

In fact, Nobel's centenaries can act as the significant yardstick to measure in reality, the greatest benefits which are conferred by Nobel prizes, on mankind since 100 years. Nobel prize is awarded in different fields of knowledge, namely physics, chemistry, physiology or medicine, literature, peace and economic sciences (from 1969). On the other hand, prizes alternative to Nobel prize are evolved in recent years namely the Right Livelihood Prize in Sweden

and Anti-Nobel Peace Prize in Libya. Concerned institutions and individuals have the task of celebrating these events in time.

2 *The World of Learning*, Europa Publications Ltd, London, England (C) 1987, 37th edn, p 1171

1. Alfred Bernhard Nobel, by Torsten Althin, in *Dictionary of Scientific Biography* (Editor-in-chief Charles Coulston Gillispie), Charles Scribner's Sons, New York, USA (C) 1974, Vol. X, pp. 132-133

27, 11th 'A' Cross  
Parsy Layout  
S.P. Extension  
Malleswaram  
Bangalore 560 003, India

M. B. S. CHAR

## SCIENTIFIC CORRESPONDENCE

### Sugarcane: A renewable natural agricultural resource

Sugarcane has held the attention of many from monks to monarchs. Legend has it that Lord Buddha was born to sugarcane. The crop is intimately associated with Indian mythology<sup>1</sup>. The earliest reference to sugarcane is in Atharvaveda (5000 years ago) and cane planting was well established in the Indus Valley. Further confirmation as a closely managed crop by the natives comes from the notings of Alexander in his eastern expedition. As a cultivated crop it travelled from India to Spain and thence to Africa. Columbus introduced it to the New World in 1493. It supports a strong industry and a significant part of the economy in many countries; a crop that changed the demographic character of many a country during colonial times.

Sugarcane is eco-friendly. It alters the microclimate, perhaps reduces the green house effect by more CO<sub>2</sub> fixation and O<sub>2</sub> emission. The production potential of sugarcane is very high due to its distinct anatomical and biochemical features associated with C<sub>4</sub> plants. These include, interalia, twilight photosynthesis, high specific leaf weight, porosity and LAI. Hence, a theoretical maximum cane yield is assumed to be 129 g m<sup>-2</sup> d<sup>-1</sup> or 470 Mg ha<sup>-1</sup> yr<sup>-1</sup> (ref. 2). This plant was so far regarded as a *monolithic* (sugar) crop. But it deserves a niche as a multi-product commodity providing food, fuel, fibre and fertilizer. The crop is a source of at least 38 byproducts having a value of US-\$ 8000 per ton of raw material<sup>3</sup>. Its dry biomass yield potential

at 60 Mg ha<sup>-1</sup> is unmatched by any other agricultural crop.

In sugar production nearly 60% of centrifugal sugar comes from sugarcane and the rest from sugar beet. Besides, low grade non-centrifugal sugar is consumed in Asia, Africa and Latin America. Interestingly per capita sugar consumption reflects geo-cultural preferences. A consumption of over 50 kg is observed in Cuba, Brazil, USA and Australia, while the lowest (2 kg) is in Burundi and Rwanda in central Africa. The World's average per capita sugar consumption is static at 20 kg. It is difficult to prognosticate the future pattern of sugar consumption. Increasing health concerns point to an era of reduced sugar consumption. Even criminal behaviour is associated with sugar consumption. A change in lifestyle would reduce per capita sugar consumption. But *nutritional gurus* are now convinced that except the dental caries sugar consumption has no health hazard. It is palatable, safe and nutritious. The bottom line is 'eat sugar with pleasure but with a measure'. The greatest challenge to natural sugar is from low calorie table top sweeteners like Aspartame, Acesulfam-K, etc. They are aptly called the 'Nutritional terrorists'; they are expensive and leave bitter after taste. Natural sugar will therefore be prized and the artificial sweeteners would fail to replace it.

The energy cane is essentially a management concept where a package of anatomical, physiological and agronomic features is tailored towards

growth<sup>4</sup>. It is theorised that the long internodes of cane are like an 'Open bag' of sugar where fermentable solids are available for growth. A distinct feature of energy cane is its 'invasiveness' and 'weediness'. Other special features of energy cane are expansive green leaf canopy, propensity of tillering, active crown leaves, stay green and extended root proliferation<sup>4</sup>. The agronomic package includes: closer spacing (0.45-0.60 m) with a millable cane population of over 30 m<sup>-2</sup> and high N rates (400-450 kg ha<sup>-1</sup>). The most promising energy cane cultivar is US 67-22-2 (*S. spontaneum* hybrid). We have observed that energy cane (cv Co 62175) under closer spacing (0.45 m) can yield 6000-8000 l ha<sup>-1</sup> ethanol as against 2000 l ha<sup>-1</sup> by sweet sorghum<sup>5</sup>.

A futuristic terminology for sugarcane would be fibre cane since the primary product would be lignocellulose, i.e. fibre. Fibre is defined as the residue of sugarcane (fibrous or not) after crushing in the mills and is termed as bagasse. Bagasse conservation becomes an over-riding concern to produce adequate lignocellulose and also be used as in-house boiler fuel. The calorific value ranges from 4550 to 4660 cal kg<sup>-1</sup>. The earliest record of bagasse as fuel dates back to 100 AD<sup>1</sup>. Globally bagasse production is estimated at 280 million tons with Asia and South America contributing 70% of total production. Assuming a 5% saving in bagasse for paper pulp, 2 million tons of bagasse pulp can be obtained<sup>6</sup>. Varieties differ with regard to fibre

accumulation. Among the *Saccharum* sp. *spontaneum* and *robustum* contain more fibre than *Officinarum*. The allied genera *Miscanthus* has the highest fibre of over 51 per cent.

The heterogenous character of bagasse fibre covers three distinct types: (a) rind fibres (45 to 50%), relatively longer, (b) vascular bundles in Cortex (15 to 20%), shorter fibres made of phloem and Xylem, (c) Pith parenchyma cells (30 to 35%), devoid of fibrous structure. Pith has fuel/fertilizer value but needs removal (depithing) to upgrade bagasse for pulping. Fresh bagasse can be directly fed to digesters for pulping, after depithing, but since fresh bagasse availability is limited to the crushing season, must be stored under acidic (pH 4) and anaerobic environment with proliferation of lactobacilli to prevent loss of strength properties.

The fibres in bagasse are short and comparable to hard woods like *Acacia* and *Eucalyptus*. The average fibre length varies from 1.0 to 1.5 mm and

width from 0.019 to 0.022 mm with a l/d ratio of 74 to 85. High pentosan and lower lignin confer superior strength properties. All grades of paper can be manufactured from bagasse fibres but bagasse newsprint (BNP) has come of age since the early attempts by Henry Low of Baltimore (USA). Newsprint is a low grade and low priced sheet which can fulfil the requirements of high speed printing presses. There is no rigid definition for BNP, but should contain over 60% bagasse pulp which is technically feasible and economically imperative. Three cardinal points for BNP are: (a) moist and wet depithing to remove maximum pith, (b) proper storage to prevent excessive loss in fibre properties, (c) high proportion of mechanical pulp in the fibrous furnish.

The long and short of it is that though the primary product of sugarcane is sugar it also provides biofuel, fibre and fertilizer and a myriad byproducts besides ensuring ecological sustainability. Truly, it is an eminent source of renewable natural agricultural resource.

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GURURAJ HUNSIGI  
M. A. SINGLACHAR

Department of Agronomy  
University of Agricultural Sciences  
GKVK  
Bangalore 560 065, India

## NEWS

### Developing a biodiversity information system

India signed the Convention on Biological Diversity at the time of the United Nations Conference on Environment and Development at Rio De Janeiro on 5 June 1992. With the ratification of the convention by thirty countries, it has become an International Convention on 29 December 1993.

The objectives of this convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources to technologies, and by appropriate funding.

For the purposes of the convention 'biological diversity' means the variability among living organisms from all

sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

As per article 7 of the convention each Contracting Party shall, as far as possible and as appropriate, identify components of biological diversity important for its conservation and sustainable use, monitor the components of biological diversity paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use, identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, monitor their effects through sampling and other techniques and maintain and organize data derived from identification and monitoring activities.

#### Discussion meeting

India is quite rich in the information regarding the taxonomy and distribution of its plants and animals. These information are being collected by different agencies, major among them being Botanical Survey of India and Zoological Survey of India, and it has been accumulated for more than a century. Most of this information is in the form of specimens, field data books and published reports which are stored in different locations. So making all these information accessible to scientists or other users is very difficult. But the revolution in the computer technology, both hardware and software, during the last decade or so has changed the scene completely. Now the computer-based database management systems make it very easy to store enormous amount of textual/graphical data, analyse and retrieve it efficiently.