6.0 Summary

Bamboo is arborescent plant of Global interest since beginning of civilization. Bamboo belongs to family Poaceae, members of sub–family Bambusoideae. It has distinctive life form. It has ecological importance having multifarious uses. It is considered as cheap, widespread, renewable, productive, versatile, easily accessed, environmentally enhancing resources. Today Bamboo helps more than 2 billion people meet their basic needs. Traditionally it is called ‘Poor Man’s Timber’. Bamboo shoot is a new emerging culm progressively formed from latent buds on rhizomes. It is also known as 'Juvenile Shoot' or 'bamboo sprout'. The shoots of some of the species are edible. Globally more than 500 species of bamboo produce edible bamboo shoots. In North East India it is preferred vegetables and more than 50 native bamboo species are edible. More or less bamboo shoots are consumed all over India depending upon availability of resource, culture, food habits etc. Canned bamboo shoots are also available in India. It is not uncommon to find bamboo shoot dishes in metropolitan restaurant. The INBAR (International Network for Bamboo and Rattan) has selected six species which are most suited for the development of bamboo shoot industry in India. These are Bambusa balcooa, Dendrocalamus brandisii, D.hamiltonii, D.strictus, and Melocanna baccifera. Shoot season in different countries depends largely on climatic condition, geographic location and genetic variability. In Central and East India shoot emerge during rainy season. In north East India shoot season begins at the onset of monsoon i.e. May to June and continues till early September. The current global shoot market is 1.5 billion US$ out of world bamboo market of 6.8 billion US$ excluding markets for bamboo in paper pulp production and unprocessed bamboo supplies to domestic consumption.
However, bamboo is so familiar, ever present and commonly available that it has long taken for granted and overlooked. Only in recent years long neglect has given way to the beginning of serious attention.

The resurgence of interest as a substitute for tropical timber and edible bamboo shoot as a rich man’s delicacy created interest among researcher, policy makers and entrepreneurs.

Diverse activities pertaining to bamboo research have been carried out in India. However, information on edible bamboo shoot in India is confined to only North East India. In this respect Jharkhand, recently constituted State within India is most neglected one. In Jharkhand as reported 14.51% of total forest is covered with Bamboo and mainly with Dendrocalamus strictus. In homesteads of Jharkhand Bambusa nutans constitute main species covering 84.85% of total non forest bamboo area. The other species being D.strictus (11.92 %,) and Bambusa bambos (2.26%). Dendraocalamus asper has been introduced in Jharkhand in late 1990 by IFP, ICFRE. The extent of plantation till date is negligible. Besides North East India as such, assessment for edible bamboo shoot consumption, collection and market potential has not been reported from any part of the country. Yield and duration of edible bamboo shoot and culm can be increased by adopting suitable silvicultural management like irrigation, inorganic fertilization, organic amendments, mulching, clump management, suitable harvesting of bamboo shoots, etc.

Main constraints for bamboo shoot sector in Jharkhand are (i) Shoot market is totally unorganized (ii) No information available on shoots collection, consumption and sale. (iii) Mostly collected by villagers from forest. (iv) Only a section is consuming bamboo shoot. (v) Absence of processing and packaging unit (vi) Lack of preservation technology (vii) Short duration of shoot emergence (viii) Absence of any agronomic silvicultural management practices and lack of motivation.
Taking into above consideration the present study has been undertaken with objectives (i) Assessment of shoot production and market potential in Jharkhand. (ii) To Study the influence of silvicultural management–manurial treatment, clump thinning and shoot harvest techniques on shoot emergence, duration of shoot production, shoot yield and culm growth in *Dendrocalamus asper*, *Bambusa nutans* and *Dendrocalamus strictus* and (iii) To assess the influence of grove management through organic amendments and mulching on shoot production, production period, shoot yield and culm growth and also on shoot quality of *D. asper*, *B. nutans* and *D. strictus*.

Extensive village and market survey activities have been accomplished. Information on selected village relating to demography, nearest market, distance from village to shoot collection site, distance from village to market, household owning bamboos, household consuming bamboo shoots, persons engaged in shoot collection, edible bamboo shoot species available or species utilized for edible shoots, duration of shoot season and availability, duration and frequency of collection by villagers, source of shoot, quantity of shoot collected per trip per villagers, quantity sold in market and consumed, sale price etc have been collected from village respondents.

Likewise, market information of frequency and size of markets, duration of sale, nature and number of shoot vendors attending markets, source of shoot and shoot products, frequency and duration of shoot trade by individual vendors, quantity traded and purchase and sale price of product etc. have been collected from market respondents in prescribed format. From these information, total bamboo shoot collection and their market value have been projected for the entire Jharkhand state. Similarly, nature of shoot market, the quality of shoot and shoot products traded by an individual vendor on district and region wise, total quantity traded in markets, total employment and man days generated for sale of shoot and shoot products, total quantity traded in Jharkhand with market value have been projected.
The following field trials have been undertaken at Ranchi on silvicultural measures/agronomic practices so as to study their influence on number of shoot emergence, their survival, duration of shooting season, shoot productivity and clump growth of *D. asper, B. nutans* and *D. strictus* during 2010, 2011 and 2012.

i. Effect of organic amendments and inorganic fertilization.

ii. Effect of mulching and organic amendments.

iii. Effect of clump management/thinning.

iv. Effect of shoot harvest.

The shoot quality due to the influence of mulching and soil organic manure of three species as reflected through nutritional and anti-nutritional parameters has been assessed through laboratory analysis.

The trial was conducted for improving the growth and yield of bamboo shoot and timber. In agronomic practice trial was conducted by application of inorganic fertilizer, organic amendments, mulching, clump management and bamboo shoot harvest. The qualitative assessment of bamboo shoot was conducted of bamboo shoot obtained in the trial after application of organic amendments and mulching.

Field trials had been conducted in 4 year old *B. nutans* and *D. strictus* and 7 year old *D. asper* plantations in RBD with three replications for assessing the effect of inorganic fertilizer and organic amendments. In the trial three treatments with application of organic treatments and three sub treatments with application of inorganic amendments were given.

For assessing the effect of mulching and organic amendments trials were conducted in 4 year old *B. nutans* and *D. strictus* and 7 year old *D. asper* plantations in RBD with three replications. In
the trial four treatments with application of mulching and three sub treatments with application of organic amendments were given.

For assessing the effect of clump management, field trials had been conducted in 15 year old _B. nutans_ and _D. strictus_ and 7 year old _D. asper_ plantations in RBD with three replications.

For assessing the effect of bamboo shoot harvest, clumps of the respective species from 4 year old plantations were selected. The treatments were 5 replications in _D. asper_ and _B. nutans_ and 4 replications in _D. strictus_. The shoots were harvested every year from 2010 to 2012 after emergence during July to September retaining the number of shoots according to the treatments maintained in RBD. Laboratory analysis for shoot quality assessment has been carried out as per available standard methods.

The result for village and market survey reveals that the most common edible species of Jharkhand is _D. strictus_ with occasional consumption of shoots of _B. nutans_ which are available during August and September mainly. Though shoot in some pockets are available for extended period of 75 days. Majority of the villagers (68%) have to travel 2 to 10 km for shoot collection while 27% less than 2 km and only 5% more than 10 km. On the other side, for sale of shoots to markets 65% collectors have to travel 2 to 10 km distance and 22% upto 2 km and 13% more than 10 km. Per head shoot collection has been found to be meagre in Jharkhand, on an average, from 1.5 to 15.0 kg per trip and out of these total collection 76.4 to 92.7% of collected shoots in districts are being sold by the collectors, not only in markets, but also among fellow villagers and villagers of other villages. Bi-weekly is the commonest frequency (35.6%) followed by weekly (26.1%), tri-weekly (21.8%), thrice in a month (6.4%), monthly (1.5%) and daily (1.2%). On an average, per head seasonal shoot collection ranges from 85.6 to 117.9 kg. The sale price of bamboo shoot varies greatly not only from month to month but also from place to place and even within a locality and within the same day. The projected yearly bamboo shoot collection for edible
purpose in Jharkhand has been found to the tune of 27.349 thousand metric tonne valued at Rs. 703.02 million.

In market survey the duration of 50 to 55 days is the most common market days by the traders. It had also been noted that a maximum of 37.5% of vendors attended market for 10-20 days in a season followed by 34.2% for 20-30 days, 17.8% for 30-40 days, 9.2 % for 40-65 days and only 1.3% attended less than 10 days. The quantities of fresh shoot or karil a retailer sold in markets ranging from a minimum of 2.5 kg to as high as 110 kg whereas the crushed-fermented moist shoot or sandhana from as low as 1.5 kg to 45.0 kg. On the other hand, a wholesaler sold karil from 5 to 100 kg and sandhana from 25 to 85 kg per market visit. On market basis, the lower and upper levels of total sale of raw shoot were 42 and 12,065 kg and that of fermented product or sandhana were 78 and 13,800 kg respectively, the lower figure was from East Singhbhum while the higher from Chatra. The purchase price of juvenile bamboo shoot varied from Rs. 25 to Rs. 40 per kg and the sale price from Rs. 35 to Rs. 49 per kg. As per the projection, Jharkhand is presently provides employment to 6,713 people which is equivalent to 1,79,098 man days solely for sale of bamboo shoot and fermented shoot excluding man days involved in collecting or purchasing from primary and/or secondary vendors.

The result in the trial for inorganic fertilizer and organic amendments showed that both inorganic and organic amendments had effect on emergence of shoots. With highest dose of both organic and inorganic amendments emergence of shoot was maximum. Minimum was in control. In subsequent years number of shoot emergence was more than the previous years. Comparing the three species B. nutans had maximum emergence and D. strictus least. As per ANOVA treatment is significant. Survival of shoot had same effect as emergence of shoot. Even there is positive correlation between emergence of shoot and its survival. In duration of emergence the trial had marginal effect on increasing the duration. The increase was not systematic in three year in all the
three species. However, duration was also found for 90 days in case of *B. nutans*. In case of culm length, with application of inorganic fertilizer and organic amendments there was increase. For organic amendments the dose of vermicompost @ 10 Kg per clump was sufficient for *D. asper* and *B. nutans* with few exceptions. With application of inorganic fertilizer, higher dose increases culm length except for *D. strictus* during 2011 and 2012. In diameter growth (DBH), the organic and inorganic amendments had positive influence for all the species during three years. Comparing three species the maximum was in *B. nutans* and minimum in *D. strictus*.

In the other agronomic trial with different mulching material and different dose of organic amendments the mulching and organic amendments had positive influence on emergence of shoot. The use of mulch material in addition to two levels of organic amendments supported increase in shoot emergence. Based on mean value, irrespective of organic treatments, maximum emergence was in polythene sheet followed by rice straw and bamboo leaves. Similarly irrespective of mulch material maximum no shoot emerged with increasing dose of organic manure for all the species in all the three years. The treated clumps favoured progressive increase in shoot with years. The influence on survival was similar to emergence of shoot. Even correlation is positive in emergence and survival of shoot. Effect of treatment on duration of emergence of shoot was very marginal. Bamboo leaf mulch had shown significant positive influence while polythene sheet mulch had shown positive but insignificant influence on culm length growth in *D. asper* during 3 years of trial. Though the mean culm length of *B. nutans* had increased, as affected by the coverings, it was only significant during 2012. In *D. strictus* also it was insignificant during 2011 and 2012. Organic manure also had shown some positive influence. Comparing the three species higher length was associated with *B. nutans* followed by *D. asper* and *D. strictus*. Significant negative role of polythene sheet mulch had been noted for DBH of *D. asper* in all the three years as recorded for culm length also. The other mulch, the bamboo leaf and rice straw
supported no effect on the species during 2010 and 2011 but conversely increased the DBH significantly during 2012. The DBH for *B. nutans* for 3 years though marginally increased due to treatments, the effect was insignificant. The same is the effect with *D. strictus* during 2010 but mulch had positive significant effect in enhancing culm diameters of the later species during 2011 and 2012. The effect of polysheet, in this respect was more than rice straw and minimum in bamboo leaf.

In the trial for clump management/thinning, removal of 50% of clumps more than 2 year old has supported maximum shoot emergence followed by either 100% removal of more than 2 years old culm or 100% removal of more than 3 year old clumps. The survival had shown same trend as emergence of shoots. The duration of emergence due to clump management through thinning had increased universally in for all the species for three years. However, the effect was significant only in 2012 for both *D. asper* and *D. strictus*. The minimum invariably was in control. Culm thinning operations had supported better culm length in three species during 2011 and 2012 but not during 2010. The effects during 2012 are significant for *D. asper* only. But increment is not uniform for all the species during three years. Similarly there was effect of thinning in culm diameter (DBH).

Similarly in the trial with harvesting of bamboo shoot, there was positive influence on emergence of shoot. In the treatment, 50% harvesting of emerged shoot had maximum number of emerged shoot followed by 30% and 20% harvesting. Survival of shoot has similar trend as emergence of shoot. For large duration of emergence harvesting 30% to 50% is suitable. Bamboo shoot harvest also favoured increase in culm length but the pattern of increment was not uniform. Similar effect was recorded with diameter (DBH). *B. nutans* responded well in terms of culm length and diameter growth with 30% harvest of emerged shoots irrespective of year of trial while 20%
removal and 50% removal were the shoot harvest intensities favouring better culm growth in *D. strictus* and 50% of removal for *D. asper*.

As per analysis it reveals that length and basal diameter of *D. asper* shoots harvested after 7 days of emergence under different treatments vary from 58.4 to 74.6 cm and 6.4 to 8.0 cm with mean of 66.2 and 7.1 cm respectively. While the corresponding range of values were 50.1 to 77.6 cm and 53.1 to 78.1 cm in length and 6.0 to 9.4 cm and 4.1 to 6.0 cm in basal diameter for *B. nutans* and *D. strictus*. The respective mean values were 64.0 and 7.7 cm and 64.5 and 5.1 cm in length and basal diameter, respectively. There was virtually very little difference in length of the shoots. *B. nutans* shoots was thickest followed by *D. asper*.

On weight basis, the freshly harvested *D. asper* shoots weighed between 916.7 to 1,535 g/shoot while that of *B. nutans* the range was 828.1 to 1,771.1 g/shoot i.e., shoots of the latter species heavier. On the other hand, shoots of *D. strictus* were lighter in mass varying from 425.5 to 1,172.0 g/shoot with mean of 725.9 g/shoot.

As regards the edible part content as percentage of total, the maximum values were found in *B. nutans* (63.1 to 74.0% with mean of 67.9%). For *D. strictus* (52.4 to 71.8 % with mean of 60.1%) and *D. asper* (52.9 to 66.5% with mean of 60.8%), the proportion of edible parts were almost identical as grown under lateritic soil types of Chotanagpur Plateau region.

It has been noted that moisture content in freshly harvested shoots of the three species increased with decrease in fresh shoot weight and there was no differential trend in this respect among the species. However, moisture content in shoots, of *B. nutans* was slightly less (77.0 to 80.1%) irrespective of treatments. The ranges of moisture content in *D. asper* and *D. strictus* were 76.7% to 81.5% and 78.6% to 82.4% respectively. On the basis of mean moisture content, *D. strictus* was the most succulent followed by *D. asper* and *B. nutans*. 
As per the proximate analytical data all the nutrient elements are present in larger quantities in shoot tip except Ca and Mg which were found in larger concentrations in the mid part of the shoots. Further, protein contents in general, were maximum followed by those of carbohydrate and sugar. Among the nutrient elements and HCN contents the decreasing order of their concentrations in bamboo shoots, irrespective of species, were N > HCN≥K > Mg > Ca > P > Na > Fe. Among the analysed chemical constituents, shoots of *D. asper* in general is higher in HCN content only while those of *B. nutans* were in sugar, Ca, Mg and Na contents. On the contrary, maximum accumulation of carbohydrate, protein, N, P and K, were found in shoots of *D. strictus*.

In North Eastern states travelling a distance of 6-7 km and spending 4 to 7 hours a day is a common feature. (Bhatt *et al.*, 2004). In Jharkhand in the surveyed village for collection 55% travelled a distance 2.00 to 5.00 Km, 13 % travelled a distance of 5to 10 km, 5 % more than 10 Km and 27 % travel less than 2 Km. For sell 22 % travelled a distance of less than 2 Km, 42% 2.00 to 5.00 km, 23 % 5.00 to 10 Km and 13 % more than 10 Km. In surveyed village, individually it was found that villagers collect 1.5 Kg to 15.00 kg shoots per head per trip. The mean collection per head per trip was minimum in Giridih (*Zone II*) i.e., 2.0 kg while maximum in Simdega district (*Zone IV*) - 12.5 Kg. The extent of collection, self consumption, sell and storing also varied from Zone to Zone. The sell was both to market and fellow villager. The self consumption was 14.05%, 13.67%, 11.86%, and 11.66 %; sale 83.061%, 81.75%, 83.54% and 82.89%; and storing 2.98%, 4.58%, 4.60%, and 5.55 % in Zone II,III, IV and V, respectively. So the collectors were primary vendors and most of the quantities they sold. Storing was very limited. They prepare *harua* for storing and consume when fresh shoot is not available. Villagers collect Bi weekly, Tri-weekly, twice in a month and sometimes as per requirement. The maximum collection was biweekly in 35.6% and only 7.4% daily.
In market survey it was found that 58% of wholesalers attended market bi-weekly, 39% tri-weekly and 3% daily. 42.8% of the vendors, not wholesalers attend thrice a week followed by 28.3% daily 27.6% biweekly. Vendors generally collected from villager. 17.8% vendors collected themselves. Retailer sold *karil* (fresh bamboo shoot) from a minimum of 2.5 Kg to maximum of 110 Kg where as *sandhana* (crushed fermented shoot) 1.5 Kg to 4.5 Kg.

In Jharkhand from surveyed village it is projected that 0.76% of total population is engaged in shoot production. 6,713 people equivalent (1,79,098) man days are involved solely in sale of bamboo shoot as retailer or whole seller. From selected village survey the projected shoot product was 27.349 thousand metric ton having market value of Rs 703.02 million and sale is 59.061 million.

Management factors that influence shoot production fall mainly under irrigation, fertilizer, mulching and thinning operation (Kleinhenz and Midmore, 2001). In the present study attempts have been made to increase shoot production, its duration and yield through application of organic matter, inorganic fertilizer, mulching, clump density regimes, and bamboo shoot harvesting in *D. asper, B. nutans* and *D.strictus*. Irrigation plays dominant role, but next to irrigation, fertilizer application and manuring are the primary and foremost means of means of maintaining soil productivity. The exceptionally rapid flush of growth of below ground shoots and above ground culms requires net import of energy and nutrients. The greater part of nutrient ions originates via absorption from the soil during the shoot season. Nutrient application shortly before and during shooting season is vital as during the present trial. Fertilizer and manure had been applied during rainy season. In case of deficient rain irrigation was provided. Beneficial role of fertilizer have been supported in various studies (Hong, 1987; Ahmad and Haron, 1994; Widjaja, 1991; Qiu et al., 1992, Lakshmana 1994a; Suzuki and Narita, 1975). The shoot season is characteristic unique
to each species, for reasons not clearly known (Midmore, 2009). Supporting this view three species had shown different behaviour. With application of inorganic fertilizer and organic amendments in present trial mean duration of emergence had increased 60 days in comparison to 33.3 days in untreated clumps. Application of organic manure increased the humus in the soil, increased its physical and chemical properties, increased the capacity in keeping it warm, and preserving its moisture and fertility. The rhizome can grow easily without any barrier (Quiou and Maoi, 1985). Organic manure acts as a slow releasing fertilizer. With repeated application it adds to consistent improvement in physical soil health. Organic manure also adds N and other nutrient. Being slow releasing, it counters the leaching effect of inorganic fertilizer. Due to dense root mat system, the leaching due to inorganic fertilizer in bamboo is also less.

For centuries, mulching has been recognized as a beneficial practice in agronomic system where it is often enhance growth and yield of annual and perennial crops (Traux and Grangnon, 1993; Robinson 1988; Tarara, 2000). Materials used as mulches vary depending on number of factors. Mulch is usually but not exclusively organic in nature. The enhancement in growth and yield has been attributed to the reduction in vegetative competition in the rooting zone (Davis, 1994; Adams, 1997) and increases in the availability of key soil resources such as N and water (Truax and Gragnon, 1993; Wien et al., 1993; McDonald et al., 1994). Mulching has also been shown to accelerate early root growth and nutrient uptake (Robinson, 1988; McDonald and Helgerson, 1990; Wien et al., 1993). The main purpose of using covers and mulches in bamboo stands is to protect rhizomes, roots and new shoots from excessively warm or cold temperatures and from solar radiation (Chaturvedi 1988; Fu and Barik, 1995; Zheng et al.; 1996a; Zheng et al., 1996b). The positive influence of mulches, both natural and synthetic may be ascribed to multifarious factors. Plastic mulches, while compared to other mulches, are completely impermeable to water, thus prevent direct evaporation of moisture from the soil and thus limit water loss. Plastic mulches
can reduce the loss of plant nutrient through leaching, provide barrier to soil pathogens, prevent germination of weeds, repel certain insects and even maintain a warm condition during night time enabling in establishment of strong root growth system. Above all, plastic mulches have exceptionally high soil solarisation effect and thus control soil borne plant pathogens including those of fungi, bacteria, nematodes and also insect and mite pests along with weed seed (Ahmed et al., 2013).

It is well known that annual yield of a bamboo clump depends on the number of new culms produced each year. Young culms contribute greatly to the health of the clump through photosynthesis in their new leaves. The foods that synthesize are partly consumed by leaves but the greater proportion is transported to the rhizomes, stored as energy and is converted into next year’s new shoots (Zhaohua and Yang, 2004). Thus a ‘too old’ or ‘too young’ age structure of a stand may constrain stand productivity through decreases in the photosynthetic capacity of the canopy or in the photosynthetic active leaf area, respectively (Kleinhenz and Midmore, 2001). Lakshmana (1990) showed that 1 year old standing culms contributed 77% to annual production of new culms in *B. arundinacea* while 2-year old culms 20% and culms of above 2 year old only 3%.

The recommended length of young shoots for harvesting is generally up to 45 cm or 50 (Choudhury et al., 2010), in the present study, shoots of all the species had attained the length from 50 cm to 80 cm with mean of about 65 cm. This length is comparatively larger than recorded by Marquez (2009) from Capiz, Philippines with *Bambusa blumeana*. The results, concerning the nutritive and anti-nutritive values have failed to manifest any remarkable trends for the treatments assigned to *D. asper, B. nutans* and *D. strictus* clumps. Some inter species variations and variations due to shoot parts have been recorded. Nevertheless, the information is of immense
value for popularizing shoots of other species than *D. strictus* which is universally accepted for its juvenile shoots throughout the Central and Eastern part of India.

**Conclusions**

In Jharkhand, there is enough potential of bamboo resources. The people have a preference for edible shoot as food. The main species are *D. strictus* followed by *B. nutans*. The main source is forest areas having natural bamboos. There is enough potential to increase the coverage by raising plantation both indigenous and exotic. Plantations will help people to collect from nearby areas, thus saving time and money. Value addition of bamboo shoot can be done by establishing packaging industry. This will fulfil demand of local people and increase earnings. Bamboo shoot based livelihood can also be one of the options. Some exotic species like *D. asper* can also be introduced.

The production of bamboo shoot, its duration of emergence and culm yield can be increased by silvicultural practices As per study, all silvicultural practices, application of organic amendments and inorganic fertilizer, mulching clump management by thinning and bamboo shoot harvest should be applied. Irrigation is also a prime requirement.

With increase in dose of organic amendments and inorganic fertilizers (NPK), there is considerable increase in emergence and survival of shoots, marginal increase in duration of emergence, culm length and culm DBH. In the study, the best result was found with NPK (300gm, 200gm, 200gm) and 20 kg vermicompost per clump. However the dose depend on soil nutrients conditions.

Mulching is also essential. Polythene sheet is better in mulching followed by rice straw and bamboo leaves. The duration, culm length and culm DBH has marginal effect and varies with the mulching material, but mulching is essential requirement.
Culm thinning by removal of more than 50% culm of 3 and 4 years old is best for emergence of shoots and its survival. Duration is maximum in case of removal of more than 100% of 2 years old as more space is available for shoot emergence. But since the objective is to get more shoot also along with duration, the practice recommend is of 100% retention of 1 or 2 years old and 50% 3 and 4 year culm.

Bamboo shoot harvest intensity for emergence of shoot, duration, culm length and culm DBH is maximum in 50% bamboo shoot harvest.

As per qualitative assessment of bamboo shoot, *B. nutans* shoot was thickest having highest mass. *D. strictus* was lightest. *D. strictus* is also the most succulent followed by *D. asper*. Among the nutrient elements and HCN contents the decreasing order of their concentrations in bamboo shoots, irrespective of species, are N > HCN ≥ K > Mg > Ca > P > Na > Fe. Among the analysed chemical constituents, shoots of *D. asper* in general were higher in HCN content only while those of *B. nutans* were in sugar, Ca, Mg and Na contents. On the contrary, maximum accumulation of carbohydrate, protein, N, P and K, were found in shoots of *D. strictus*.

In absence of systematic documentation and records on bamboo shoot collection, consumption and sale in Jharkhand and studies related to management of bamboo clumps for yield enhancement, the present observation and information could be used to frame a comprehensive bamboo shoot policy and also to commercializes the available resource through setting up of processing and packaging units. This would not only improve the economy of the state but also uplift the socio-economic status of rural people.