crop which produces huge quantity of fresh biomass and so far not much attention has been given towards the waste utilization. Every year million tonnage of banana pseudostem are dumped as waste and many farmers facing many difficulties in disposing the pseudostem. In order to utilize this residue in an effective and profitable way, many agricultural universities and national institutions are undergoing many research and findings. NAIP (Component II) also plays an important role in sanctioning to improve value chain on utilization of pseudostem which can strengthen the condition of banana growers, entrepreneurs, policy makers and industry people. Using pseudostem many products can be developed which have the capacity to generate additional income and also provides eco-friendly raw materials to the industries like pharmaceuticals, textile, paper, confectionary, etc. It can also overcome unemployment problems in rural areas. Especially women can play a major role in this sector which can improve social and economic conditions of the family.

For further interaction, please write to:
Raghavendra H R, Post-harvest technology, ICAR-Indian Agricultural Research Institute, New Delhi 110 012. Corresponding author *e-mail:* raghuhorti53@gmail.com