Food and Nutrition Security Community

Solution Exchange for the Food and Nutrition Security Community
Consolidated Reply

Query: Bamboo Usage in Livestock and Poultry - Experiences; Referrals

Compiled by Gopi N. Ghosh, Resource Person, Raj Ganguly, Consultant and T. N. Anuradha, Research Associate

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From M. Islam Barbaruah, Fellowship for Agri-Resource Management and Entrepreneurship Research (FARMER), Guwahati

Posted 15 January 2009

Bamboo is used traditionally in our country, in construction of houses, household appliances, storage structures, livestock and poultry sheds and in various other forms in rural areas, since time immemorial. There are also references of feeding bamboo charcoal to cattle for minimizing the odor of cattle sheds. We at FARMER are implementing a project in North East India funded by Cane and Bamboo Technology Center (www.caneandbamboo.org) under National Bamboo Mission (http://www.icfre.org/UserFiles/File/BTSG/concept_note_13112007.pdf) India. Considering the low appreciation value for bamboo amongst rural farmers, the project aims at scouting, documenting and standardizing bamboo use in livestock and poultry. It also envisages steps to encourage entrepreneurship and educate people on use of technology in making their bamboo items / structures durable and appropriate.

Till date we have scouted interesting uses of bamboo by small holder dairy and poultry farms which include raised cattle/poultry sheds and uses like bamboo cages designed for small holder layer farms producing eggs. You can download a poster at http://www.solutionexchange-un.net.in/food/cr/res08010901.pdf (Size: 3 MB) view some of the grassroots innovations. There is ample scope to commercialize bamboo use in smallholder livestock farming, as these are locally available, durable and economical. The design of such bamboo usage/structures can also be enhanced to a great extent with modern scientific treatment and processing, to enhance durability and efficacy.

The knowledge gained and output of the above project can be of immense importance for smallholder commercial poultry (up to 2,000 birds) and dairy (20-30 animals, stall fed condition). Use of bamboo (a locally available resource for most of the farmers) will not only reduce cost on fixed asset but also permit smallholder farms to expand/reduce the farm size/shift operations with limited investment.

We would like to request esteemed members of this community to share:

- Experiences related to bamboo use in livestock and poultry farming along with scope for scaling up of any specific use

- Reference of organizations undertaking similar projects and knowledge gained
- Any other use of bamboo in livestock farming besides construction of sheds and appliances

We also plan to share the consolidated reply of this query during forthcoming VIII World Bamboo Congress, 16-18 September 2009 to be held at Bangkok, Thailand.

Responses were received, with thanks, from

1. **Rajib Lochan Pathak, Udyogini, New Delhi**
2. **Pitam Chandra, Indian Council for Agricultural Research (ICAR), New Delhi**
3. **Namrata Pathak, Amity School of Natural Resources and Sustainable Development, New Delhi**
4. **C. M. Muralidharan, Consultant, Chennai**
5. **Ashok Kumar Pathak, Consultant, Uttar Pradesh**
6. **M. Islam Barbaruah1, FARMER, Guwahati**
7. **Sarala Gopalan, All India Women's Funds Association, New Delhi**
8. **H. S. Sharma, K. M. Modi Institute of Engineering, Ghaziabad**
9. **S. G. Dalvi, Vasantdada Sugar Institute, Pune**
10. **Jeevanandhan Duraisamy, Food and Agriculture Organization of the United Nations (FAO), Rome (Response 1; Response 2)**
11. **Manoj Singh, Independent Consultant, New Delhi**
12. **Raj Ganguly, Consultant New Delhi**
13. **K. V. Peter, World Noni Research Foundations, Chennai**
14. **Usha Srinivasan, Development Alternatives, New Delhi ***
15. **Shailja Kishore, Aga Khan Rural Support Programme (India), Ahmedabad ***

**Offline Contributions*

Further contributions are welcome!

Summary of Responses

Bamboo is the fastest growing plant on earth. It is an extremely versatile and useful material used in everything from food to scaffolding. Exploring uses of bamboo in livestock and poultry farming, members shared information on innovative experiments with bamboo along with references of organizations that are working to leverage technological innovations and ideas to enhance the utilization of bamboo.

Appreciating the **versatility of bamboo**, respondents pointed out that it is one of the most useful forest produce. Bamboo has the ability to regenerate within three years, making it a renewable structural material, and the Planning Commission of India has placed bamboo among the 13 plants identified as sources for renewable energy. It also has many characteristics that enable it to be extensively used in fabricating tools and implements, as well as for building material. However, members also highlighted the lack of data on the engineering properties of bamboo (unlike other structural materials), making it difficult to undertake the designs for using it in housing and other structural uses.

Discussants shared varied **experiences using bamboo for livestock and poultry farming**. In some areas of **Assam,** bamboo cages are used for rearing layer breeds of chickens, which has helped improve egg production and enabled farmers to sell their eggs in urban markets**.** In **Bihar,** during the River Kosi flood, cattle survived on bamboo leaves as fodder. Similarly in **Himachal Pradesh,** communities use the bamboo species *Dendrocalamus hamiltonii* as a fodder plant for their cattle during winter when there is no green fodder**.**

Further, members reported the use of bamboo leaves as fodder for ruminants, rabbits and fish in **Nepal** and **Vietnam**. Additionally, in the southern and northern Terai of **Nepal**, bamboo is one of the main sources of fodder for cattle and buffaloes during the winter season. In **Taiwan and Thailand,** people utilize bamboo in the construction of simple shelters, cages, perches, and nests for native chickens and as a "bamboo brooder" (multiple nests for laying ducks) for ducklings**.** Raised bamboo platforms are also used in **Bolivian** poultry houses. A study on bamboo leaves reported Dry Matter content (87-94%) and crude protein content (12-15%) comparable to those of other tree leaves.

Members also suggested the use of bamboo tubes in forced feeding technology for cattles as a low cost tool. Also, in poultry farming feeding troughs and waterers, can be made of bamboo. They further shared useful information on innovative use of bamboos in poultry.

Moreover, in **Japan,** an extract from bamboo shoots is used as a fly management technique in poultry houses and it is utilized as a deodorant in some wastewater treatment processes. Additionally, the Food and Fertilizer Technology Center found that feeding bamboo charcoal powder to domestic animals including cattle, pigs, and poultry was beneficial.

Along with using bamboo for farming purposes, in North-East India, other livelihood options include use of bamboo for infrastructure (river bridge, rope bridge), fuel (bamboo charcoal, bamboo waste), household utility items (mats, utensils), food and medicine (bamboo shoot), fashion accessories (hats, ornaments) and housing (bamboo walls, columns, trusses, ropes, fences, to extent roofs).

In addition, bamboo is used to make baskets, winnowing trays, mats, musical instruments, toys, walking sticks, rafts, boats, furniture, handmade paper, handlooms, curtains and blinds, toothpicks, chopsticks, incense sticks and various other products. About half of India's bamboo is consumed in the process of making paper pulp, which has excellent great market value and huge profit margins. People also use bamboo shoots in the preparation of vegetables, as well as for various horticultural purposes. In **Kerala** bamboo is extensively used as construction material in place of Ferro cement for reinforcing structures. Bamboo is also used for building rainwater harvesting tanks, however discussants noted this involves the risk of fungal infection/microbial attack.

Members also offered **suggestions** for increasing the use of bamboo:

- Conduct feasibility research on technology and management aspects, looking at the traditional skills of communities with using bamboo
- Develop bamboo from an engineering point of view as a 'structural material'
- Document the "know-how" bamboo usage among tribal communities
- Experiment on Fodder for pigs, cows, sheep and goats
- Popularize the *Dendrocalamus hamiltonii* species of bamboo
- Promote bamboo charcoal as an alternative livelihood for small farmers
- Differentiate multifarious usage of bamboo and rattan to leverage its' unique advantages

The main **problem with using bamboo**, respondents noted is preservation. Fungus and insects quickly attack harvested bamboo. To help address this problem, the Zero Emission Research and Initiatives (ZERI) has developed a simple system for naturally preserving bamboo. Discussants also mentioned a practice that uses cashew shell oil as a preservative for lengthening the life of bamboo mats. Another issue flagged the use of bamboo in poultry farming given the increased incidents of Highly Pathogenic

Avian Influenza (HPAI). Bird fecal droppings carry the virus and it is very difficult to sanitize bamboo structures as compared to metal structures. Members also raised concerns over the lack of documentation on the latest technological and scientific innovations using bamboo, and urged organizations to take this issue up.

Finally, discussants provided a wide-ranging list of **organizations** promoting bamboo as a livelihood option and encouraging technological innovations towards product diversification.

Overall, members appreciated the multifaceted use of bamboo and the immense research and development it has already gone through. It is now a question of leveraging it to its' utmost potential.

Comparative Experiences

Himachal Pradesh

Bamboo Leveraged as a Key Source of Livelihood, Palampur *(from Jeevanandhan Duraisamy, FAO, Rome)*
The Indo-German Changar Eco-Development Project (IGCEDP) identified the bamboo species widely grown in the region and popular among farmers for crafts, especially poor traditional craftsmen. Currently, six groups of farmers are producing a wide variety of bamboo products like mats, bags, file covers, fans, baskets, folding stools, TV stands, hangers, soap cases, ash-tray, cots, and table. Farmers are now earning between Rs 1,700 and Rs 2,200a year. Read more

Assam

Bamboo Cages help Improve Egg Production, Golaghat and Sibsagar Districts *(from M Islam Barbaruah, FARMER, Guwahati)*
FARMER has been able to popularise small scale rearing of improved layer birds (breeds producing more eggs than indigenous birds) enhancing availability of fresh eggs to the urban populace and provision of low cost bamboo cage has further helped farmers to make flexible commercial bamboo cages for keeping 5-10 birds, that is sold to mostly urban households. Read more

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Related Resources

Recommended Documentation

From M. Islam Barbaruah, FARMER, Guwahati

National Bamboo Mission
Note; by Shashi Malik; Forest Research Institute; The Forester; Dehradun; September 2007
Available at http://www.icfre.org/UserFiles/File/BTSG/concept_note_13112007.pdf (PDF Size: 160 KB)
Narrates the objectives and strategies of the Mission, which include various ways to promote plantation, product diversification and marketing of bamboo

Innovative Bamboo Use in Pultry and Dairy
Project Poster; FARMER; Guwahati
Available at http://www.solutionexchange-un.net.in/food/cr/res08010901.pdf (PDF Size: 3 MB)
Provides pictorial depiction of the various innovative uses of bamboo in poultry and livestock production

From Manoj Singh, Independent Consultant, New Delhi

Integrated Fly Management in Poultry Houses in Japan
Article; by Yuichiro Tabaru; Sankyo Co., Ltd.
Available at http://www.icup.org.uk/reports%5CICUP635.pdf (PDF Size: 527 KB)

Reports on a fly attractant extracted from bamboo shoots that was found to be very effective against the lesser house fly

Bamboo Poultry House
Note; by Harlan Attfield; Poultry Feeding in Tropical and Subtropical Countries; Food and Agriculture Organization of the United Nations (FAO); Rome
Available at http://www.cd3wd.com/cd3wd_40/vita/poultry/EN/POULTRY.HTM

Provides information on constructing a bamboo poultry house with a thatch roof and slat walls, which provides good ventilation

Use of Bamboo Charcoal to Remove the Bad Smell of Manure (*from Raj Ganguly, Independent Consultant, New Delhi)*
Note; Food and Fertilizer Technology Cente for the Asia Pacific
Available at http://www.agnet.org/library/pt/2002013/

Mentions how cattle sheds generally have a bad smell from animal wastes, and how bamboo charcoal can be used to improve the smell of cattle sheds

From Jeevananadhan Duraisamy, FAO, Rome

Public Health Interventions for Prevention and Control of Avian Influenza
Manual; World Health Organization; March 2006
Available at http://203.90.70.117/PDS_DOCS/B0237.pdf (PDF Size: 2.1 MB)

Page 18 of the manual explains that using poultry cages made of plastic or non-toxic metal are easier to clean and disinfect than bamboo cages, which are more difficult to clean and sanitise

Preserving Bamboo and Making it a Source of Livelihood
Article; by Ravinder Sood; The Tribune; 7 September 2004
Available at http://www.tribuneindia.com/2004/20040907/himachal.htm#8

Describes project initiatives that have identified bamboo as natural resource that can emerge as a major vocation for farmers, especially poor traditional craftsmen

System Study on Sedentary Gaddis of Kangra Valley
Paper; by Bimal Misri and Inder Dev; Indian Grassland and Fodder Research Institute; Palampur; 2001
Available at http://gbpihed.gov.in/envis/HTML/vol91/vol91Misri.html

Survey presents socio–economic status, livestock rearing practices and feeding strategies adopted by the sedentary Gaddis

Rate and Extent of Digestion and Potentially Digestible Dry Matter and Cell Wall of Various Tree Leaves
Article; by B. Slngh, H.P.S. Makkar and S. S. Negi; Indian Veterinary Research Institute, Palampur; Journal of Dairy Science; 1989
Available at http://jds.fass.org/cgi/reprint/72/12/3233.pdf (PDF Size : 496 KB)

Describes potential of the bamboo species D. hamiltonii in terms of digestibility- rates of digestion, amount of digestible fiber, indigestible residue and discusses its use as livestock feed

Use as Ringal as Fodder in Himalayas
Note; National Mission on Bamboo Applications
Available at

http://www.bambootech.org/subsubtop.asp?subsubid=109&subid=39&sname=STATE&subname=UTTARANCHAL#bm_activities

Informs about the dominant bamboo species- ringaal, a typically thin, reedy, shrubby, thornless and clump forming plant, and explains that the leaves widely are used as livestock fodder

Bamboo (*from Usha Srinivasan, Development Alternatives, New Delhi)*
Note; Zero Emmission Research and Initiatives
Available at http://www.zeri.org/case_studies_bamboo.htm

Provides information on the practical uses of bamboo, including as construction material, toilets, and other various products, such as chemical free preservation of bamboo

From Raj Ganguly, Consultant, New Delhi

Understanding Poultry Meat and Egg Production
Technical Paper; by Dr. H.R. Bird; Volunteers in Techni- cal Assistance
Available at http://www.bcca.org/services/lists/noble-creation/poultry.html

Intended to be used as guidelines to help people choose technologies that are suitable to their situations for poultry including use of bamboo

Handy Farm Devices and How to Make Them
Note; by Rolfe Cobleigh; Small Farms
Available at http://journeytoforever.org/farm_library/device/devices5.html

Mentions a poultry feed hopper for feeding ground grain has proved very useful also provides various designs of the same

From T. N. Anuradha, Research Associate

Improved Management Practices for Culinary Bamboo Shoots
Report; by V. Kleinhenz and D. J. Midmore; Rural Industries Research and Development Corporation; May 2002
Available at http://www.rirdc.gov.au/reports/AFO/02-035.pdf (PDF Size: 890 KB)

Addresses key issues identified by bamboo growers, including production issues (i.e. water and nutrient usage and culm management) and post-harvest issues

What makes Good Rattan, Wicker and Bamboo Furniture?
Note; Sun Valley Rattan
Available at http://www.sunvalleyrattan.com/index.php?page=processing

Provides information on the production and processing for bamboo and rattan, including commonly committed mistakes and do's and don'ts

Recommended Organizations and Programmes

Cane and Bamboo Technical Centre (CBTC) India, Guwahati *(from M. Islam Barbaruah, FARMER, Guwahati)*
Zoo-Narangi Road, Narikal Basti, Guwahati, Assam 781024; Tel: 91-361-2410242/886; Fax: 91-361-2410250; info@caneandbamboo.org; http://www.caneandbamboo.org/nbm.htm

Involved in talent scouting, training, technology sourcing and creating market linkages to give a new thrust to the bamboo sector; including ways to use it to meet livestock needs

Udyogini, New Delhi *(from Rajib Lochan Pathak)*
A-36, 2nd Floor, Gulmohar Park, New Delhi 110049; Tel: 91-11-41651175; Fax: 91-11-41651175; mail@udyogini.org; http://www.udyogini.org/field_project.asp

Implementing a project on non-timber forest produce (NTFP), which includes developing micro-enterprises that involve using bamboo

Action for Food Production (AFPRO), New Delhi (*from C. M. Muralidharan, Consultant, Chennai)*
25/1-A Pankha Road, D-Block, Janakpuri, New Delhi 110058; Tel: 91-11-28525452/2575/5412; Fax: 91-11-28520343; afprodel@afpro.org, ed@afpro.org, pd@afpro.org, atfg@afpro.org; http://www.afpro.org/Innovations.htm

Has worked out a model that uses bamboo instead of brick to construct the leach pit toilets

National Mission on Bamboo Applications, New Delhi *(from Ashok Kumar Pathak, Consultant, Uttar Pradesh)*
2nd Floor, Vishwakarma Bhawan, Shaheed Jeet Singh Marg, New Delhi 110016; Tel: 91-11-42525646/66/54; Fax: 91-11-26962267; bamboo@bambootech.org; http://www.bambootech.org/Gallery.asp?sname=GALLERY&rand=BON56

Developing a bank of visual material on the many aspects of bamboo, from species to cultivation to processing and product development.

Canada's Bamboo World, British Columbia, Canada *(from Sarala Gopalan, All India Women's Funds Association, New Delhi)*
8450 Banford Road, Chilliwack, BC, V2P 6H3 Canada; Tel: 604-792-9003, 604-596-2090; Fax: 604-792-9004; info@bambooworld.com; http://www.bambooworld.com/index.html

Collectors of rare, cold hardy bamboo plants and exotic bamboo plants

Appropriate Rural Technology Institute (ARTI), Pune *(from S. G. Dalvi, Vasantdada Sugar Institute, Pune)*
2nd Floor, Maninee Apartments, Survey No. 13, Dhayarigaon, Pune 411041 Maharashtra; Tel: 91-20-439-0348/4392284; Fax: 91-20-4390348; adkarve@pn2.vsnl.net.in; http://www.littlehut.org/project1/profile.asp

Has developed various technologies for using bamboo, like constructing scaffolding for grapes, greenhouses, fences, and water tanks out of bamboo

Kerala Forest Research Institute, Peechi *(from K. V. Peter, World Noni Research Foundations, Chennai)*
Peechi, Kerala 680653; Tel: 91-487-2699037/0100; Fax: 91-487-2690111/21; kfri@kfri.org; http://www.kfri.org/html/bamboo.htm

Conducted extensive research on bamboo, along with holding training programmes and maintaining a good germplasm supply of bamboo and rattan

From Jeevanandhan Duraisamy, FAO, Rome

International Network for Bamboo and Rattan, New Delhi
A-408, Defence Colony, New Delhi 110024; Tel: 91-11-24334801/02; Fax: 91-11-24334804; subramony@inbar.int; http://www.inbar.int/Board.asp?Boardid=173

Dedicated to improving the social, economic, and environmental benefits of bamboo and rattan towards diversification and use of its products

Indian Veterinary Research Institute (IVRI)
Izatnagar, Uttar Pradesh 243122; Tel: 91-581-2300096; dirivri@ivri.up.nic.in; http://ivri.nic.in/about/campuses/palampur.htm

Primarily focused on developing animal feeding systems using locally available feed resources, like bamboo

Chaudhary Sarwan Kumar Himachal Pradesh Agricultural University, Palampur

Krishi Vishvavidyalaya, Palampur, Himachal Pradesh; Tel: 91-1894-230465; Fax: 91-1894-203511; http://hillagric.ernet.in/education/cohs/frm/extension_activities.htm

Extension activities include micro-training for rural women on bamboo articles, brooms and mat making, including research on using bamboo as fodder for livestock

Uttaranchal Bamboo and Fiber Development Board, Dehradun
Watershed Management Directorate, Indra Nagar Colony, Dehradun, Uttaranchal; Tel: 91-135-2760897; Fax: 91-135-2761155; info@ubfdb.org; http://www.ubfdb.org/index.htm; Contact S. T. S. Lepcha; ceo@ubfdb.org

Working towards realizing the economic, social and environmental potential of bamboo and fiber utilizing present and future resources

Recommended Portals and Information Bases

From Manoj Singh, Independent Consultatn, New Delhi

Poultry Production: Low Cost Technology, Food and Fertilizer Technology Centre for the Asia and Pacific Region, Taiwan
http://www.agnet.org/library/bc/50005/

Provides information on technology for poultry rearing using local materials like bamboo, low-cost poultry feeds and cages

Poultry Housing
http://www.smallstock.info/info/genhusb/poultry-house.htm

Contains detailed information on raised bamboo platform based poultry houses in Bolivia

From Jeevanandhan Duraisamy, FAO, Rome

Bamboo on Pastoral Farms in New Zealand
http://www.forestfloor.co.nz/ff/bamboopastoral.htm

Portal provides information on the main uses of bamboo in New Zealand, where people plant Bambusa oldhamii for horticultural shelter

Dendrocalamus Hamiltonii
http://www.inbar.int/publication/txt/tr17/Dendrocalamus/hamiltonii.htm

Provides complete information on the bamboo species, including material on nutritive value of leaves as fodder and also data on seasonal variations

Livestock and Poultry Production, The New Zealand Digital Library Project *(from Raj Ganguly, Consultant, New Delhi)*
http://nzdl.sadl.uleth.ca/cgi-bin/library?e=d-00000-00---off-0cdl--00-0--0-10-0---0---0prompt-10---4-------0-1l--11-en-50---20-about---00-0-1-00-0-0-11-1-0utfZz-8-00&a=d&c=cdl&cl=CL1.13&d=HASH77cea0366bd82f63dcc250.14

Documents extensive information on low cost livestock and poultry management techniques

Recommended Upcoming Events

VIII World Bamboo Congress, Bangkok, 16-18 September 2009 (*from M Islam Barbaruah, FARMER, Guwahati)*
Sponsored by World Bamboo Organization, Information available at http://www.worldbamboocongress.org/bamboo/index.php

The theme of the Congress is Bamboo, The Environment and Climate Change to focus attention on the role of bamboo in rural, economic, industrial, and environmental development

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Responses in Full

Rajib Lochan Pathak, Udyogini, New Delhi

Bamboo had been used for several usage by various tribes in Northeast so far right from housing, infrastructures (river bridge, rope bridge), fuel (Bamboo Charcoal and bamboo wastes), household utility items (mat, utensils) food and medicine (bamboo shoot), fashion accessories (hats, ornaments) and for housing (bamboo walls, columns, trusses, ropes, fences and also to an extent roofs). The versatility of the resource makes it one of the most useful forest products in the world.

Secondly, its green nature (bamboo regenerates itself within three years compared to wood and timber) has also put bamboo to be the next most potential resource to replace other precious resources like timber, and steel (too an extent).

No doubt, the know how of the tribal populace in using the resource effectively so far certainly needs to be documented and if possible protected through community owned IPR. But I have also concerns regarding how much these learnings will contribute in creating more enterprise opportunities and economic gains to the region compared to the existing one.

But the highest challenge is still not in documenting the know how, but more in incorporating these know how with the latest innovations in technology and science. In earlier efforts in the similar line it had been seen that the initiatives taken in the Northeast Region were not driven by scientific spirits and requirement of the market, but more by emotional attachment of the Northeastern community to the resource and the traditional know how and also by a bias towards making **high value buy low volume craft and furniture items**.

The need for the moment is to think out of this box and see where we can replace resources like steel which is in use every household to make items like **say roofing sheets, prefabricated bamboo ply, boards etc**. which will offer large volume of market and large scale livelihood opportunity.

It will also offer **competitive edge to the landlocked market within northeast** where there is a transportation barrier for goods sourced from rest of India.

The requirement is to do a **feasibility research on technology, management aspect of such a project** simultaneously looking at the **traditional skill of the community in using the resource**.

Udyogini (http://www.udyogini.org/) is currently trying to seed the concept of doing a **feasibility of the management aspect of such a project that can lead to development of a significant numbers of micro-enterprises around the same resource** with some local partners in Assam.

We would definitely be happy to join hand with FARMER or CBTC to conceptualise such initiatives.

Pitam Chandra, Indian Council for Agricultural Research (ICAR), New Delhi

Bamboo is a renewable structural material in addition to many other characteristics. It has been used extensively in fabricating tools, implements, and housing as structural material. However, unlike other structural materials, there is an apparent lack of authentic data on engineering properties of bamboo to undertake the design of implements and housing.

Therefore, there is a need for characterising bamboo from engineering point of view. This basic information should encourage civil and mechanical engineers to use bamboo as a structural material.

Namrata Pathak, Amity School of Natural Resources and Sustainable Development, Delhi

Incidentally, while collecting information/data on construction of Rainwater harvesting tanks, using indigenous material, say Bamboo specifically, it is although a very common practice to make gutters using halves of a bamboo pipe (centrally cut), and sometimes it is also used in constructing tank (reinforced). It has been researched that though this proves to be economical, however, the fungal infection / microbial attack leads to contamination thereby polluting the rainwater within.

To avoid this, there are suggestions to replace old tanks/ gutters with new ones (a little more often).

C. M. Muralidharan, Consultant, Chennai

Though not exactly for livestock program, Action for Food Production, (AFPRO) had developed the technology of bamboo reinforced cement in construction of Biogas plants, low cost twin pit latrines and also in rain water harvesting tanks.

The technology involves using interwoven bamboo material as in a bamboo basket, used as reinforcement material with cement plastering on either side. Sure these type of structures could be of use in livestock shed, drinking water tank or other structures. For more details please contact AFPRO at afprodel@afpro.org; ed@afpro.org; pd@afpro.org; or atfg@afpro.org

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Ashok Kumar Pathak, Consultant, Uttar Pradesh

Of all the materials, Bamboo is most eco-friendly and bio-degradable. There is traditional and historical use of Bamboo in India. In construction, Bamboo is used for pillars, post, roofing and for other purposes. Bamboo is also used for making baskets, *Soups*, mats, musical instruments, toys, walking sticks, rafts, boats, furniture, handmade paper, handlooms, curtains and blinds, toothpicks, chopsticks, incense sticks and various other products. Bamboo shoots are used in the preparation of vegetables and many other horticultural uses. About half of India's bamboo consumption is for making paper pulp. It has a great market value, which is producing huge amount of money.

The National Mission on Bamboo Applications, structured as a Technology Mission is one of the key initiatives of the Department of Science & Technology Government of India for the Tenth Plan. *Dharikar* community in eastern Uttar Pradesh is mostly dependent on Bamboo for their livelihood. They belong to mobile population and are expert in making many items from Bamboo. But they are socially and economically excluded. There is a need to study Dharikar population in detail. Also there is a problem of decrease in the area of natural forest, where bamboo is grown normally, for variety of reasons like afforestation, changing land-use pattern, provision of *Patta* land to poor in rural areas etc. To save Bamboo and population dependent on Bamboo, there is urgent need for CSOs, Media and Government to focus on the issue. We can also visit the site (www.bambootech.org) for more information on Bamboo technology.

M. Islam Barbaruah, FARMER, Guwahati

Namrata Pathak has indirectly raised an important point as to feasibility of bamboo based feeding and watering trough for birds and animals. Can existing bamboo treatment methods prevent fungal growth or other such risk? What kind of treatment should we prescribe for bamboos to be used in making feeding and watering trough for animals? Community members can help us in locating specific resources, research work, and traditional knowledge in this regard.

Rajib Pathak raised many vital points. The project referred in the query is a part of FARMER's chain of activities aimed at building capacity of poor farmers to innovate. While scouting bamboo use in layer farming in the egg production clusters of Golaghat and Sibsagar district of Assam, many farmers informed us that, use of bamboo cage for rearing improved layers breeds (Commercial Egg laying birds) was a result of their constant experiment to improve productivity with less investment. Absence of modern layer farm equipments / metal cages suitable for small-scale operation may be another reason that triggered said grassroots experiments.

You all will be glad to know that, after our intervention few farmers are now pondering on the idea of making flexible commercial bamboo cages as small as for keeping 5-10 birds, that can be sold to mostly urban households interested in producing by themselves their daily requirement of fresh eggs. The idea assumes significance as most of the urban egg consumers in major cities of NE India are dissatisfied with quality of available table eggs in the market (Majority of eggs in NE India market are coming from southern states of India) and they are paying premium price as high as Rs. 4/- for a locally produced egg. Popularization of small scale rearing of improved layer birds (breeds producing more eggs than indigenous birds) both in urban and rural areas can greatly enhance availability of fresh eggs and low cost bamboo cage can make this happen!

We look forward to members sharing of further inputs and experiences that would help us strengthen our initiatives in the northeast

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Sarala Gopalan, All India Women's Funds Association, New Delhi

The Kerala State Bamboo Development Corporation, located in Angamaly Kerala (http://www.bambooworldindia.com/corp.htm) has been marketing Bamboo mats. It has also converted into Bamboo-ply, using special adhesive and sealing machines.

There is also a practice of using cashew shell oil as a preservative for lengthening the life of the bamboo mat for its various uses; cooper sulphate solution is also used for the purpose. Lot more work has been done in Kerala for using it as construction material, in place of Ferro cement for reinforcement.

Hope the information is useful.

H. S. Sharma, K. M. Modi Institute of Engineering, Ghaziabad

This is to share my personal experience of 'bamboo chips' sample received from Japan, which absorbs foul odour from clothes. You may further explore this special quality of bamboo, whose chips absorb bad odour, during the bamboo conference to be held in Thailand. I am sure this can generate alternate livelihood for millions.

S. G. Dalvi, Vasantdada Sugar Institute, Pune

I would like to share information about bamboo. Here at Pune a NGO Appropriate Rural Technology Institute (ARTI) http://www.littlehut.org/project1/profile.asp has developed many applications of bamboo by treating them with chemicals. They are making the water storage tanks and low cost green hoses from it. Information to micro-propagate Giant bamboo with cost effective way for rural people planting programs would be useful.

Jeevanandhan Duraisamy, Food and Agricultural Organization of the United Nations (FAO), Rome *(response 1)*

I have been closely following this discussion and find many valuable inputs to the numerous other uses of bamboo, though not much in livestock.

I would be glad if members share any experience of using bamboo in poultry/duck rearing for building pen, and other structures, considering safety of bamboo structures in the poultry disease context and use of bamboo shoots for feedstock i.e. bamboo used as a fodder for cows, buffalo's, sheep, goat, horses and other animals.

Manoj Singh, Independent Consultant, New Delhi

Following are some of the uses of bamboo in poultry in different parts of the world.

Use of bamboo in Poultry in Taiwan and Thailand http://www.agnet.org/library/bc/50005/

- Simple Shelters for Native Chickens
- Cage for Native Chickens
- Perch for Native Chickens
- Bamboo Brooder for Ducklings
- Nest for Native Chickens
- Multiple Nests for Laying Ducks

Fly management in Poultry houses in Japan using fly attractant extracted from bamboo shoots
www.icup.org.uk/reports%5CICUP635.pdf (Size: 527 KB)

Raised bamboo platform based poultry houses – Bolivia
http://www.smallstock.info/info/genhusb/poultry-house.htm

Bamboo Poultry House
http://www.cd3wd.com/cd3wd_40/vita/poultry/EN/POULTRY.HTM

Raj Ganguly, Consultant, New Delhi

Feeding Bamboo charcoal powder to domestic animals including cattle, pigs, and poultry, is beneficial as reported by Food and Fertilizer Technology Center. (http://www.agnet.org/library/pt/2002013/) Also, cattle sheds generally have a bad smell from animal wastes. This bad odour is difficult to remove.

Bamboo charcoal can be used to improve the smell of cattle sheds. It can be used for wastewater purifier, waste deodorant and as feed additives in livestock industry.

Bamboo charcoal can also be promoted as an alternative livelihood for small farmers.

K. V. Peter, World Noni Research Foundations, Chennai

Bamboo and rattan are two species of Bambusa genus belonging to Graminae. Rattan generally used to make mats, baskets, furniture, handicrafts and as fuel. Bamboo is tall, gigantic and with widely spread root system. The Kerala Forest Research Institute Peechi maintains a good germplasm of bamboo and rattan. The western ghat passing through Karnataka, Kerala and Tamil Nadu sustains bamboo and rattan. The rattan chairs adore many houses in the south. Bamboo and rattan are included among 13 plants identified by the Planning Commission of India as sources for renewable sources of energy. It will be desirable to make a distinction between bamboo and rattan in the present discussion.

Jeevanandhan Duraisamy, Food and Agricultural Organization of the United Nations (FAO), Rome *(response 2)*

I am glad to see many pointing out many more uses of Bamboo.

Having worked with International Network for Bamboo and Rattan in the North Eastern Region in bamboo based livelihood and knowing people from Cane and Bamboo Technology Centre (CBTC) and now working in Highly pathogenic Avian Influenza (HPAI) or Bird flu with FAO in Rome I hope my comments would be of some interest to you.

Bamboo use in Poultry (Chicken / Duck / other bird rearing)

The technology under experimentation/prototype is structurally sound, cost effective and uses locally available material. Since I work with Highly Pathogenic Avian Influenza (HPAI) global programme, some of the presentations I have heard from Veterinarians / Scientists after their visit to South East Asia (China, Vietnam, Indonesia, etc) where HPAI is still continuing to be a threat had pointed out that use of bamboo in building cages/platforms. Use of bamboo is a big concern as birds fecal droppings carry the viruses and it is very difficult to sanitize bamboo structures in comparison to metal structures which are used in commercial poultry sector.

So FARMER should be able to get this aspect clarified from the Veterinarians who are working with bird flu (HPAI). This is of particular concern from the disease control perspective as recently West Bengal, Assam, neighboring countries Bangladesh, Bhutan, Myanmar and Nepal either are at risk or have had out breaks.

Use of Bamboo as a Feed stock for Cattle:

Some bamboo species particularly *Dendrocalamus hamiltonii* has been extensively used as fodder in Palampur parts of Himachal Pradesh. Indo German Changar Eco Development Project (IGCEDP) implemented by GTZ with INBAR's technical support looked for expanding the bamboo *D. hamiltonii* as fodder plant in a big way. As communities got fodder for cattle during winter when there was no other green fodder, also bamboo shoots.

Can bamboo be used as animal fodder? http://www.inbar.int/Board.asp?Boardid=173

A: Leaves: The use of bamboo leaves for ruminants, rabbits and fish (Nepal, Vietnam) has been reported. In the southern and northern Terai of Nepal, bamboo is one of the main sources of fodder for cattle and buffaloes during the winter season. In a study by P. Poudyal *(J. Amer. Bamboo Society, 10(1&2), 1993)*, leaves of *Bambusa tulda*, *Dendrocalamus spp.* and *Bambusa balcooa* were analysed for various nutrients. Dry matter (DM) contents of 87-94% and **crude protein** (CP) contents of 12-15% were reported. As to **the nutritive value** for ruminants, *in sacco* nylon bag degradability test and *in vitro* gas production test were used to compare leaves from tropical trees and shrubs in Vietnam. The values for bamboo leaves were found to compare reasonably well to those of other tree leaves *(Source: Brenda Keir, Nguyen Van Lai, T. R. Preston and E. R. Orskov1997, Livestock Research for Rural Development 9(4).*

Culms: The **in-vitro digestibility** of steam-exploded bamboo culms for ruminant nutrition was found to be comparable to that of alfalfa *(Source: Higuchi, T., Tanahashi, M. and Togamura, Y. 1987: Characterisation of steam-exploded bamboos for cattle feed. In: Rao, A.N., Dhanarajan, G. and Sastry, C.B. (ed.): Recent Research on Bamboo, Proc. International Bamboo Workshop Hangzhou, China).*

Below some data collected from FAO's Animal Feed Resources Information System (all contents as % of dry matter):

Bambusa arundinacea - fresh leaves, India	DM	CP	CF	Ash	EE	NfE
	57.1	18.6	24.1	11.8	4.1	41.4

Digestibility (leaves, sheep) in %:		CP	CF	EE	NfE	ME
		72.4	49.1	10.8	48.8	1.77
Chusqea pinifolia - dried leaves, Brazil	DM	CP	CF	Ash	EE	NfE
	87.7	7.6	41.2	7.3	5.0	38.9
Chusqea quita - leaves, Brazil	DM	CP	CF	Ash	EE	NfE
	56.8	10.0	34.5	11.3	3.6	40.5
Chusqea baculifera - dried leaves, Brazil	DM	CP	CF	Ash	EE	NfE
	89.9	8.8	34.4	10.5	3.1	43.2
Dendrocalamus strictus - fresh leaves, Pakistan	DM	CP	CF	Ash	EE	NfE
	27.4	20.5	26.0	14.8	7.5	31.2
- fresh leaves, India		14.2	27.2	12.0	1.7	44.5
Digestibility (leaves, cattle) in %:		CP	CF	EE	NfE	ME
		66.0	58.0	33.0	50.0	1.83
Arundinaria cannavieira - dried leaves, Brazil	DM	CP	CF	Ash	EE	NfE
	88.3	7.8	45.0	3.3	2.4	41.5
Bambusa vulgaris - fresh leaves, Jamaica	DM	CP	CF	Ash	EE	NfE
		19.0	28.8	16.9	0.5	34.8

Other sites with bamboo fodder information:

India Veterinary Research Institute http://ivri.nic.in/about/campuses/palampur.htm
Digestion kinetics together with chemical and metabolic studies have shown the following ranking of tree leaves in the feeding of ruminants: Biul (Grewia optiva), Mullberry (Morusalba), Tooni (Cedrela toona), Khirk (Celtis australis), Bamboo (Dendrocalamus hamiltonii), Kachnar (Bauhinia variegata), Robinia (Robinia pseudoacacia), Ohi (Albizzia stipulata) and Ban (Quercus incana). This has been recommended for Social Forestry Programme of the Himachal Pradesh Govt.
http://gbpihed.gov.in/envis/HTML/vol91/vol91Misri.html
http://www.forestfloor.co.nz/ff/bamboopastoral.htm
http://jds.fass.org/cgi/reprint/72/12/3233.pdf

Use of Ringal as fodder in Himalayas
http://www.bambootech.org/subsubtop.asp?subsubid=109&subid=39&sname=STATE&subname=UTTARANCHAL

In Ethiopia the highland bamboo is also used as a fodder.

Apart from this Bamboo as many has pointed out is a good structural material, locally available.

Organisations and People working/ promoting bamboo in Animal Husbandry:

CSK Himachal Pradesh Agricultural University - Palampur. In 2002 I visited the D. hamiltonii plantation and the university staff dealing with the bamboo informed that they are looking at bamboo based fodder development. http://www.hillagric.ernet.in/

To find out more the best people to contact are the Palampur forest department office who were counterparts to the erstwhile GTZ implemented IGCEDP watershed project. DFO's office in Palampur might be able to provide more information.

Uttarakhand Bamboo and Fibre Development - Mr. STS Lepcha, CEO - Durai Jayaraman Programme officer - durai.ubfdb@gmail.com, might be able to provide more information about ringal bamboo in Himalayan region (http://www.ubfdb.org/)

Forest Research Institute in Dheradun might be able to provide more information on use of bamboo as a fodder.

Apart from this International Network for Bamboo and Rattan (www.inbar.int) particularly Dr. Ramanuja Rao, and Prof. Zhu would be able to assist CBTC/ FARMER more on more indepth and projects which are internationally being carried out. Dr. Rama was involved in some of the Germplasm transfers in 1980's to Kenyan Forest Research Institute, there might be some links to fodder development, As Kenya and other East African countries have large cattle ranching. Also fodder is a big problem in this part of the world.

Other famous bamboo scientists whom I know who were working on bamboo as a fodder are

Dr. R. L. Banik - Ex DG from Bangladesh forest research institute, use to work with INBAR, NMBA
Dr. Haridasan use to work with NMBA, SFRI - Itanagar
Dr. Seethalakshmi - KFRI
Dr. Usha Rao - Botany Department, Delhi University
Dr. H. B. Naithani FRI, Dheradun, India.

These are the some of the most directly relevant Animal husbandry uses for bamboo.

I am also planting *D. Hamiltonii (*Provenance from Manipur 2003 & Mizoram 2008) in my farm in a rainfed semi arid region which is a classified waste land, receiving less than 600 mm of rainfall. The basic idea is to see if these water rich Himalayan riverine bamboos would adopt to dry climates. Already I have done some basic trails with cows, buffaloes, sheep and goat they are feeding well on green leaves of *D.hamiltonii.* So far the bamboos are being irrigated moderately to get the rhizomes established and after 3 years I am planning to use drip irrigation / just leave it as rainfed.

The *D.hamiltonii* grows naturally in all the North Eastern States and I guess FARMER can initiate fodder trails for pigs, cows, sheep and goats and popularize this bamboo.

Hope this would be of some use to FARMER and CBTC towards presenting its paper in World Bamboo Congress.

Usha Srinivasan, Development Alternatives, New Delhi

Bamboo can be preserved without the use of toxic chemicals. I am sharing the ZERI (Zero Emission Research and Initiatives) experience.

Bamboo – "The Wonder Grass"

The benefits and advantages of bamboo are multitudinous. Recent studies confirm that bamboo's water requirements are small and that its root system is an excellent watershed protector. Environmentally, bamboo is more effective at removing Carbon Dioxide from the atmosphere than most other tropical forest:

Technical studies and research have shown that bamboo has superior mechanical properties and hence called "vegetable steel" The European Building Code approved bamboo as a building material to be used for the Guadua Pavilion at Expo 2000 in Hanover. Bamboo construction is also earthquake-resistant. Earthquakes in Colombia's coffee zone and Costa Rica have proved this when many bamboo houses built in the 1930s survived, while modern houses collapsed.

Preservation of bamboo

The main problem with the use of bamboo is probably its preservation technique. Harvested bamboo is quickly attacked by fungus (e.g. *Schyzophyllum commune*) and insects. The hemicellulose of bamboo,

which is well protected when alive, is attacked when cut. The only preservation technique available until recently was a chemical treatment which is not only toxic, but also expensive. The preservation of one bamboo with chemicals costs double the price of the bamboo itself. Simon Velez, the outstanding guadua (Bamboo) architect, identified the "immunization technique" as the major challenge for construction science at the turn of this century.

The system is simple and consists in the extraction from and the re-evaporation on the bamboo of the biochemicals, which are naturally preserving bamboo. The process is simple, its investment and operational cost is low, its impact is permanent, eliminating the toxic side effects, as well as the need to import chemicals from overseas.

An incomplete combustion of the waste leaves and stem of the bamboo generate fumes, which are distilled with cold water, and concentrated at the bottom of this low temperature oven. This liquid is pyrolytic acid. The process is repeated for approximately 2 weeks, after which the bamboo is well penetrated with the acid, dehydrated, strengthened thanks to the polymerization of the lignin, without risking the conversion of cellulose into carbon. The bamboo comes out so beautiful, preserved, and strengthened that the Japanese experts argue that the producer can offer a 100 year guarantee. The grandchildren have a chance to claim the warranty.

The cost of smoking bamboo is half that of a chemical treatment. The economic impact is felt immediately. A small oven will cost a mere US$600, which can handle 1,000 poles per year (40-45 per two weeks). If one operates on the basis of an internal rate of return of 100 percent, then the cost of investment per bamboo is one third as compared to that for chemical treatment. This innovation leads to a dramatic improvement in construction productivity, which is most critical for the poor. In economic terms, the process to replace a non-treated bamboo after use, or a chemically treated bamboo, in a locally treated construction material substitutes an expensive importation or obligatory rebuilding, with a local investment, generating value added on the farm, which translates in additional revenues.

The first oven with a capacity of 40 bamboos per fortnight was installed in Armenia, Quindio by Antonio Giraldo. In August, Antonio started the building of a large oven with a capacity of 1,500 nine meter bamboos. Gabriel German Londoño is constructing an oven of similar dimensions in Pereira while the GTZ, the German Technical Cooperation Agency is establishing a unit in Barcelona, Quindio in order to respond to the local need for smoked construction material.

Shailja Kishore, Aga Khan Rural Support Programme (India), Ahmedabad

During the recent flood by River Kosi in north Bihar, In the interior villages which were surrounded by rivers and submerged for more than 3-4 month and hardly any fodder was available in the village. They had left their cattle's free, during that time, people use to make them survive on bamboo leaves.

It was extensively used till it finished / dried up.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Food and Nutrition Security Community in India at se-food@solutionexchange-un.net.in with the subject heading "Re: [se-food] Query: Bamboo Usage in Livestock and Poultry - Experiences; Referrals. Additional Reply."