

# **Tree Fodder, Agroforestry and Fodder Development**

## General

**168** Amir, P. 1990. **Economic aspects of using shrubs and tree fodders to feed farm animals.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 331-339p.

**Keyword(s):** *Feed crops / Trees / Animal feeding / Economic aspects*

**Call No:** 636.085 DES

**Lang:** En

Shrubs and trees can play an important role in increasing feed supplies on small farms and among landless livestock owners. These feed sources are especially important during critical periods of feed shortage, such as during the dry season. Increasing shrubs and trees may reduce the pressure on farmers to unwillingly sell livestock because of feed shortage and, thus, receive a lower price. This paper attempts to lay out a simple economic analysis of using shrubs and trees, with special reference to small-scale farmers and landless and noncommercial producers. A framework is also outlined to evaluate the appropriate methods, data needs and approaches to on-farm testing and analysis of shrubs and trees in ruminant production.

**169** Devendra, C. (ed.) 1990 **Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.** Ottawa, Ont: International Development Research Centre. 349p.

**Keyword(s):** *Animal feeding / Feed crops / Animal nutrition*

**Call No:** 636.085 DES

**Lang:** En

This publication presents the results of an international meeting, that focuses on the use of shrubs and tree fodder by farm animals. It includes 26 papers, which describe and discuss feed-resource availability, use by ruminants and nonruminants, processing methodology, economics and development issues. These aspects and the current knowledge on shrubs and tree fodder are further highlighted by country case studies detailing prevailing situations and policy matters. The publication is divided into five sections followed by conclusions and recommendations. First section includes papers on the resources and second section covers papers on fodder use by farm animals. In the third section, papers on three strata forage system is highlighted. Papers on country case studies and

processing, methodology and economics are included in fourth and fifth sections.

**170** Devendra, C. 1990. **The use of shrubs and tree fodders by ruminants.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 42-60p.

**Keyword(s):** *Feed crops / Trees / Animal feeding / Ruminants*

**Call No:** 636.085 DES

**Lang:** En

In this paper the potential value of shrub and fodder trees are discussed with reference to the range of feeds available and extent of their use by ruminants in developing countries. The discussion indicates that most of the information on hand relates to agronomic characteristics, rates of productivity, and chemical composition. The information on use by ruminants is generally sparse. Currently, shrubs and tree fodder have the greatest value in extensive systems in semi-arid and arid regions, especially for small ruminants. By comparison, fodder from trees are used as supplements for large ruminants. Following which the most widely used feed sources have been discussed. Additionally, the paper refers to potentially important feeding and development strategies which could increase the use of these feed resources and benefits the development of ruminant animals.

**171** Ghani, A. N. A.; Awang, K. 1990. **Development and evaluation of agroforestry system for fodder production.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 319-330p.

**Keyword(s):** *Feed crops / Agroforestry / Farming systems*

**Call No:** 636.085 DES

**Lang:** En

Agroforestry, which integrates tree management, food production, and environmental conservation, has a potential role in rural development. This paper outlines how agroforestry systems that incorporate fodder production as a main objective can be developed. It focusses on the basic criteria to use, species selection, management practices, and the advantages and constraints involved. A method of evaluation and strategies for future consideration are also discussed.

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**172** Gutteridge, R. C.; Shelton, H. M. 1994. **Animal production potential of agroforestry systems.** In Copland, J. W.; Dijajanegra, A.; Sabrani, M. (eds.) *Agroforestry and animal production for human welfare: proceedings of an International Symposium held in association with the 7th AAAP Animal Science Congress on 11-16 Jul 1994 at Bali, Indonesia.* (ACIAR [Australian Centre for International Agricultural Research] proceedings, 55). Canberra, ACT: Australian Centre for International Agricultural Research. 7-16p.

**Keyword(s):** *Livestock management / Animal husbandry / Animal production / Agroforestry*

**Call No:** 634.9 COA

**Lang:** En

Animal production potential of agroforestry systems is reviewed in this paper. Factors influencing animal productivity including the forage contribution from tree and non-tree sources, competition between tree and understorey, compatibility between tree crop and animals, and the service role of the tree in ameliorating the microclimate of the animal, all have been discussed in this paper. Additionally, the range of successful systems in use have also been discussed. Animal productivity ranges from highly productive, in systems where the tree forms the primary source of forage for animals, and poorly productive, in silvopastoral situations where the animal is of secondary importance dependent on an underused resource within the system.

**173** Limeangco-Lopez, P. D. 1990. **The use of shrubs and tree fodder by non-ruminants.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 61-75p.

**Keyword(s):** *Feed crops / Trees / Animal feeding*

**Call No:** 636.085 DES

**Lang:** En

The trend of increasing prices for animal feed has compelled researchers from developing countries to direct their research to non-conventional feeds, with particular emphasis on protein substitutes. The use of plant leaves as possible sources of protein is one among many possibilities. The first half of the paper deals mainly with the use of shrubs and tree fodders by non-ruminants with a short description on different species of leaf meals. Among the leaf meals, leucaena (*Leucaena leucocephala*) and cassava (*Manihot esculenta*) are considered most popular. The use of leaf meals as feed is limited by their high fibre content and, in some cases, the presence of toxic factors or metabolic inhibitors. The final half of

the paper concentrates on leaf protein xanthophyll concentrate which deals with the extraction of protein from the leaves to obtain a product high in protein, low in fibre, and without residual toxins. Finally, a short description on shrub and tree leaves used in small quantities as soilage for swine is also presented.

**174** National Academy Press. 1984. **Leucaena: promising forage and tree crop for the tropics.** Washington, DC: National Academy Press. 100p.

**Keyword(s):** *Forestry / Fodder plants / Feed crops*

**Call No:** 634.9 NAL

**Lang:** En

Leucaena is a tropical tree with a wide assortment of uses. Increasingly, forests and farmers in the tropics are exploring its potential, and the area planted to leucaena is expanding rapidly. This report has detailed leucaena's potential value as a source of feed, fuel, and wood and its importance for solving deforestation problems in some tropical regions. Experience with leucaena is increasing very rapidly. However, more detailed information on site adaptability and cultivation practices is still needed which has also been recommended in this report.

### Bangladesh

**175** Saadullah, M. 1990. **Availability and use of shrubs and tree fodders in Bangladesh.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 221-236p.

**Keyword(s):** *Feed crops / Animal feeding / Bangladesh*

**Call No:** 636.085 DES

**Lang:** En

This paper highlights the importance of shrubs and fodder trees and their availability and patterns of use as animal feeds in Bangladesh. Shrubs and trees are regarded as good fodder sources in the country. Using shrubs, tree leaves, tender shoots, stems and twigs as feed for ruminants is a village tradition. The characteristics, types, and uses of common shrubs and fodder trees in the homestead, forest and common lands are discussed. Institutional support to compile a complete inventory of forage shrubs and trees is necessary as is the need for regulated lopping and grazing in the forest, homestead and common lands. Indiscriminate lopping often results in the death of desirable shrubs and trees. Special attention should also be directed to determine the nutritive

value of various feeds and the nature and extent of various toxic elements, which have all been discussed in this paper.

## China and the Tibetan Plateau

**176** Xu Zaichun. 1990. **Availability and use of shrubs and tree fodders in China.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 295-302p.

**Keyword(s):** *Feed crops / Trees / China*

**Call No:** 636.085 DES

**Lang:** En

This paper reviews information on the availability and use of shrubs and fodder trees in China. It is estimated that there are more than 400 species of shrubs and fodder trees in China, which could produce over a very large amount of fodder for animals. Their use is underestimated. Data are given on the nutrient contents of some tree leaves and on the use of feeds from *Pinus* species for egg production and use of *Robinia pseudoacacia* by pigs. Up to 10 per cent of *Leucaena leucocephala* leaf meal in the diet has been reported to be beneficial for pigs. The importance of developing shrubs and trees for fodder to keep pace with an anticipated expansion in animal production is emphasised.

## India

**177** Dwivedi, B. N. 1985. **Plantation of fuel and fodder species performance and promises.** In Singh, J. H. (ed.) *Environmental Regeneration in Himalaya: Concept and Strategies - reports from the seminar on ... held on 24-26 Oct 1983 at Nainital, India.* Nainital: The Central Himalayan Environment Association / Nainital: Gyanodaya Prakashan. 312-324p.

**Keyword(s):** *Himalayas / Plant production / Forest plantations*

**Call No:** 304.2 SIR

**Lang:** En

The increase in human and cattle population on the one hand and the shrinkage of forest area in the hills on the other hand, has created an acute scarcity of both fuel and fodder. This paper deals with the plantation of fuel and fodder species and the performances of the species screened on the basis of results obtained during the last five to six years. A large number of fodder and fuelwood species have

been tried, and their survival and growth behaviour have been recorded in nursery as well as in the field. *Grewia optiva*, *Desmodium nicaraguense*, *D. gyroides* and *D. tiliacifolium*, *Bauhinia purpurea* and *B. retusa*, *Boehmeria rugulosa*, *Leucaena leucocephala* var. K-8, *Oleaglandulifera*, *Acer oblongum* and *Gleditsia triacanthos*, among the fodder species, and *Acacia mearnsii*, *Alnus nepalensis*, *Albizia chinensis*, *A. falcata*, *Eucalyptus globulus* and *E. grandis* and *Saiz alba* var. *coerulea* among the fuelwood species, have given encouraging results. *Calliandra calothyrsus*, *Lespedeza bicolor*, and exotic pines, such as *Pinus greggii* and *P. elliottii* are the other promising species reported in this paper.

**178** Gupta, R. K. 1989. **Development problems and potential for increased fodder production in the sub-Montane regions of Western Himalaya.** In Singh, T. V.; Kaur, J. (eds.) *Studies in Himalayan ecology and development strategies.* New Delhi: Himalayan Books. 145-157p.

**Keyword(s):** *Feed grasses / Pasture management / Himalayas*

**Call No:** 574.5264 SIS

**Lang:** En

The problems dealing with the development and management of sub-montane grasslands comprising the region of Siwaliks and the outer hill ranges of western Himalayas is presented. Development and management practises for increased production to improve the economy of the hill region is discussed. But the paper excludes the temperate and alpine regions of the montane and altimontane regions comprising principally of the high level oak and conifer forests and the alpine grasslands. Ecology of grass cover in the western Himalayas is also briefly described. List of grasses and their distribution is given in the Annex II.

**179** *Indian Society of Tree Scientists.* 1987. **Social forestry for fodder production: Fourth Seth Memorial Lecture.** *ISTS Newsletter* 3(4):10-14 Solan: Indian Society of Tree Scientists.

**Keyword(s):** *Community forestry / Feed crops / Forest products*

**Call No:** 634.9 ISN

**Lang:** En

India is principally an agricultural country with a large livestock population. The livestock constitute an important component of the economy in the villages. The importance of the livestock in the economics of farming systems can be recognised but the desirability of maintaining a big livestock population is however debatable. Low productivity of livestock is mainly due to poor nourishment. The fodder product

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in the country is not sufficient to meet the requirement of livestock population. The possibility of increasing fodder production from agricultural land is not possible. Therefore, social forestry on wasteland, might help fodder produce. This article focusses on the prospects of social forestry for the production of fodder based on the strategy for meeting fodder shortage in terms of livestock population in India.

**180** Pokhriyal, T. C.; Kumar, A.; Nautiyal, S. 1992. **Fodder from forests.** Dehra Dun: Indian Council of Forestry Research and Education. 426p.

**Keyword(s):** Forests / Herbs / Grasses / Fodder plants / Trees / Shrubs / India

**Call No:** 633.2 POF

**Lang:** En

The increasing shortage of fodder for the livestock calls for increased production, better utilisation, and effective management. The possibility of increasing fodder from agricultural land is limited, keeping in view the increasing human population and consequent rising demand for food from dwarf varieties. Wasteland reclamation with shrubs, herbs and grasses can enhance fodder production appreciably. The leaf fodder from some of the trees, shrubs, herbs is almost as nutritious as the agricultural green fodder crops. Therefore, the potential of fodder production from forest has to be systematically tapped. Forests support livestock population by providing green dry fodder and grazing facilities. This book provides consolidating information on fodder from forest. In the first half of the book, information on livestock population and requirement of fodder, forest grazing and policy, fodder resources and strategies for fodder production are included. While, in the second portion descriptive information of fodder plants have been given.

**181** Pratap, D.; Qureshi, M. H. 1992. **Forest, fodder and hill agriculture: an analysis of inter-dependence in Uttar Pradesh Himalayan region.** The Indian forester 118(12):929-939

**Keyword(s):** Sustainable development / Forests / Agricultural research / Himalayas / India, UP

**Call No:** 634.9 INF

**Lang:** En

Forests as a source of fodder, fuel and timber, not only affect the economic activity of the people in the hill region, but play a dominant role in shaping their social and cultural life. The livestock which is so essential for the hill agriculture cannot be maintained without the fodder from forests. The quantity of the fodder brought from the forest depends on the size of the stock, the nature of feeding and the quantity of the fodder available from agriculture. Forests thus, serve as source of fodder, in varying degrees in the

Himalayan region. This paper highlights the analysed pattern of requirement of fodder so essential to maintain the livestock for agricultural purposes in the hill region and the role of forests in this process. It is observed that the dependence on forest for fodder requirement increases with increase in the altitude.

**182** Purohit, K.; Samant, S. S. 1995. **Fodder trees and shrubs of central Himalaya.** Nainital: Gyanodaya Prakashan. 116p.

**Keyword(s):** Trees / Fodder plants / Leaves / Plants / Forests / Shrubs / India

**Call No:** 636.0855 PUF

**Lang:** En

In this book, about 150 trees and shrubs growing between 1,000 to 13,500m above sea-level in the central Himalayas have been described. Species have been arranged alphabetically. For each species correct botanical name, synonym if any, local name, family, distribution, botanical description, and uses have been given. Photorate and seed germination rate available in some cases is presented. Feed values, multi-purpose nature, propagation technique of some of them have been indicated on the basis of available literature. Leaf fodder is a major constitute of fodder base in the central Himalayas. Identification of many trees and shrubs used to obtain leaf fodder, observations on local methods and periods to feed them by herdsman have also been given. The most interesting features of the book includes, multiple utility, annual characteristics, lopping period of leaves, indicative methods to propagate, chemical composition, nutritive constituents, digestibility coefficients, total digestible nutrients of some trees and shrubs of the central Himalayas.

**183** Raghavan, G. V. 1990. **Availability and use of shrubs and tree fodders in India.** In Devendra, C. (ed.) Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia. Ottawa, Ont: International Development Research Centre. 196-210p.

**Keyword(s):** Feed crops / Animal feeding / India

**Call No:** 636.085 DES

**Lang:** En

Ruminants feed widely on shrubs and tree leaves than on grass or grass legume pastures in India. Some fodder trees are almost as nutritive as leguminous fodders. This paper gives data enumerating the value of shrubs and tree leaves on nutritional aspects and their patterns of use by animal species. The data suggest the necessity for integrated, intensive efforts to cultivate and propagate shrubs and tree leaves. The critical limitations and constraints to use the fodder plants require, however, more intensive

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research for economic feeding, as is discussed in this paper. Government policies concerning the production of these feeds require an integrated approach involving concerned scientists and government departments.

**184** Singh, P. 1990. **Agrosilvipasture systems in India.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 183-195p.

**Keyword(s):** *Agroforestry / Pasture management / Farming systems / India*

**Call No:** 636.085 DES

**Lang:** En

Agrosilvipasture systems have evolved in response to pressure of both animal and human population coupled with changing climatic regimes. The systems, integrating trees or woody perennials and grasses with crop farming, ensure stability in land productivity, achieve high productivity and diverse product, improve soil fertility, and enhance the supply of nutritious fodder to livestock in varied agroecological conditions. Agrosilvipasture systems, when compared with traditional land-use systems, have much higher yields and year-round forage availability. Potential fodder trees, grass species, and production systems, besides being economical, results in ecological improvement and show great promise for enhancing biomass production and meeting the increasing demand for forage and fuel wood. Each of these aspects, including the use of trees and shrubs, and research and extension needs are discussed in this paper.

**185** Singh, P. 1990. **Agrosilvipasture systems in India.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 183-195p.

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**186** Singh, P. 1989. **Wasterlands their problems and potentials for fuel and fodder production in India.** In Mellink, W. H. H.; Shingi, P. M. (eds.) *Wasteland development for fuelwood and other rural needs: report of the Regional Workshop on Development of Wastelands for Fuelwood Energy and Other Rural Needs held on 1-8 Nov 1988 at Vadodara, India.* Bangkok: FAO / Bangkok: Regional Wood Energy Development Programme in Asia. 102-113p.

**Keyword(s):** *Wasteland / Fuels / Feed crops / Land development / India*

**Call No:** 333.73 MEW

**Lang:** En

Wastelands present a picture of barren landscape where no agricultural activity thrives and no gainful employment is available. The increasing misuse of land resources through short-sighted development policies has resulted in wastelands with poor ecological and economic functions. Such lands are poor in fertility and their current use is only for grazing animals and mining of shrub roots or tree stumps for firewood. Considering the poor productivity, nature of risk, employment potential, demand for outputs and overall economic gains, tree-pasture farming seems to be most appropriate for wasteland development and utilisation. In this paper, several issues related to the problem of wastelands and their potentials for fuel and fodder production in India are presented.

**187** Singh, R. V. 1982. **Fodder trees of India.** New Delhi: Oxford and IBH Pub. 663p.

**Keyword(s):** *Feed crops / Trees / Fodder plants / India*

**Call No:** 633.2 SIF

**Lang:** En

India is predominantly an agricultural country and has the largest cattle population in the world. A large livestock population, particularly in hill areas, cannot be maintained on the fodder production on arable land alone. Because of the increasing pressure of human population and also because of higher income from cereal and cash crops than from forage crops, more agricultural area cannot be set apart for fodder production. The potential of tree for green

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fodder production is not fully appreciated in India except in the hill areas where they constitute a major source of green fodder for the livestock. The preference for leaf fodder among different tree species also differ with the regions. Some trees which are extensively lopped for leaf fodder in one region, are not either lopped at all or their leaf fodder is considered to be of poor quality in another region. The poor appreciation of tree leaf fodder is because of the fact that nutritional value of most of them has not been demonstrated. This book compiles the available information on the silviculture of Indian fodder-yielding trees of India. On the basis of available information on the nutritional value of leaf fodder of various tree species, this book has been divided into three parts. In the first part, tree species having nutritional value of leaf fodder has been determined. In the second part, tree species which are considered of regional importance for fodder production, but the nutritional value of whose leaf fodder has not yet been determined are included. In the third part, tree species which grow scattered and are lopped locally for leaf fodder whose chemical composition and nutritional value are yet to be determined are included. For each tree species their habitat, life history, silvicultural characters, natural reproduction and artificial propagation and its importance as leaf fodder is presented.

**188** Singh, V.; Naik, D. G. 1987. **Fodder resources of central Himalaya.** In Pangtey, V. P. S.; Joshi, S. C. (eds.) *Western Himalaya: environment problems & development.* Nainital: Gyanodaya Prakashan. 223-241p.

**Keyword(s):** *Vegetation / Animal production / Feed crops / Himalayas*

**Call No:** 551.431 PAW

**Lang:** En

As in many hill regions of Asia, livestock form an essential and integrated part of mixed farming systems. To many families, especially those having no cultivated land, livestock are the only source of livelihood. Therefore, the fodder resource has become the important source in the hill regions of Asia. This paper presents the survey report on the fodder resources of central Himalayas along with its methodology. A detailed inventory on the source and existing availability of dry and green fodder, requirements and deficit and surplus of fodder and grazing pressure on grasslands have been discussed. Finally, an attempt has also been made to give a programme of efficient management of communal land for harnessing maximum fodder production potential.

**189** Yadav, H. R. 1989. **Agroforestry and animal husbandry development on the**

**wastelands of Sultanpur district.** In Singh, P. (ed.) *Problem of wasteland and forest ecology in India.* New Delhi: Ashish Publishing House. 115-123p.

**Keyword(s):** *Agroforestry / Animal husbandry / Waste land*

**Call No:** 333.3 SIP

**Lang:** En

The problems of wastelands and animal in the Sultanpur district is analysed in this paper. This is followed by the discussion on the problem of animals and agroforestry systems for animal husbandry and wastelands development in Sultanpur district. Finally, conservation measures are briefly discussed.

### Nepal

**190** Iles, A.; Dool, V. D. 1986. **United Mission to Nepal (UMN)'s work on fodder trees.** In Robinson, P. J. *Proceedings of the first Meeting of the Working Group on Fodder Trees, Forest Fodder and Leaf Litter held on 23 Jun 1986 at Kathmandu, Nepal.* (FRIC occasional paper, 3/87). Kathmandu: Nepal. Department of Forest. Forest Research and Information Centre. 10-10p.

**Keyword(s):** *Rural development / Institutional framework / Feed crops / Fodder plants / Nepal*

**Call No:** 636.08551 ROP P

**Lang:** En

This article provides the summary of the work conducted by United Mission to Nepal on fodder improvement by planting fodder trees through Community Development and Health Project in Jumla, Surkhet, Andhi Khola, Okhaldunga, and Lalitpur Districts.

**191** Joshi, N. P.; Singh, S. B. 1990. **Availability and use of shrubs and tree fodders in Nepal.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 211-220p.

**Keyword(s):** *Feed crops / Animal feeding / Nepal*

**Call No:** 636.085 DES

**Lang:** En

Fodder from more than 100 different kinds of trees and shrubs are used as animal feed in Nepal. More than 75 per cent of the trees and shrubs are used from November to June. Fodder production depends on species, locality, age, season, and method of lopping. Most of the fodder trees and shrubs in Nepal supply firewood, timber, fruits, vegetables,

fibre and fat for soap, and are used for agricultural tools, in medicine, and as live hedges. Fodder trees and shrubs are usually lopped once a year and fed fresh to the animals. This paper provides information on the geographical distribution of fodder plants, patterns of use of fodder trees and shrubs, their nutritive value, fodder yield, other uses of fodder trees and shrubs, toxic effects of fodder trees, and recommendations to improve and enhance the use of shrubs and tree fodder in Nepal.

**192** Kark, J. B. S. 1992. **Forest and fodder: an historical perspective.** Banko janakari: a journal of forestry information for Nepal 3(3):1-4

**Keyword(s):** *Fodder plants / Forest products*

**Call No:** 634.9 BAJ

**Lang:** En

The forest is a source of many products used by hill farmers for a variety of purpose. Fuelwood and fodder are the most important products extracted from the forest. It seems unlikely that fuelwood-gathering alone has contributed significantly to the loss of forest areas over the last two centuries. This paper highlights the ecological consequences of fodder consumption and other landuse systems in the middle hills of Nepal. Some attention has been given to the socioeconomic consequences as well. Different control remedies and its effort to control forest use has also been discussed.

**193** Nield, R. S. 1985. **Fuelwood and fodder: problems and policy.** In Nepal. Ministry of Water Resources. Water and Energy Commission. Five Energy Workshops: Small Hydro, Micro Hydro, Biogas, Improved Cookstoves, Fuelwood and Fodder: proceedings of the workshops on ... held on Sep-Nov 1986 at Kathmandu, Nepal. Kathmandu: Nepal. Ministry of Water Resources. Water and Energy Commission. (33)p.

**Keyword(s):** *Energy / Forestry / Land use / Fuelwood / Feed crops*

**Call No:** 333.79 WAF

**Lang:** En

Problems and policy required for the development of fuelwood and fodder are presented in this paper. In this context, the author has first discussed the consumption and supply from the land resource base and then described the current land used situation in Nepal. Potentiality of productive forest and pasture land is discussed followed by forest management policy required for its development. Finally, the problems and constraints are discussed with its solution and the means of carrying them out.

## Pakistan

**194** M. Akram; S. H. Haujra; M. A. Qazi. 1990. **Availability and use of shrubs and tree fodders in Pakistan.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop on ... held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 176-182p.

**Keyword(s):** *Feed crops / Animal feeding / Pakistani*

**Call No:** 636.085 DES

**Lang:** En

Despite efforts to increase fodder production in Pakistan, livestock farmers experience traditional periods of shortage in May-June and October-November. Shrubs and trees are potentially important and merit attention, especially in areas where conventional agriculture may not be possible or desirable because of dangers of site degradation; steep and rocky slopes; arid, saline, or water-logged soils; or severe climatic conditions. This paper presents a brief information on the value of shrubs and tree fodder, national forage and fodder research programme, availability and use of shrubs and tree fodder and recommendations for its improvement. According to the paper, some promising exotic and indigenous fodder trees and shrubs have been selected for plantation in various ecological zones of Pakistan.

## Asia

**195** Copland, J. W.; Djajanegra, A.; Sabrani, M. 1994. **Agroforestry and animal production for human welfare: proceedings of an International Symposium held in association with the 7th AAAP Animal Science Congress on 11-16 Jul 1994 in Bali, Indonesia.** (ACIAR [Australian Centre for International Agricultural Research] proceedings, 55). Canberra, ACT: Australian Centre for International Agricultural Research. 125p.

**Keyword(s):** *Agroforestry / Animal production / Livestock management / Pasture management / Asia / Asia and the Pacific*

**Call No:** 634.9 COA

**Lang:** En

This series of publication includes the papers of research workshops of an international symposium on 'Agroforestry and animal production for human welfare' held in Indonesia, from 11-16 July 1994. This publication includes seventeen research papers

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presented at the symposium mainly dealing with different subjects to explore the evidence, experiences and information which provide alternatives in developing agroforestry and animal production systems that will contribute to improve human welfare by producing appropriate technology and policy.

**196** Gintings, A. N.; Lai, C. K. 1994. **Agroforestry in Asia and the Pacific: with special reference to silvopasture systems.** In Copland, J. W.; Dijajanegra, A.; Sabrani, M. (eds.) *Agroforestry and animal production for human welfare: proceedings of an International Symposium held in association with the 7th AAAP Animal Science Congress on 11-16 Jul 1994 in Bali, Indonesia.* (ACIAR [Australian Centre for International Agricultural Research] proceedings, 55). Canberra, ACT: Australian Centre for International Agricultural Research. 32-38p.

**Keyword(s):** *Agroforestry / Silvopastoral systems / Pasture management / Asia and the Pacific*

**Call No:** 634.9 COA

**Lang:** En

Agroforestry as a farming system has been practised in the Asia-Pacific region for many centuries. Agroforestry practices and systems are diverse and vary within and between countries. Population growth is increasing the need for more agricultural land; at the same time the land available for agriculture is dwindling. Consequently, the pressure on forest and land resources is becoming serious. The development of an appropriate agroforestry system in all agroecological zones is necessary. This paper focuses on agroforestry systems especially with examples of silvopasture systems in several countries (Bangladesh, India, Nepal, Pakistan, Sri Lanka, Indonesia, Lao PDR, Philippines, Thailand, Vietnam, China, Papua New Guinea) in the Asia-Pacific regions, and discusses the future directions for agroforestry and silvopasture research and development. Silvopasture is one form of agroforestry that produces grass and fodder for livestock.

**197** M. Wanapat. 1990. **Availability and use of shrubs and tree fodders in Thailand.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 244-254p.

**Keyword(s):** *Feed crops / Animal feeding / Thailand*

**Call No:** 636.085 DES

**Lang:** En

Feed resources for livestock production in Thailand are becoming increasingly important because of the rising costs and scarce supplies. It is, therefore, imperative to use fully the available feed resources, including unconventional supplies, to meet the rising demands of the rapidly increasing animal populations, especially during critical feed shortages. Crop residues, shrubs, and tree fodders are potentially important in small farms to alleviate shortage of feed and increase the efficiency of the production system. However, some of these feeds contain toxic elements that need to be reduced or removed before they can be fed to animals. Evaluation of essential agronomic characteristics and nutritive value of potentially important shrubs and tree fodders and use of these plants have been summarised in this paper with important recommendations for its development.

**198** Singh, P. 1994. **Agroforestry as a feed base for livestock in semi-arid regions of Asia.** In Copland, J. W.; Dijajanegra, A.; Sabrani, M. (eds.) *Agroforestry and animal production for human welfare: proceedings of an International Symposium held in association with the 7th AAAP Animal Science Congress on 11-16 Jul 1994 in Bali, Indonesia.* (ACIAR [Australian Centre for International Agricultural Research] proceedings, 55). Canberra, ACT: Australian Centre for International Agricultural Research. 99-105p.

**Keyword(s):** *Livestock management / Agroforestry / Feed crops / Semiarid zones / Asia*

**Call No:** 634.9 COA

**Lang:** En

Livestock, especially the large and small ruminants, are a valuable resources in the semi-arid Asian region. But their productivity is quite low in most situations. Lack of adequate amounts of quality feed is one of the principal reasons for this. Incorporation of a leguminous component has potential to improve the quality of existing grasslands. Among such legumes, trees and shrubs assume special importance because of their ability to provide fodder during lean periods, the multiple uses to which they can be put, their establishment and maintenance, and the possibility of growing them as a component in two and three-tier systems. Potential species may be incorporated in the farm through various agroforestry options: live fences, alley cropping, plantation on uncropped areas and agrosilvopasture and silvopastures. In the present paper, an effort has been made to explore and identify some promising shrubs and tree legumes for different agroforestry systems and grasslands in the region. It also presents an account of management aspects for obtaining regular yields and their effects on livestock productivity.

**199** Topark-Ngarm, A. 1990. **Shrubs and tree fodders in farming systems in Asia.** In Devendra, C. (ed.) *Shrubs and tree fodders for farm animals: proceedings of a Workshop held on 24-29 Jul 1989 at Denpasar, Indonesia.* Ottawa, Ont: International Development Research Centre. 12-21p.

**Keyword(s):** *Feed crops / Trees / Farming systems / Asia*

**Call No:** 636.085 DES

**Lang:** En

Farming systems in Asia normally include small-scale crops and livestock. The performance and productivity of the farm animals are generally poor

because of the limited farm area and animal feeds, especially during the dry season. Shrubs and fodder trees are one solution to the feed problem. In general, the shrubs or trees can be incorporated economically into the farm as living fence around the household, vegetation on the farm's uncropped areas, hedgerows in alley cropping, or as a component species of intercropping. However, shrubs and fodder trees are relatively underused. In this paper, the establishment techniques and benefit of useful shrubs and trees are discussed. More information on species adaptation, nutritive value and crop management are needed to use shrub and tree fodder more efficiently in farming systems, which is suggested in this paper.