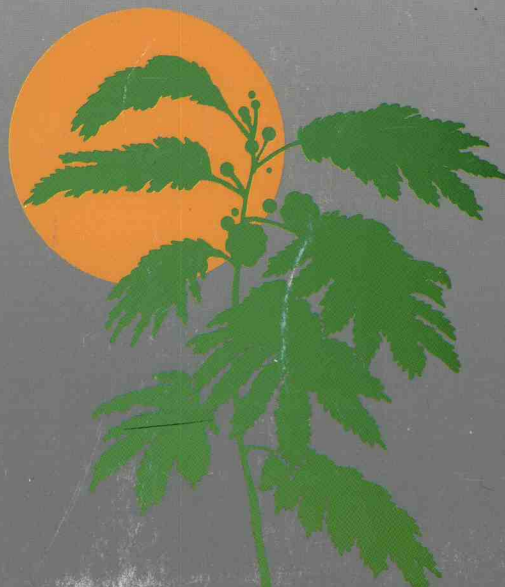


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SHRUBS AND TREE FODDERS OR FARM ANIMALS

PROCEEDINGS OF A WORKSHOP IN DENPASAR, INDONESIA, 24 - 29 JULY 1989



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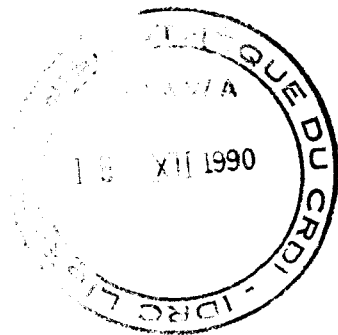
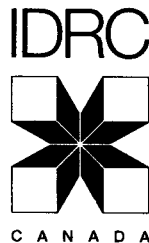
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Shrubs and tree fodders for farm animals

Proceedings of a workshop in Denpasar, Indonesia,
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Abstract

This publication presents the results of an international meeting held in Denpasar, Bali, Indonesia, 24–29 July 1989, that focused on the use of shrubs and tree fodders by farm animals. Through 26 papers, the workshop addressed feed-resource availability, use by ruminants and nonruminants, processing methodology, economics, and development issues. These aspects and the current knowledge on shrubs and tree fodders were further highlighted by country case studies detailing prevailing situations and policy matters. A special session was held to discuss the successful development and results achieved in the three-strata forage system in Indonesia. The workshop concluded with important working group discussions on the priorities for further research and development, and on the potential for the wider use of shrubs and tree fodders in the developing world.

Résumé

Cette publication présente les résultats d'une rencontre internationale tenue à Denpasar, Bali, Indonésie, du 24 au 29 juillet 1989 et qui a porté sur l'utilisation des arbustes et fourrages végétaux par les animaux d'élevage. Les 26 communications qui y ont été présentées traitaient de la disponibilité des ressources alimentaires pour les animaux, de leur utilisation par les ruminants et les non-ruminants, des méthodes de transformation, des aspects économiques et des questions du développement. Ces sujets et les connaissances actuelles sur les arbustes et les fourrages végétaux ont ensuite été étudiés plus à fond dans le cadre d'études de cas de divers pays exposant les circonstances particulières de chacun et les questions liées aux politiques. Une séance spéciale a porté sur la mise en place et les résultats des systèmes de production de fourrages végétaux en trois strates en Indonésie. L'atelier s'est terminé par d'importantes discussions des groupes de travail sur les priorités de recherche et de développement pour l'avenir et sur les possibilités d'utilisation élargie des arbustes et des fourrages végétaux dans les pays en développement.

Resumen

Esta publicación presenta los resultados de una reunión internacional celebrada en Denpasar, Bali, Indonesia, del 24 al 29 de julio de 1989, y la cual centró su atención en la utilización de forrajes elaborados a partir de arbustos y árboles para alimentar a animales de granjas. En 26 trabajos presentados al seminario, los participantes abordaron temas tales como la disponibilidad de recursos alimentarios y la utilización de los mismos por rumiantes y no rumiantes, metodologías de procesamiento y cuestiones de economía y desarrollo. Estos aspectos y el conocimiento que se tiene actualmente sobre los forrajes de arbustos y árboles se vieron subrayados aún más por estudios de casos por países en los que se detallaron situaciones existentes y cuestiones de políticas. Se celebró una sesión especial para discutir el desarrollo y resultados exitosos alcanzados en Indonesia con el sistema de forraje de tres niveles. El taller concluyó con importantes discusiones de los grupos de trabajo sobre las prioridades existentes en el campo de la investigación y el desarrollo y sobre el potencial que encierra la amplia utilización de arbustos y árboles en el mundo en desarrollo.

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Availability and use of shrubs and tree fodders in Pakistan

M. Akram, S.H. Hanjra, M.A. Qazi, and J.A. Bhatti

Department of Livestock Management, University of Agriculture, Faisalabad,
Pakistan

Abstract — 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. Some promising exotic and indigenous fodder trees and shrubs have been selected for plantation in various ecological zones of Pakistan. Animals depend on these shrubs and trees, especially in arid zones, but wider use is limited by the fact that the nutritional value of most species has not been demonstrated. Factors affecting the usefulness of shrubs and tree fodders also need to be determined.

Résumé — Malgré les efforts déployés pour accroître la production de fourrage au Pakistan, les éleveurs de bétail traversent encore des périodes de pénurie de fourrage, habituellement en mai–juin et en octobre–novembre. Les arbustes et les arbres présentent un potentiel important et méritent notre attention, surtout dans les régions où l'agriculture conventionnelle n'est peut-être ni possible ni souhaitable en raison des dangers de dégradation des sites: pentes abruptes et rocheuses; sols arides, salins ou saturés d'eau; ou conditions climatiques difficiles. Quelques arbustes et arbres fourragers indigènes et exotiques, qui semblaient prometteurs, ont été plantés dans différentes zones écologiques pakistanaïses. Les animaux, surtout dans les zones arides, se nourrissent de ces arbustes et arbres, mais le fait que la valeur nutritive de la majorité de ces espèces fourragères n'a pas été prouvée en limite l'exploitation plus répandue. Il faut aussi déterminer les facteurs qui influent sur l'utilité des arbustes et arbres fourragers.

Resumen — A pesar de los esfuerzos destinados a incrementar la producción de forraje en Paquistán, los ganaderos atraviesan períodos tradicionales de escasez de mayo a junio y de octubre a noviembre. Los árboles y arbustos son potencialmente importantes y merecen ser tenidos en cuenta, especialmente en zonas en que la agricultura tradicional puede no ser posible o deseable, debido a los peligros de la degradación del terreno: laderas empinadas y rocosas, suelos áridos, salinos o húmedos; o duras condiciones climáticas. Se seleccionaron algunos árboles y arbustos forrajeros naturales de potencial promisorio para su plantación en varias zonas ecológicas de Paquistán. Los animales dependen de estos arbustos y árboles, especialmente en zonas áridas, pero no se utilizan más ampliamente pues no se ha demostrado el valor nutritivo de la mayoría de las especies. Es necesario determinar también qué los factores afectan la utilidad de arbustos y árboles forrajeros.

Introduction

Pakistan has 30.6 million large ruminants (buffaloes and cattle) and 58.5 million small ruminants (sheep and goats) (Nawaz et al. 1988). By the year 2000, populations for the major species will be approximately 19.2 million cattle, 24.8 million buffaloes, 36.6 million sheep, and 56.8 million goats (Anon. 1987). There is an annual shortage of digestible crude protein (DCP) and total digestible nutrients (TDN) of about 1.6 and 12.5×10^6 t, respectively (Akram 1987).

Considerable on-station research has been done since 1975, and the data clearly show that fodder crops production can be increased 50–100%. Despite this information, livestock farmers still experience two traditional stress periods of fodder and forage shortage: May–June and October–November. This results in livestock achieving only 75–80% of inherent productive capacity. To overcome this, it has been recommended that studies be initiated with shrubs and fodder trees. The increasing animal population will require a 51% increase in feeds over the current supply. The current feed deficiency implies that the future generation of livestock will be underfed as in 1988, or perhaps even more because of anticipated increased genetic potential through breeding and up-grading (Crowder 1988).

Value of shrubs and tree fodders

Green fodder production on cultivated land is handicapped by the lack of area for fodder production, the lack of irrigation facilities and other inputs, and low economic returns from fodder crops compared with cash crops. Trees that can be grown either in combination with agricultural crops or on land usually unfit for agriculture offer the opportunity of producing nutritious fodder for livestock. It is seldom realized that probably more animals are fed on shrubs and tree fodders than on grasses. Also, some tree fodders are almost as nutritious as leguminous fodder crops.

Trees can produce as much, if not more, green fodder per unit area than fodder crops. Furthermore, trees are capable of growing under conditions and in areas where it may be impossible to grow conventional agricultural crops, such as on steep and rocky mountain slopes, in arid, saline, or water-logged soils, and in areas with severe climatic conditions. The ability of trees to tap water from deep underground layers and to withstand drought is another outstanding advantage. Trees do not need heavy inputs of fertilizers, pesticides, fungicides, and labour, as do agricultural crops. Also, fodder production from trees will make available fuelwood as a by-product, which will help the rural population meet their energy requirements. Trees, therefore, deserve attention for the production of nutritious fodder for livestock, especially in areas where conventional agriculture may not be possible or desirable because of the dangers of site degradation (Singh 1978).

The potential of trees and shrubs for green fodder production is not fully appreciated except in hilly or desert areas, where they are a major source of green fodder for livestock. One reason for this is that the nutritional value of most trees and shrubs has not been demonstrated (Singh 1978). The preference for tree fodders also differs with the regions.

Nutritive value

The potential of trees and shrubs as livestock feed is being increasingly recognized. It is a surprising realization that more animals feed on shrubs and trees than on grass. This is true in arid zones all over the world (Khan 1965).

It is difficult, however, to lay down general rules about what makes a good browse species. It is initially important to know the relative nutritive value of grasses and shrub vegetation. The nutritive value of shrubs and tree fodders fluctuates much less than that of grasslands. In the arid areas of Pakistan, the vegetation has been reduced to a very low level of ecological succession because of overgrazing; under such circumstances, the importance of fodder trees and shrubs greatly increases. To keep the shrub cover productive and to avoid soil erosion, it is essential that grazing be well-managed and adjusted to the rate of recovery of shrubs in pastureland. In arid areas, the livestock population is generally greater than what the land can support. Under these circumstances, the cultivation of trees and shrubs assumes great importance. However, indiscriminate lopping often results in the death of desirable trees and shrubs (Khan 1965).

Trees and shrubs not only provide fodder for the livestock but may also be useful in providing fuel. A system of alternate husbandry has become established in some areas of Sind, where *Acacia* is the main cultivated genus. Although *Acacia* is primarily grown for fuel, its leaves and pods are used as fodder when other types of fodder are in short supply. Pods supplement and extend the critical fodder period. *Acacia* leaves are valued for their nutritive value and milk-improving quality during the cold months of the year, but their use must be restricted if the plants are to flower and produce pods. *Acacia* is cultivated in rows about 10–12 m apart, and the land in between is used for cropping until the trees mature. *Prosopis specigera* is an important tree in arid areas in Sind (Khan 1965).

In hilly regions, trees and shrubs are lopped in forested areas. Because of the larger livestock population, the absence of a proper management system and rotation, and wasteful methods of feeding animals, fodder trees have disappeared in such areas (Khan 1965).

The utility of trees as an integral component of pastureland is also determined by suitability of species, needs of animals, soils, etc. Trees and shrubs also act as windbreaks. In arid zones, where superficial moisture is much less, trees are important for both shade and feed in pastureland. Thus, it is obvious that more consideration should be given to trees and shrubs in the management of rangeland and pastures (Khan 1965).

National Forage and Fodder Research Program

In 1974, a working group on fodder and forage research met in Islamabad to review the state of the art and make recommendations regarding future programs. A conceptual framework was proposed within which a National Forage and Fodder Research Program was developed. Thus, the Coordinated National Research Program was implemented in July 1975 for a period of 5 years: 1975–1980. The program was to be undertaken at the National Agricultural Research Centre, Islamabad, and at agricultural and livestock research institutes in four provinces.

The range and forage research was to be carried out at research stations in Pakistan's different ecological regions: tropical maritime (Dhabji, Sind), tropical plains (Thal, Punjab), subtropical (Islamabad and Pakistan Forest Research Institute, Peshawar, NWFP), mediterranean (Hazara, NWFP, Gunje, Quetta, Baluchistan), Himalayan subtropical (Jaba, NWFP), and Himalayan temperate (Dirkot, Azad Kashmir).

Because of limited funding, the proposed research was not supported at all locations. Nevertheless, through commendable efforts and activities, encouraging results have been achieved, especially at the National Agricultural Research Centre, Islamabad; Fodder Research Institute, Sargodha; Ayub Agriculture Research Institute, Faisalabad; and Livestock Production Research Institute, Bahadurnagar. Supplementary information has also been obtained from the University of Agriculture, Faisalabad; Agricultural Research Institute, Sariat, Quetta, Tandojam, Sind; and Tarnab, NWFP. The National Fodder and Forage Research Program was thus extended. In 1985, the program was separated to form two different divisions:

- the National Cooperative Fodder Research Program and
- the National Cooperative Forage Program.

Fodder crops in Pakistan include all crops that are used as cut-and-carry feed for livestock. Pastures and forage include all vegetation grazed and browsed by livestock, with particular reference to rain-fed flat lands, hilly areas, and rangelands. There is no clearly defined responsibility for fodder trees and shrubs that are lopped for feeding or browsing. Considerable information has been collected in various stations and institutions engaged in fodder crops research. The salient achievements are as follows:

- High-yielding varieties of *Egyptian clover* lucerne, *Avina sativa* sorghum, millet, and maize have been developed.
- Multicut fodders, i.e., Bajra-Napier hybrid (*Pennisetum* hybrid) and SS-hybrid (sorghum-Sudan grass), have been developed.
- Production technologies for improved cultivars have been standardized.
- Quality of the different fodders and forages evolved have been determined through biochemical and biological evaluation.
- Production of prebasic seeds of high-yielding varieties of fodders has been initiated.

Despite these notable results, the fact remains that the farmer is experiencing the two stress periods that hamper animal performance (Muhammad and Naz 1985).

Availability and use of shrubs and tree fodders

Khan (1965) has compiled information, probably based on surveys, on the availability and use of shrubs and tree fodders in Pakistan. Yaqub and Chughtai (1979) compiled information on the chemical composition and nutritive value of indigenous feedstuffs. The mineral composition of shrubs and tree leaves as well as digestion coefficients of dry matter and crude fibre of some tree leaves were also reported.

During the past 23 years, the Pakistan Forest Research Institute, Peshawar, and the provincial forestry departments have helped to introduce several exotic, fast-growing fodder and fuel trees and shrubs in the various ecological zones of Pakistan (Table 1).

Recently, *Leucaena leucocephala* was introduced at the farmer level as well as at the Livestock Experiment Station within the agroforestry program of Farming Systems Research (FSR). Postgraduate students in the Department of Livestock Management, University of Agriculture, Faisalabad, have been studying the comparative nutritive value of *L. leucocephala*, *Acacia arabica*, *Zizyphus jujuba*, and *Morus nigra* for small ruminants. The research will focus on the proximate composition, digestibility of nutrients, and production performance by the animals.

A research project on the use of shrubs and fodder tree leaves by farm animals involving multidisciplinary teams and researchers from the Departments of Animal Nutrition, Livestock Management, Veterinary Pathology, and Veterinary Pharmacology and Physiology, University of Agriculture, Faisalabad, is being formulated. The proposed research project and the work already initiated under the FSR program will go toward educating farmers in the use of shrubs and tree

Table 1. Fodder trees and shrubs suitable for plantation
in various ecological zones in Pakistan.

Ecological zone	Species
Subalpine, temperate	<i>Amorpha fruticosa</i> , <i>Indigofera geradiana</i> , <i>Prunus padus</i> , <i>Fraxinus excelsior</i> , <i>Aesculus indica</i> , <i>Alnus nepalensis</i> , <i>Celtis australis</i> , and <i>Quercus dilatata</i>
Subtropical, humid	<i>Amorpha fruticosa</i> , <i>Grewia oppositifolia</i> , <i>Prunus</i> spp., and <i>Robinia pseudoacacia</i>
Subtropical, subhumid	<i>Acacia modesta</i> , <i>Acacia aneura</i> , <i>Ceratonia siliqua</i> , <i>Leucaena leucocephala</i> , and <i>Olea cuspidata</i>
Arid and semi-arid desert plains	<i>Acacia arabica</i> , <i>Acacia modesta</i> , <i>Acacia senegal</i> , <i>Prosopis cineraria</i> , <i>Tecoma undulata</i> , and <i>Zizyphus mauritiana</i>
Mediterranean	<i>Atriplex canescens</i> , <i>Caragana ambigua</i> , and <i>Pistacia khinjuk</i>

Source: Muhammad and Naz (1985).

fodders. Among native species, *Prosopis cineraria*, *Acacia nilotica*, *Tecoma undulata*, *Acacia senegal*, *Zizyphus nummularia*, *Caligonum polygonoides*, and *Indigofera oblongifolia* are suggested for revegetation of the arid area of Sind. Planting exotic species such as *Acacia aneura*, *Atriplex numularia*, and *Opuntia* spp. is also recommended (Muhammad 1984). *Leucaena leucocephala*, *Acacia aneura*, *Acacia tortilis*, *Tamarix dioca*, *Atriplex numularia*, and *Opuntia ficus indica* have successfully been planted in the Kohistan tract of Sind (Muhammad 1984). *Zizyphus nummularia*, *Zizyphus jujuba*, and *Prosopis cineraria* have been planted over large areas of Thal in Punjab (Khan 1965).

Recommendations

A number of recommendations are suggested:

- A comprehensive survey is necessary on the availability and use of shrubs and tree fodders.
- Productivity of rangelands can be increased by planting selected fodder trees and shrubs.
- To meet the firewood and fodder demand, planting of fast-growing fuel and fodder trees and shrubs needs to be encouraged in all ecological zones.
- Collaborative research is necessary between animal nutritionists and bacteriologists to determine if the mimosine bacterium exists in the microflora of ruminants.
- The potential benefits of small ruminant production systems integrated with tree cropping, including fencing, needs to be explored.
- Parallel work with agroforestry programs also needs to be strengthened.

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