933 91 - 7/69

Agroforestry
Review, book, proceedings, forestry, desertification, production, utilization, processing systems, conservation, policy, institutions, socio-economic aspects, UNEP, UNESCO, ICRAF, USAID, GTZ, IUFRO, FAO

BEN SALEM, B.

**Role of forestry in combating desertification.**

FAO Conservation Guide 21, FAO, ISBN 92-5-102802-8, 1989, 332 pp.

Arid and semi-arid lands, together with their sub-humid margins, constitute what are called "dry regions, dry zones or dry lands" and cover a global area of about 45 million $km^2$. It is in this area that desertification is endangering the livelihood of some 850 million inhabitants.
The United Nations Environment Programme (UNEP) has estimated that a totalof 35 million $km^2$ of the world's range, rainfed crop land and irrigated land is affected by desertification.
Forestry has a major role to play in reversing the desertification trend and in providing an excellent long-term investment in the valuable natural resources needed for continued development.
The Food and Agriculture Organization of the United Nations (FAO) organized in Saltillo (Mexico) from 24-28 June 1985, a consultation on the role of forestry in combating desertification. The consultation reviewed and assessed the present state of knowledge in the arid zone forestry field, discussed research and application of existing knowledge and outlined a strategy and proposals for action to enhance the role of forestry in combating desertification. The components of this strategy are discussed in this manual.
The structure of the package of proposals designed to foster forestry's contribution to checking and reversing desertification corresponds to three main areas:
- production, utilization and processing systems,
- conservation and restoration systems,
- policy, institutions and socio-economic aspects.

This document has been prepared and organized in 5 sections.
Section I summarizes the main element for a strategy on the role of forestry in combating desertification as well as in developing arid lands, identifies the main objectives of an arid zone forestry programme and action proposals to enhance the contribution of forestry to rural development.
Section II presents an overview of recent developments in three main areas, namely: production, utilization and processing system, conservation, restoration systems and policy, institutions and socio-economic aspects.
The section on production systems reviews forestry, silvopastoral systems, agrisilviculture and wildlife production systems.



The section on conservation and restoration highlights approaches and techniques for the control of wind erosion, watershed management, water harvesting, land restoration and revegetation, rehabilitation of saline environments, wildlife conservation and genetic resources conservation.
The section on policy, institutions and socio-economic considerations examines the characteristics of policy and legal orientations, administrative and financial implications, and the status of research, extension, dissemination of information and education as related to dry zones. Action proposals for each area are identified.
Section III contains selected papers on various aspects of arid zone forestry.
Section IV summarizes the state of knowledge and experience in the world's arid region covering North America, Latin America and the Caribbean, the Sudano-Sahelian region, Eastern Africa, North Africa, Near East, India, Pakistan, China, the Asian part of the USSR and Australia.
Section V analyses the role of arid zone forestry and its contribution to rural development.
This document, while summarizing the state of knowledge and experiences in the various arid regions of the world, should be completed with specific practices for particular areas by consulting special references for individual regions, many of which are listed in the extensive bibliography provided at the end of each paper in section III.
This document is intended to serve as a general guide for decision-makers and managers to better design forestry programmes in arid zones.

934 91 - 7/70

Agroforestry
Review, book, case study, Africa, afforestation, economics, policy, forestry approach, farm forestry approach, shelterbelts, roadside plantings, desertification, cost-benefit analysis, soil fertility, crop output, livestock production, research needs, World Bank

ANDERSON, D.

**The economics of afforestation - a case study in Africa.**

The Johns HOPKINS University Press, Baltimore, USA; Published for The World Bank, Washington, USA; ISBN 0-8018-3552-6, 1988, 83 pp.

Erosion and loss of soil fertility arising from the destruction of trees over large areas of developing countries are among the most important problems of economic development today.
By rural afforestation is meant the maintenance or restoration of trees in farming areas, on farm boundaries, in villages and hamlets, near dwellings, in copses, in village woodlots, and in watersheds and shelterbelts. All such plantings, if carried out over large areas by farmers and forestry services together, protect soils from erosion and from loss of nutrients and moisture.
Few attempts have been made to assess their economic value. With exceptions, the economic analysis of foresters tends to concentrate on wood, that of agriculturalists on crops, and that of livestock specialists on meat and dairy products, with no attempt to draw out the mutually beneficial associations between silviculture, agriculture, and livestock in rural areas.
This book has the following main intentiens:
- To provide a brief overview of the extent and causes of the loss of trees in farming areas in Sub-Saharan Africa (chapter 1)
- To review policy options and outline and approach for evaluating afforestation investments (chapter 2)
- To demonstrate, using a case study in northern Nigeria, the usefulness of the approach for the economic analysis of afforestation projects in general (chapter 3-5)
- To propose topics for research on the effects of rural afforestation (chapter 5)

The main findings of the book are summarized by the author as follows. The technical solutions to the ecological problems that arise from the loss of trees on farmlands are well known; they include the replenishment and maintenance of farm tree stocks and the adoption of soil and farm management practices that would sustain the carrying capacity or fertility of the soil.
Knowledge about the design and implementation of afforestation programs has grown. Much that is constructive can be learned from successes in India, China, and other places and even from failures, and these lessons corroborate current thinking about the ingredients of a successful program.



One of the main conclusions is that afforestation programs have low cost per hectare of farmland protected. When their effects on soil fertility are allowed for, these programs could do much to improve the value of farm output; they have prospects of good rates of return. As with all investments in low income and ecologically threatened regions, there are significant risks, mainly because of uncertainty about how farmers will respond to the programs.
A positive commitment to rural afforestation and to improving soil and farm management practices, combined with better incentives for investment in agriculture, could successfully address the serious ecological problems that now threaten large tracts of arable land.
The findings, interpretations, and conclusions expressed in this study are the results of research supported by the World Bank.

91 - 7/71

935

Agroforestry
Review, book, tropics, trees, food, palms, bananas, breadfruit, jackfruit, socio-economy, utilization, production

FAO

**Utilization of tropical foods: trees.**

FAO Nutrition Paper 47/3, FAO, Rom, ISBN 92-5-102776-5, 1989, 50 p. + index

This is one of a series of books prepared by the staff of the Food Policy and Nutrition Division on the subject of traditional food crops from tropical areas. The series includes studies on the nutritional value, household processing and utilization of good plants growing in given ecological conditions as well as monographs by country.
Taking the palms as an example this book deals with the following aspects:

- **Social and economic importance:**
  Mankind is dependend on trees for many necessities of life: for shelter and clothing, for cooking fuel, for food itself, even for drink.
  Not all tropical societies are dependent on palms but in many cultures they play an important and integral part in the diet, agriculture and daily lives of the community. In economic terms, they provide a wide range of products useful to man. Edible products include the stem, the sap and the fruit. The relative importance of each of those parts as a food source, depends on the species.
  On a number of atolls in the Pacific Islands, coconut is the staple food. Human life would hardly be considered possible without the coconut palm. Other palms dominate or supplement the food pattern in widely diverse situations, from the dates of the Saharan oases, to the oil-bearing palms of tropical Africa and Brazil.
  In the South Pacific, the sago palm (*Metroxylon* spp.) is grown to produce a starchy pulp from its stem, the "raffia palm" (*Raphia* spp.) and the kitul palm, or toddy palm (*Caryota urens*), are cultivated for their "wine" and for their "honey", but most tree foods are in the form of the immature or ripefruits which are prepared in many ways. Among the "trees of life", palms hold a place of special importance.
- **Characteristics of palms:**
  Palms (*Palmae*) are a very ancient family and are believed to be among the oldest flowering plants in the world. Fossil palms have been identified in Cretaceous rocks, dating back over 120 million years. Palms provide plant superlatives: the world's largest flowering spray (*Corypha*), the largest leaf (*Raphia*) and the largest cane, in the rattan (*Calamus*) are all found in that diverse and widespread family. The extraordinary "coco-de-mer" seed or "double coconut", *Lodoicea maldivica*, must surely be the



world's largest single fruit. On account of its suggestive shape it has fabled aphrodisiac properties, but the overall reputation of the palm family rests on firmer foundations than those of botanical curiosities.

- **Food products:**
  In many of the short-lived palms the fruit is of limited value; food is obtained from starches and from sugars in the stem. Starches are built up during vegetative growth and, just before flowering, these reserves are mobilized for fruit formation and are converted into sugars. In palms which die after flowering and fruiting, the food reserves are often extracted and processed in the form of the starchy pith of the stem or the sugary sap.
  In other palms, death does not follow the first flowering, and the major food products is the fruit. Two of the most important palms in this category are the coconut palm (*Cocos nucifera*) and the oil palm (*Elaeis guineesis*). The date palm (*Phoenix dactylifera*) is also of great importance but, as it requires completely dry weather for pollination and very high temperatures averaging 30°C for proper ripening, it can be grown only in the southern Arabian region.
  Other crops like bananas, breadfruit, and jackfruit are also dealt with in this book.

This compendium on technological and nutritional aspects of processing and utilization of tropical foods, both animal and plant, is for purposes of training and field reference.

936 91 - 7/72

Agroforestry
Africa, Rwanda, study, highlands, alley cropping, maize, pole bean, Sesbania, FSRP, USAID

YAMOAH, C.F.and J.R.BURLEIGH

**Alley cropping *Sesbania sesban* (L) Merill with food crops in the highland region of Rwanda.**

Agroforestry Systems, 10, 1990, pp. 169-181

This study examines the effect of *Sesbania* prunings and the moderate use of fertilizer on the performance of pole bean and maize, the factors that influence regeneration and longevity of the *Sesbania* under pruning management, and the effect and row position on development of *Puccinia sorghii* Schw.
The study was conducted on the Rwanda National Agricultural Research Station in the Buberuka highlands (2060m) where the rainfall is bimodal with an annual average of 1200 mm.
The mean monthly temperature ranges from 13 to 17°C. Soils are classified as Oxisols.
The experimental design was a split-split plot.
In the highlands of Rwanda, where undeveloped agricultural land is limited, demographic pressure calls for high-input agriculture to ensure sustained food production. Inorganic fertilizers are costly and farmyard manure is not available to all farmers. The employment of natural, soil-improving techniques to fix nitrogen and recycle nutrients offers means to improve crop yields that is cost effective and appropriate for subsistence farming. Alley cropping uses leguminuous shrubs to supply N, and organic materials, and to mobilize nutrients from the subsoil to the soil surface for crop use.
*Sesbania* is a leguminous shrub that has been extensively used for agroforestry in several rural development and energy projects in Eastern Africa.
In the highland areas of Rwanda, *Sesbania* grows faster than *Leucaena, Calliandra* and *Markhamia.* It is currently the most popular woody species among farmers in the highlands of northern Rwanda.
Bean yield in 6 m alleys (1100 kg/ha) was about twice in 2 m alleys (500 kg/ha). Bean responded to N and P. Optimum alley width and N for bean yield were 6 m and 30 kg/ha, respectively. Cuttings from alley hedgerows provided stakes for climbing beans. Maize responded to N but not to residual P. The highest maize yield came from 8 m alleys with 40 kg/ha, but yields from 8 and 6 m alleys with the same N treatment were not significantly different. Maize plants in middle rows were significantly taller than plants in rows adjacent to hedgerows. Maize rust development showed significant alley width and row position effect. There were significantly fewer uredinia in the Sesbania alleys relative to the control plots without shrub hedgerows. Rust development on



maize in middle rows was significantly greater than development in border rows.
Shading is a serious problem with Sesbania because complete removal of foliage kills the shrub. Mortality of Sesbania is low, once established, but care is required to ensure shrub longevity. There are reports that mortality of Sesbania is affected by nematode infection, but there is no evidence of this in Rwanda. Alley cropping might reduce the impact of foliar plant pathogens on crop yield by slowing disease development.
From a management standpoint, shrubs should be pruned once a year when rainfall is adequate and reliable, to enhance biomass production. Economic appraisal is necessary to determine if Sesbania alley cropping with these inputs is a viable and feasible alternative for the resource poor farmers who dominate the region. An economic analysis should also consider the value of stakes for pole bean production which are produced by hedgerows.

937 91.- 7/73

Agroforestry
Review, book, Africa, Asia, Latin America, community forestry, farm forestry, traditional tree cultivation, tree depletion, tree growing constraints, programme approaches, country experiences, IIED, FAO, SIDA, USAID

FOLEY G. and G.BARNARD

**Farm and community forestry.**

Earthscan Energy Information Programme, Techn. Report No. 3, London, UK; 1995, 214 pp. + Appendices

The purpose of this report is to provide a review and appraisal of the experience to date with farm and community forestry.
A major part of the report is based upon a study of farm and community forestry commissioned by the Forestry Department of FAO. This was carried out between February 1983 and May 1984, and involved a comprehensive literature review together with field visits to projects in several countries.
Over the past decade, farm and community forestry has emerged as a major new area of Third World forestry policy, encouraging people and communities to grow trees themselves on their own farms and around their villages.
Its purpose is to provide a review and appraisal of hitherto experiences and to discuss the scope and limitations of farm and community forestry.
The contents is subdivided into five parts: general appraisal, the context, programme approaches, aspects of programme design and implementation, and country experience. Four different approaches are discussed to forestry on non-forest land and principally implemented by rural people:
- Farm forestry aims to encourage commercial tree growing by individual farmers on their own private land. Trees are regarded as a cash crop. Not all farmers, however, are provided with technical and financial assistance.
- Tree growing for family uses. Important to note that fuelwood scarcities, by themselves, rarely seem to be a sufficient incentive for people to grow trees, whereas shade, fruit, windbreaks in life fences may be the principal justification.
- Community forestry is land on public or communal land for tree growing in order to meet community needs. The bulk of work is carried out by the forestry service with a varying participation of the community.
- Land allocation schemes. These focus on the allocation of public land that is unsuitable for agriculture to individual families, either permanently or temporary (e.g. taungya and related systems), on the condition that they grow trees on them.

A brief review of some of the main national programmes is provided in Part V. A more extensive listing of projects currently underway with funding from international donor agencies is presented in the Appendix.



The report describes the different approaches that have been used, and discusses their scope and limitations. It examines the reasons why people grow trees, and the constraints they face at the village level. Key aspects of programme design and implementation are also considered, including technical problems and the role of extension services. Detailed examples are provided from Asia, Africa and Latin America.
The report includes critical reviews of the limitations and constraints on tree growing, and these parts should deserve special attention by all those involved in the above-mentioned forestation projects. Among the main constraints are antipathy to trees, lack of incentives or other priorities, land tenure problems, questions of tree ownership, competition for labour, and the time factor.
The report is a very important contribution to a better understanding of forestry's changing role in many parts of the world, of its promising as well as limiting prospects for rural development and the involvement of rural people in growing trees.
The book is written in a clear style, it will be useful to policy makers, students and teachers of forestry, as well as practicing foresters.

938 91 - 7/74

Agroforestry
Review, book, sustainable development, social forestry, people, trees, farmer, World Bank

GREGERSEN, H. et al.

**People and trees: the role of social forestry in sustainable development.**

Publ. of the Economic Development Institute of the World Bank (EDI Seminar Series), Washington D.C., ISBN 0-8213-1205-7, 1989, 288 pp.

This timely book presents a synthesis of the past decade of experience in social forestry, broadly defined as the involvement of local people in growing trees for their own use. Its stated purpose is to bring together in a systematic and consolidated form the information necessary to improve education and training programmes for social forestry, and its intended audience consists of those concerned with the training of policy makers, project planners and project implementers.
The book is divided into two parts. Part 1 concerns the contribution of social forestry to development, beginning in Chapter 1 with an introductory overview of social forestry, followed in Chapter 2 by an examination of how social forestry relates to issues of environmental protection and sustainable development. Chapter 3 shows how agricultural productivity and food security can be increased by incorporating trees into farming systems and Chapter 4 deals with social forestry's contribution to solving the rural fuelwood crisis. Chapter 5 concludes with a discussion of how social forestry in combination with traditional small-scale processing enterprises can reduce unemployment and provide income and investment opportunities for the rural poor.
Part 2, by far the larger part of the text, addresses the complex question of how to realize these potentials in practice through the planning and implementation of social-forestry projects. Issues crucial to the success of social-forestry projects are dealt within Chapters 6 to 12. These include: the planning framework; learning about local communities and their institutions; choosing which units of social organization to work with; using incentives to motivate local participation; dealing with land constraints and needs; administering and coordinating projects, and monitoring and evaluating social-forestry projects. Chapters 13 and 14, on education for social forestry and research to support social-forestry initiatives, go beyond the immediate needs of projects to the larger issue of how to support the further growth and development of social forestry as a whole. Noting that the planning and implementation of social forestry programmes present a large and complex array of issues that defy a simplistic formula approach, the editors nevertheless attempt to consolidate their findings in a final summary chapter on 'indications for the future'.



As a consolidated synthesis and resource book on approaches to social forestry, this volume provides a basis for further development of the field. As such, it is a valuable resource, not only for trainers, but for anyone involved in expanding the horizons of social-forestry practice.
Although the book does not deal with agroforestry as a separate subject, it adds to the agroforester's vision of the role of trees in rural development and particularly of the socioeconomic and infrastructural arrangements needed to fulfil the promise of agroforestry. Many agroforestry techniques have now been accepted as part of the technical repertoire of social foresters, but there is still much to be done to reap the full potential of multipurpose trees in integrated land use. Toward that larger work-in-progress this book makes a most significant contribution.
Abstract by J.B. Raintree

## VIII HOMEGARDENS

939 91 - 8/32

Homegardens
Review, Africa, developing countries, food production, household level, women, farmers, benefits, AVRDC, FAO, USAID

DAVIDSON, F.R.

**Food production at the household level.**

In: Proc. of a Workshop on Vegetable Research and Development in SADCC-Countries, Arusha, Tanzania; ISBN 92-9058-042-9, AVRDC Publication No. 90-328, 1990, pp. 169-171

Home based food production is an ancient activity, primarily carried out by women, having an impact on the nutritional status of entire families and communities. The household garden is as old as human civilization and plant cultivation.
Home gardening is rarely considered, when formulating agriculture projects. This is unfortunate since the support of home gardens could play an important role in future efforts against hunger and malnutrition.
Support for household gardens as one part of a development strategy for private and governmental organizations has fluctuated over the years. While individual gardening efforts have been continued despite uncertain interest from the larger agricultural sector and its supporters, current interest in the role of nutrition and 'natural foods' in assuring good health in the developed world may have a benefit for those engaged in gardening in developing countries.
Household gardens, often referred to as 'horticulture activities', do not, traditionally, compete with larger agricultural activities. In fact they exist in a complementary fashion, especially since they often are limited to the production of indigenous vegetables and fruits. Since they are located in close proximity to the home, they can be maintained by anyone residing there. Garden workers are usually women, children and older members. Households involved in gardening, be it a home garden or participation in a community garden (school, clinic, etc.) have more diverse diets than those without gardens. This diversity results in better nutritional status overall and might result in better health and resistance to disease which are important development goals.
Women play a part in every aspect of the food chain. They prepare the land for cultivation, plant, weed, harvest and process the resulting food. Some aspects of these activities may be performed in order to earn income, others to ensure an affordable food supply.
New technologies usually bypass women. Extension advice and loans for mechanization are given to men. In order for programs meant to increase production and food supply to be successful, they must



reach the right people. Many such programs are exclusively addressed to male adults when those most responsible are, in fact, the women in the area.
The problem of evaluation of home gardens, in order to justify their position in allocation of resources, remains complicated. The lack of statistically significant evidence on the costs and benefits of home gardening has been a considerable obstacle to serious consideration of its role in food production.

940 91 - 8/33

Homegardens
Review, developing countries, backyard gardens, food security, project design, research parameters, food crops, income

HAHN, N.

**Backyard gardening - A food security system managed by women.**

entwicklung + ländlicher raum 25, 1, 1991, pp. 24-27

This paper focuses on the importance of backyard compounds as an under-exploited and untapped potential for food security with specific country examples and suggestions for innovation to intensify research as a basis for project design and greater recognition of household food crops to improve diets, add income and provide foods for all seasons.
Most of the world receives the bulk of its calories and protein from fewer than 20 species. It has been estimated that of the 20.000 species, man is using only seven species intensively as basic food crops, and only six of the 18.000 legumes have been the focus of most of the pulse research.
Broadening the foodbase through greater utilization of indigenous food crops is one of the promising ways of increasing agricultural and food production. It is an understudied survival system which is based on indigenous knowledge.
Traditional food plants are an underexploited natural resource, neglected by policy makers and at risk, sometimes to the point of generic erosion, or extinction. Knowledge concerning the cultivation, processing and even use of these plants is disappearing. The potential for their improvement is being ignored and as a result, the food base of developing continents is dangerously reduced. Traditional foods are secure foods: they can be produced locally, without the constraints of limited rainfall, unstable, infertile soil, and restricted inputs. They are adapted to local ecological conditions, to existing farming systems and to community food preferences and eating habits. They are often rich in important nutrients, sometimes even more than other foods which, have replaced them. In addition, they have advantages of seasonality.
Backyard gardens or compounds can vary dramatically according to the ecology, household labour and the extent to which households depend upon the crops for consumption or as an income.
Research is required on the potential for cultivating and intensifying the plants found in household gardens. Much of the genetic information is being lost as indigenous people abandon their lands. The forces of population growth and poor resource management are doubly damaging.
In Africa an estimated 80 percent of vitamin A and more than a third of vitamin C are supplied by traditional food plants; production of most of minor crops constitute the women's domain within the family. Development of these crops would have important implications for women's work with the expected outcome improving



household diets and the earning of supplementary incomes. Even when secluded, women may cultivate small plots within the compound walls. There has also been insufficient recognition of the importance of minor crops, for example, in preventing serious diseases of the eye and besides reducing resistance to infections in the case of provitamin A, and anaemia in the case of iron. Minor crops are also potentially important in ensuring an adequate diet during the critical weaning period.
In the area of production, agricultural investment has not always taken explicit steps to recognize the importance of minor crops in the farming systems.
In future the required actions should be taken to guarantee that backyard gardens are more supported in aid programmes.

941 91- 8/34

Homegardens
Review, postharvest technology, vegetables, marketing, food losses, postharvest environment, postharvest treatments, harvesting and handling, packaging, AVRDC

WILLS, R.B.H. and J.A. SEBERRY

**Postharvest handling of vegetables.**

In: Proc. of a Workshop on Vegetable Research and Development in SADCC Countries, Arusha, Tanzania, 1990, pp. 159-167

In horticulture much attention is given to increasing production by research on breeding improved varieties, optimizing fertilizer and crop water requirements, better pest and disease control, and other farm management aspects. Providing farmers with good production techniques and given favorable seasons, the right soils and adequate moisture, one can often ensure that crops of high quality fruits and vegetables are grown. However, much of the resources and energy devoted to production will be wasted if postharvest technology to handle the products and marketing procedures are inadequate.
With higher cash returns the use of more costly postharvest handling and transport technology is appropriate. For any new horticultural project it is necessary to first determine the market target and then design the postharvest technology appropriate for delivering the product to the consumer.
According to FAO estimates, product losses between harvest and consumption account for 20-33% of all food produced.
The aim of postharvest technology is to prevent undesirable changes between harvest and consumption. Most of the problems occur because vegetables are living plant organs both before and after harvest, respiring and converting metabolites into carbon dioxide, and giving off heat energy and water. When vegetables are harvested they continue to carry on their metabolic reactions, but they have been removed from their source of water and nutrition on the parent plant and soon start to deteriorate.
All vegetables have water as a major constituent, ranging from 60% in legumes to 98% in leafy vegetables and melons. In dry atmospheres water continues to evaporate from the surface of the produce and losses can be considerable. Vegetables exposed to tropical temperatures for periods as short as 2 hours may lose 10% of their weight, resulting in loss of quality and economic loss because they are unsaleable. Even a loss of 5% weight may be visible as wilting or shriveling of root crops and reduce the product's value. One way of reducing moisture loss from vegetables is to increase the relative humidity of the air, thus reducing the vapour pressure difference between the produce and the air.
Good postharvest technology aims to reduce the product's metabolic rate and water losses, so that its nutrient reserves last longer and senescence is delayed.



Because of their high water content vegetables are very susceptible to damage through rough handling.
Damaged plant cells respire more rapidly and provide sites for infection by microorganisms which can result in rots and reduced postharvest life.
Harvested vegetables are susceptible to invasion by a range of bacteria and fungi. Infection may take place either before or after harvest. Many pathogens may remain dormant on or near the surface of the plant tissue in the field. They only develop as rots after harvest when senescence processes have weakened the outer cells or the product has been damaged.
The rate of all chemical and biochemical reactions is dependent on temperature. By lowering the temperature of the product one can reduce its rate of metabolism. The retention of quality and storage life of vegetables can be significantly extended by precooling the crop within a few hours of harvest.
The rate of water loss from produce is directly proportional to the relative humidity (RH) of the surrounding air. Most vegetables are highly susceptible to moisture loss, with leafy vegetables wilting readily. Unlike fruit, which are often susceptible to increased rots and physiological disorders at high RH, most vegetables stored at high RH are resistant to decay and breakdown. A few vegetables such as onions, garlic, squash and pumpkin require low RH.
Of significance for the storage of vegetables is the presence of ethylene in the atmosphere. The concentration of ethylene in air is normally only 0.01 ppm, but it accumulates in the storage atmosphere (0.1-1 ppm) then it can reduce the postharvest life of vegetables. Many fruits give off ethylene during ripening which can cause yellowing of leafy vegetables, induce bitterness in carrots and sprouting in potatoes and onions. These products should therefore never be stored or transported together, unless special provisions are made for chemically absorbing the ethylene or ventilating the air.
The highest priorities for attention in the postharvest treatment of vegetables are handling practices and temperature management.

942 91 - 8/35

Homegardens
Asia, Sri Lanka, survey, highlands, homestead holdings, traditional system, mixed cropping, agroforestry, spices, fruit trees, medicinal plants, timber species, coffee, arecanut

JACOB, V.J. and W.S. ALLES

**The Kandyan gardens of Sri Lanka.**

In: Agroforestry Systems in the Tropics; Kluwer Academic Publishers, The Netherlands, ISBN 90-247-3790-7, 1989, pp. 181-195

This paper examines the situation with respect to the Kandyan garden system and endeavours to identify the directions of research for the improvement of the system. The data presented in the paper are based on a survey of 30 farms and on results of mixed cropping experiments conducted.
The paper further analyses the production and labour-utilization patterns of the system, discusses its constraints and potentials, and outlines the research needs to improve this sustainable, multiple-output agroforestry system.
The Kandyan gardens of Sri Lanka represent a traditional system of perennial cropping which has been practised for several centuries. It is essentially a system of mixed cropping with a variety of economically valuable tree crops such as spices, fruits, medicinical plants and timber species. These systems are usually in small homestead holdings and are practised in a few districts in the "mid-country" region of Sri Lanka. In the district of Kandy, this is the most predominant cropping system and hence the name "Kandyan gardens". The mixed forest-gardening system offers a highly diversified and economically viable form of land use.
The total number of trees/shrubs varies from 65 to as many as 1,700 per hectare, with a multistorey canopy configuration. Most of the high-density plantings occur where coffee and arecanut are the dominant components, and, in general, the species diversity as well as plant density on a farm is inversely proportional to the holding size.
The farmers who practise the forest garden system in Sri Lanka enjoy a relatively better standard of living by virtue of returns from both the economic cash crops and the subsistence products. With improved management, the system has the potential for increased production and better returns.
Some of the agronomic aspects that need to be examined in detail before the suggested new models are recommended to farmers include:
- Selection of appropriate species and assessment of their compatibility with each other;
- Arrangements and spacing of various component crops according to the level of input and management;
- Use of improved, high-yielding, fast-growing cultivars and varieties;



- Response of various individual components and the system as a whole to management constraints;
- Input-output relations at various levels;
- Long-term effects and sustainability of various combinations.

With appropriate modifications, the system can also be extrapolated to other areas with similar environmental conditions outside Sri Lanka

943 91 - 8/36

Homegardens
Tropics, experiments, tomato production, low-cost technique, hydroponic system, urban garden

AVRDC

**A non-circulating hydroponic system for tomato production in the tropics.**

In: AVRDC 1990 Progress Report, Shanhua, Tainan; ISSN 0258-3089; 1991, pp. 202-204

The noncirculating hydroponic system developed at AVRDC in 1986 - was adopted for urban home gardens. It was found economical, clean, and easy to manage. It appeared that this system could be an economical way of producing under the adverse conditions in the tropics. This project aimed to scale up this system, assess its performance and improve it for commercial production of tomatoes in the tropics.
The level and temperature of nutrient solutions which affect root activities are important factors for the growth of tomato under the noncirculating hydroponic system, especially under high temperature conditions. Heavy rains and high temperature are the main abiotic constraints for tomato production in the tropics.
The constituents of a nutrient solution for the noncirculating hydroponic system had been discussed in the 1986 AVRDC progress report. In this project, a nutrient solution with the same constituents was prepared by a fertilizer company into two stock solutions.
The trial on nutrient level was conducted in large concrete containers (2 x 1.5 x 0.6 $m^3$). The container was covered by polystyrene boards, which had 6.0 cm diameter holes for inserting small pots in it. Small plastic seedling pots, 6.5 cm in diameter and 7.5 cm in height, each with a layer of window screen (3 x 2.5 mm), were utilized to support medium plants. The nutrient solution levels were kept at 15, 20 and 25 cm from the bottom of pots. For the third treatment, the noncirculating hydroponic system was put under a simple structure with a bamboo frame and plastic cloth on top only to compare with those in the greenhouse. The growth and yield of tomato, and nutrient consumption were recorded.
A series of trials on effects of nutrient solution temperature, nutrient solution level, and simple structure on the growth and yield of tomato were conducted in 1990 to develop an effective and economical non-circulating hydroponic system for tomato production in the tropics.
Seventy kilograms of tomatoes were harvested from a 13.5 m x 1.1 m hydroponic unit in 50 days.



944 91 - 8/37

Homegardens
Africa, tropics, review, vegetable, classification, cereals, roots and tubers, pulses, fruits, nuts, indigenous crops, exotic vegetables, husbandry improvement, genetic improvement, AVRDC

OKIGBO, B.N.

**Vegetables in Africa.**

In: Proc. of a Workshop on Vegetable Research and Development in SADCC Countries, Arusha, Tanzania, 1990, pp. 29-53; AVRDC Publication No. 90-328, Shanhua, Tainan, Taiwan

Vegetables constitute a group of food crops that are of nutritional and economic importance to low-resource farmers in Africa. Apart from their being chief sources of minerals and vitamins, they are also cheap sources of plant protein. They are of major nutritional importance to farmers of the humid tropics who cannot afford to purchase adequate quantities of animal protein and to vegetarians who mainly depend on plant protein. Vegetables feature in different traditional farming systems of tropical Africa and especially in the highly sustainable multi-storied home garden agroforestry systems of the humid and subhumid tropics. They are increasingly grown in the highly lucrative and commercialized market gardens and specialized horticultural production systems. Home gardening as part-time farming close to urban centers is becoming a major source of vegetables under the prevailing economic squeeze in many African countries.
To realize the potential of vegetables in sustainable agricultural production systems, the following measures are recommended:
- Highest priority should be given to the study of nutritional evaluation, genetic improvement and conservation of indigenous vegetable crops. This should include the collection and study of the botany, mode of reproduction, genetics and methods of utilization of the indigenous African vegetables. The recent advances in biotechnology should not be regarded as a substitute for conventional plant breeding in crop improvement.
- Since many indigenous vegetables are not fully domesticated, very little is known of the variation among them and the utilization of this in genetic improvement. Since high rates of deforestation are associated with genetic erosion and loss of species and varieties with a range of desirable characteristics, the faster these species are studied and conserved the better.
- There is need for the development of improved propagation techniques and improved husbandry for indigenous vegetables. More is known about methods of propagation and husbandry techniques for introduced vegetable species. Lack of such knowledge of native vegetables hampers their production and utilization.
- Some priority should be given to the study, documentation and dissemination of information on the nutritional quality of African vegetables, in addition to methods of their preparation

and consumption. This will contribute significantly to more efficient utilization of Africa's vegetable resources, and increase the diversity and spectrum of vegetables consumed.
- Valley bottoms, flood plains of streams and rivers and to some extent small-scale irrigation projects, provide conditions for dry or off-season production of vegetables. Priority should be given to utilization of these highly productive areas for the growing of vegetables including the elimination of health hazards that may hamper their production in such environmental situations. Related to this is the need to develop production systems that make better use of solid and liquid wastes in vegetable production so as to minimize the environmental pollution that may result where they are allowed to accumulate.
- There is need to develop improved processing and preservation techniques of introduced and indigenous vegetables, so as to ensure better conservation of what is produced and their availability throughout the year.
- Since many African governments are interested in introducing agriculture into the curriculum of primary and secondary schools, it is recommended that vegetable gardening constitutes a production system that could be used for the practical work component of such courses.
- There is need to study and document the variations in germplasm among and within species with respect to yield, texture, cooking qualities, nutritional quality, toxic factors, keeping quality or storability, local preferences and, above all, adaptation to environmental stresses.

Author's Abstract, shortened



945 91 - 8/38

Homegardens
Africa, study, indigenous vegetable, diversity, conservation, use, research, needs, future prospects, AVRDC

ATTERE, A.F.

**Conservation and use of indigenous vegetable resources in the SADCC region.**

In: Proc. of a Workshop on Vegetable Research and Development in SADCC Countries, Arusha, Tanzania, 1990, pp. 55-61; AVRDC Publication No. 90-328, Shanhua, Tainan

Vegetables remain the cheapest source of important protein, vitamins, minerals and essential amino acids in the diet of many rural communities in Africa. In their diversity of species, forms and texture, vegetables can supplement the diet with nutrients in a way that cannot be achieved with any other major energy-providing food.
The nutritional value of indigenous vegetables is comparable to that of the exotic vegetables. Uses of indigenous vegetable species vary from one community to another. Some vegetables are believed to have some medicinal value and are given to the sick, or to babies.
A considerable variety of vegetable species are indigenous to Africa. These species are more common to most rural populations. Some of the important vegetable species grown in Southern Africa are: *Abelmoschus esculentus*, *Amaranthus* spp., *Basella alba*, *Corchorus* spp., *Crotalaria brevidens*, *Curcurbita* spp., *Commelina* spp., *Vigna* spp., *Gynandropsis gynandra*, *Solanum* spp., *Manihot* spp., *Celosia* spp., *Hibiscus* spp., and *Brassica* spp.
Rural populations consume various parts of the indigenous vegetables, the leaf, the seeds, the stem and/or the roots. For example, women and children are effective producers of pumpkins. Leaves and fruits are also in demand in urban areas. Generally pumpkin leaves are gathered (and sometime sun-dried) for use in the relish. Seeds are also dehulled, pounded and added to the relish. Fruits of edible species are eaten fresh, boiled or dried and stored. It was noted during collection missions that farmers saved their seeds from one or two fruits resulting in possible genetic drift.
Indigenous species are known to contain varying concentrations of nutrients, according to variety, stage of maturity, conditions of storage, methods of processing and sometimes areas of origin.

946 91 - 8/39

Homegardens
Africa, Tanzania, multistorey cropping, agroforestry, multipurpose trees, shrubs, animals, food crops, small scale farmer, research needs, diversity, risk insurance, ICRAF

FERNANDES, E.C.M. et al.

**The Chagga homegardens: a multistoreyed agroforestry cropping system on Mount Kilimanjaro (northern Tanzania).**

In: Agroforestry System in the Tropics; Kluwer Academic Publishers in cooperation with ICRAF, Dordrecht, The Netherlands, 1989, pp. 309-325

This paper identifies the major components, describes their interactions and management aspects and presents an evaluation of the system's ecological stability, productivity and sustainability of the Chagga homegardens.
Mt. Kilimanjaro is one of the most densely populated areas in Tanzania. This is due largely to the ecological and economic success of the Chagga cropping system. The homegardens enable the farmer to have sustained production with a minimum of external inputs and thus they represent a good land-use model for extrapolation to other areas with similar ecological and socio-economic characteristics.
The Chagga are skilled farmers with an intimate knowledge of the crops and their ecological requirements. They have a good idea of functions/uses of the plant species on their farms. The great diversity provides both subsistence and cash crops. It enables the farmer to keep his management options open and provides insurance against drought, pests and economic risks.
The intensive cropping system of the Chagga involves integration of several multipurpose trees and shrubs with food and cash crops and livestock simultaneously on the same unit of land. Within this cropping system several agroforestry practices can be identified. These include the use of multipurpose trees/shrubs:
- to provide shade for coffee
- as live fences
- for fodder and mulch production
- for bee forage
- with anti-pest properties

The homegardens are located mainly between 900 - 1,900 m above sea level. In addition, each family has another plot (kishamba) 10 to 16 km away in the drier plains below the southern and eastern slopes. The kishamba has only very few trees and is used mainly for growing annual crops.
Food crops are banana (*Musa* spp.), beans (*Phaseolus vulgaris*), cabbage (*Brassica oleracea*), cowpea (*Vigna unguiculata*), maize (*Zea mays*), onion (*Allium cepa*), potato (*Solanum tuberosum*), sweet potato (*Ipomoea batatas*), taro (*Colocasia* spp. and *Xanthosoma* spp.), tomato (*Lycopersicon esculentum*) and yam (*Dioscorea* spp.).



Cash crops are coffee (*Coffea arabica*), cardamom (*Elettaria cardamomum*). Surplus bananas and other food crops. Women are responsible for marketing the surplus bananas, vegetables and milk and they keep the proceeds. Men get the money from coffee, poultry and egg sales.
Chagga farmers deliberately retain and manage numerous species of trees and shrubs on homegardens. The men are responsible for lopping the fuel and fodder trees while the women harvest the fodder grasses and herbs.
Cattle are kept for milk, while goats and pigs are kept for meat for sale and/or for home consumption. Recently, some farmers have started keeping improved cattle. The more popular breeds are Fresian, Jersey, Ayrshire and crosses involving these and local breeds. Each farmer has an average of 3 cows, 2 goats and 6 chickens. In some cases a pig is also kept. Livestock are stall-fed with fodder from trees/shrubs, banana plants and grasses grown on the homestead.
Although the Chagga cropping system has been stable over at least a century, it is only recently that the system as a whole has come under presure due to rapid population growth, diminishing land resources and change in dietary habits.
Despite these pressures, however, the system still appears to be working well with the majority of farmers. Nevertheless, if the system is to remain sustainable, then its productivity will have to be increased to cater for the rapidly increasing population.

947 91 - 8/40

Homegardens
Africa, Senegal, experiment, irrigation, vegetable production, organic gardening project, manuring, pest control, reafforestation, NGO, IFOAM

THIAM, A. and A.G. DIENG

**Organic market gardening experiment in the "Niayes" (Senegal).**

In: Proc. of the IFOAM 7th Int. Sc. Conference, Ouagadougou, Burkina Faso, 1989, pp. 68-76

Since the 1968 drought, irrigated crops have become more and more important in Senegal. Among them, market gardening has a choice place.
In spite of important realizations in the market gardening field, this sector still encounters a lot of problems. Among them: irrigation water availability, irrigation scheme, the low technical level and lack of experience of some producers, lack of qualified support, high cost of inputs, such as seeds, fertilizers and pesticides, the commercialization of production.
Since 1982, the ENDA PRONAT program has been organizing and animating peasant sessions and workshops about agro-ecological techniques for agricultural production, building up written and audio-visual documents, and circulating these documents for the people involved in rural world development (peasant groups, technical support staff, development organizations, organic farmers' associations, etc.).
The "Niayes" benefit from the influences of the trade winds, from fresh water which is often not very deep, and from the proximity of urban centers which are great vegetable consumers. These characteristics make it a favourable area for market gardening. There are traditional smallholders as well as large producers, or producer groups with more important areas and means of production. Fertilizers and chemical pesticides are much used in this area, by smallholders as well as large producers. Several cases of pesticide poisoning have been reported in this area. With the input price growing up year after year, the producers, mainly the small ones, are finding it increasingly difficult to cover their production costs. Soil organic matter content is constantly decreasing. Fields are often cultivated without sheltering tree lines. So, they suffer from wind erosion and become less and less fertile. The organic production approach offers a solution to these problems and is working in this direction.
The setting up and management of the projects were preceded by several peasant training sessions and workshops about the risks linked to the use of chemical pesticides and about agro-ecological production techniques. Several sessions were organized in the "Niayes" area. During these sessions, some participants, mostly farmers, studied different aspects of market gardening protection: identification of crop pests and means of control, dangers of the use of pesticides and practices favouring natural crop protection.



From these sessions, it came out that all the farmers used various pesticides, but none of them had the means to apply the precautions recommended by the manufacturers.
The results of these experiments and demonstrations will be capitalized and circulated with different supports (technical cards, audio-visual documents, etc.). They are important elements of research and popularization of agro-ecological techniques in Senegal and in the other Sahel countries.

## IX SEED PRODUCTION

948 91 - 9/24

Seed production
Review, seed technology, developing countries, storage insects, farm level, alternative practices

GONSALVES, J.

**Farm level seed technologies.**

The Sustainable Agriculture Newsletter, Vol. 2, No. 3, 1990, pp. 8

Farmers have developed their own technologies on seeds (to maintain or improve quality), which through time and experience, were proven effective. Unfortunately, these practices are not well documented and their adoption by others does not always guarantee success. Results depend highly on many factors in the farm such as the mother trees' growing environment, the type and initial quality of seed, type and preparation of seed protectants or other treatments, type and degree of insect infestation, storage environment, etc.
The most common seed problem encountered in the farm is storage insects. For small quantities of seeds, keeping seeds dry (less than 10%) could effectively inactivate insects. However, for large quantities of seeds, the availability of air-tight containers, drying agents and storage facilities become a limitation. The following are alternative practices reported by farmers to work in their farms:

- Keeping seed bags in areas where they are always stepped on, like at the base of stairways (commonly done for beans). The constant disturbance discourages insect infestation.
- Regular/periodic sun-drying of seeds in storage. Insects dislike disturbance and the adults prefer the shade, while non-adults are killed by heat.
- Washing bean seeds before drying to remove the bran-like (dust) particles that remain after harvest. The particles which are washed-off are claimed to attract insects because they serve as food.
- Hanging unthreshed seeds above the fireplace (kitchen stoves) or under branches of trees (where it is shady, breezy and cool). The dry air and smoke (and ash) from the burning wood are believed to be responsible for the controlled infestation. If unthreshed, seeds are also shielded from insects.
- Storing seeds in ash, sand, oil and other inert materials. Ash keep seeds dry and also impairs the insects breathing. Sand and ash act as abrasive which damage the insect's cuticle, enhance water loss, thus, dehydrating the insect. When packed well with seeds, they fill air spaces and prevent movement and insect copulation inside the containers. Vegetable oil controls insect reproduction by making it difficult for eggmasses to be anchored on the surface of seeds and prevents eggs from being hatched.
- Coating wet seeds (especially cereals) with ash before sowing. This is also claimed to be effective against insects, fowls and birds. The ash may render the seeds unpalatable or invisible to the animals.



- Using botanicals in storage or during germination/planting. Botanicals repel, kill or discourage growth and reproduction of insects in storage. Seeds soaked in water mixed with some botanicals suppress the growth of fungi and repel the attack of ants, termites, birds and fowls. Botanicals, however, could also harm seeds if improperly used.
- Soaking seeds in water or salt solution is a common practice to clean seeds and as a means of sorting and separating heavier, good-quality seeds from lighter, poor-quality and damaged seeds, fungal spores, and other light debris.
- Soaking seeds in water or salt solution is also regarded to have some invigorating effect for many cereals, vegetables and fiber crops. Seeds were reported to have faster and more uniform emergence and seedling growth and have improved seed storability when soaked then dried back to original moisture content. However, soaking is a disadvantage to some seeds especially those of thin-coated legumes where seeds tend to absorb water rapidly and expand abruptly, leading to cracking and eventual death.
- Keeping seeds in earthern jars or even cave interiors for cooler atmosphere. This practice also reduces insect activity and prolongs the storage life of seeds. However, seeds should be kept dry, if positive effects of temperature is to be enjoyed.

Author's Abstract.

91 - 9/25

949

Seed production
Africa. study, cropping systems, low external input systems, seed technology, shifting cultivation, genotypes, fallow system, permanent upland, cereals, vegetables, legumes, IAC, CTA

FRESCO, L.O.

**Characteristics of low external input cropping systems - with special emphasis on seed related aspects.**

Proc. of the Seminar on Seed Production, Yaounde, Cameroon, Vol. I, 1985, pp. 22-34; IAC, Wageningen and CTA, Wageningen, The Netherlands.

Low external input systems in Third World agriculture cover a wide range of cropping systems. For the present purpose low input cropping systems are limited to rainfed agriculture and are characterised by low levels of those (external) inputs that have to be obtained on the market with cash. Inputs refer to biochemical and industrial technology applied by individual farmers (improved seeds, fertilisers, pesticides etc. and tractor equipment) as well as to engineering works that benefit groups of farmers (irrigation, terracing).
In contrast to **low input systems** high input systems are not only characterised by a heavy dependence on purchased inputs but also by the fact that inputs are frequently used in combination. Labour inputs in low external input farming are not necessarily low, but most of the labour employed is unpaid family labour (casual hired labour may be involved usually on the basis of communal labour exchange).
"Low external input" is of course a relative term which it is impossible to quantify. More than the exact definition of low input levels, which vary from place to place and from year to year, the concept of low input farming is important. Low external input cropping systems refer to more than just the level of cash inputs. They denote a way of life, a relative independence from market structures and an emphasis on staple food self-sufficiency. Farmers who practice low external input cropping are therefore more concerned with risk avoidance than with high yield levels as such. Their farms are characterised by the interdependence of many enterprises: cropping, livestock and off-farm work.
**Seed related activities** include seed selection, seed treatment and storage as well as decisions about the adoption and purchase of new seeds. The role of women in seed related activities deserves special attention.
General figures for Africa are not available, but the role of women in seed related activities is likely to be considerable.
Farmers may acquire seeds from various sources: from the harvest of their own cereal crops, from fields cultivated for the specific purpose of seed production, through gifts, or exchange with other farmers, or through purchase in the local market. The purchase of commercial, certified seed is a rather recent phenomenon, as is the government distribution of seeds in drought stricken areas. In the great majority of cases, however, seeds in low input cropping systems are obtained from local sources.
The shortage of seeds constitutes a serious problem in certain areas, where farmers have lost their seeds because of drought or



pests and diseases, or where food shortages have forced farmers to consume even their seed supply.
It is not always possible for small farmers to obtain seed from their own fields or local sources.
With increasing levels of external inputs, the purchase of seed becomes more attractive, because the cost of seed constitutes only a small percentage of total production costs.
There is relatively little information on how farmers actually **select seeds.** Farmers practice seed selection in order to obtain good quality seed and to include desired characteristics. A study of seed selection criteria in Kenya shows that the size of seeds and seed bearing parts of the plant are important to most farmers. Furthermore, specific requirements exist for each crop. For example, in sorghum, which suffers heavily from insect damage, early maturity is crucial. In Ruanda, women plant a variety of beans in order to maintain desired seed qualities. Seed selection may take place in the field, before or during harvesting, while the selection of undamaged seeds after the harvest is probably the most common procedure.
Traditional **seed storage** systems depend to a great extent on ecological conditions. Losses occur frequently due to pathogens and pests, and germination may be reduced.
Seeds may be kept unthreshed, often near a fireplace, or threshed, in special containers, mixed with lime or ashes. In low input systems the use of chemical seed treatment is limited. Nearly without exception, farmers keep more seed than required for one planting season, usually for 2 or 3 seasons. In this way, they may replant if the first seeding fails. The maintenance of seed from several varieties constitutes another method to reduce risks.
The role of traditional farmers in the maintenance of **genetic diversity** deserves to be mentioned. In many villages it is still possible to find small plots of land races that have not yet been replaced by introduced genotypes. While there can be no doubt about the role of human selection in the evolution of crops, how exactly human and natural selection have interacted is unknown.
Rusticity and adaption to environmental constraints such as drought must have been important criteria in past selection processes, as well as the conditions imposed by the particular life style of the people involved.
Cereal crops are often grown in a **varietal mix**, dictated by a desire to spread risks, secure the stability of food supply (early and late maturing varieties) and the range of end uses (grain for beer brewing or as staple food, legumes for human or animal consumption). For reasons of germplasm conservation as well as on socio-economic grounds, this diversity should be respected when introducing new varieties. This implies that the new varieties must be adapted to growth conditions in varietal or crop mixtures.
The supply of **quality seeds** of improved and adapted varieties to low input farmers could be a first step towards increase the productivity of low external input cropping systems in the Third World. However, new seeds remain an ineffective short term solution if other measures are not taken. These measures must include both the improvement of soil fertility as well as the provision of input delivery and marketing services. Farmer participation in the development and production of new varieties is essential.
Because farmers in low external input systems have little opportunity to take risks, the new varieties should be carefully

tested on farmers' fields, and under farmer management, in comparison with the entire range of existing varieties.
Finally, the effects of the introduction of new seed must be monitored carefully. New seeds might increase farmers' dependence from market structures, directly, through seed purchase, but also indirectly, because other inputs must also be purchased, and because farmers must find an outlet for their surplus production.
Author's summary, shortened



950 91 - 9/26

Seed production
Asia, Philippines, review, indigenous tree species, seed technology, provenance testing, seed classes, seed certification, seed handling, asexual propagation

BAGUINON, N.T.

**Seed production of indigenous tree species.**

The Sustainable Agriculture Newsletter, Vol. 2, No. 3, 1990, pp. 19-20

Seed and seedling production efforts of the forestry sector in the Philippines have been concentrated mainly on exotic (or introduced) tree species. Initial planting materials have been imported and subsequently multiplied to supply the requirements of government reforestation projects.
To ensure the supply and quality of seeds of indigenous trees, a workable system of seed production must be developed. This may mean establishment of a seed program or setting-up of centers which handle seed production, collection and (or) distribution. The success of these programs or centers require a combination of careful planning, good management, and adequate technical knowhow. When such a program is being considered, the following aspects should be noted:

- **Survey and Seed Collection.** A survey of the area would give information like availability of seeds and wildlings (seedlings that grow out from naturally dispersed seeds), presence of suitable mother trees and adaptability of species and with their growth, flowering, and seeding schedule carefully noted. A local seed forecasting calendar could then be developed for planning seed collection activities. An experienced forester or one who could identify, characterize and classify indigenous trees is required for these activities.
- **Provenance Testing.** Provenance which identifies the place of origin or place of adaptability of a species, is also used to indicate source of planting materials. Provenance testing evaluates performance of different provenances of a given species (including bred materials) in different reforestation sites (or micro-sites within a site). For the seed program, it could give information on seeding characteristic and identify other possible seed production sites. This could also later serve as requisite in species certification.
- **Seed Classes.** Seeds gathered randomly from an uncharacterized stand of trees (source-identified seeds) command low prices due to less labor requirement and a relatively lower purity of seedlot. Seedlots collected from trees with more or less uniform traits (selected seeds) command higher prices than source-identified seeds because of higher costs incurred and due to higher purity of seedlot. Selected seeds of species that had been bred or which underwent provenance trials are classified as certified seeds.
- **Seed Certification.** Forestry/agroforestry seeds are certified on the basis of breeding and/or provenance testing. However, a body that handles official seed certification (especially of indigenous species) for varietal identity, germination capacity, and seed health does not exist in the country. A seed production

program should therefore consider setting up a system to certify seeds not only for site or economic suitability but also for seed attributes in relation to its general planting value.

- **Seed Handling.** A thorough knowledge on seed behaviour of each species is essential to minimize seed losses and maximize seedling turn out. No single formula exists for handling indigenous seeds considering the diversity of the species and of the ecosystem which they occupy. Species from the virgin forest have generally different seed characteristic/behaviour from seeds of trees in pioneer (open) areas in terms of response to drying, degree of dormancy and dispersal mechanisms.
- **Seed Orchards Establishment.** Natural sources of seeds often could not sustain seed supply because of insufficient number and (or) the loss of some mother trees as a result of natural death or continuing deforestation. Seed orchards (from seedling-raised mother trees) could turn out to be cheaper and more sustainable source of seeds than natural seed production areas due to accessibility and reduced costs for field maintenance and collections.
- **Asexual Propagation.** Seed orchards may be further complemented by the use of asexually-propagated mother trees, for species with high success in asexual propagation. Asexually propagated trees enjoy the advantage of earlier flowering and seeding and more certainty of getting true-to-type plants than sexually propagated ones (i.e. from seeds).

The success of the seed program is guaranteed only if people from various disciplines work together giving emphasis on careful planning, assessing the economic, managerial and operational and environmental feasibility of the undertaking. Finally, it should be remembered that the use of indigenous species will yield benefits that would go a long way towards a real development of the country.



951

91 - 9/27

Seed production
Review, book, proceedings, Australia, tree seed, direct seeding, low-cost techniques, native trees, natural regeneration, environmental protection, NGO

Greening Australia

**Sowing the seeds.**

Proc. of a Conference, Australia; available from "Greening Australia", P.O.Box 9868, Canberra, ACT 2601, Australia, USD 50.00

This proceedings volume brings together recent scientific, technical, and practical information on low-cost techniques for direct seeding and natural regeneration of Australian native trees. It includes material presented by more than 30 speakers and panelists at a conference organized by Greening Australia, a non-profit organization set up in 1982 to increase the tree and shrub cover in rural and urban areas of Australia.
The objectives of tree-planting and protection efforts are to counter degradation of rural land, to protect livestock and crops from wind and extremes of heat and cold, to provide a habitat for wildlife, to reclaim mine sites, and to produce wood, honey, and tree products such as oils and pharmaceuticals.
This volume includes accounts of: tree seed farming using clonally propagated material to obtain higher-quality wood fibre for paper production; the arrangement of tree lots with clover pastures in a chessboard pattern to produce honey and to protect sheep from cold winds; and approaches to land rehabilitation after mining using native Australian tree species.
Abstract from Agroforestry Today.