VII AGROFORESTRY

652 90 - 7/41

Agroforestry
Africa, review, book, project experience, tree growing, crop production, technical package, extension methods, institutional framework, training, seedling production, monitoring and evaluation, case studies, sustainable development, CTA, SIDA, EEC

KERKHOF, P.

Agroforestry in Africa - a survey of project experience.

Panos Publication Ltd, Angel House, 9 White Lion Street, London N1 PD, UK; ISBN 1-870670-16-7, 1990, 215 pp.

Agroforestry is still a very new discipline.
Although valuable lessons are being learned by projects, there are few mechanisms by which these can be shared with projects in other countries, or even in neighboring districts.
This study is designed to help address this problem. It presents a survey of the experience of 21 projects in 11 countries throughout Africa. Although it makes use of project reports and other literature, it is based primarily on visits to each of the projects concerned. It looks at agroforestry from a pragmatic viewpoint; that of the people most directly involved in the design and implementation of projects.
What the surveyed projects have in common is that all contain elements which involve the active management of trees within the farming environment. Each has also been in existence for a minimum of 3-4 years so that there is enough experience for at least preliminary conclusions to be drawn.
Each project visit involves detailed discussions with project staff, local officials and others.
This book is divided into three parts. Part I gives a summary of the overall lessons that have emerged from the experience to date. Profiles of individual projects are presented in Part II; the 21 projects visited are covered in 19 profiles, since two of them include two projects. To help make comparisons, profiles are grouped in five categories. Although there is some overlap between them, the projects in each category have a number of broad similarities in the environment in which they are working and in their approach and objectives. Part III draws upon the profiles to illustrate and discuss a number of key elements in the design and running of projects.
Funding for the study was provided by the Swedish International Development Authority (SIDA), and Technical Centre for Agricultural and Rural Cooperation (CTA), and the Commission of the European Communities.

653 90 - 7/42

Agroforestry
Review, book, Africa, arid and semi-arid zones, desertification, environmental degradation, agroforestry systems, woody vegetation, woody perennials, political implication, participation, land tenure, CTA, technology and research

BAUMER, M.

The potential role of agroforestry in combating desertification and environmental degradation.

Technical Centre for Agricultural and Rural Cooperation, ACP-EEC Lomé Convention, Postbus 380, 6700 AJ Wageningen, The Netherlands, ISBN 92-90810394, 1990, 233 pp.

Various definitions of agroforestry have been given by many authors; the definition adopted here is the following: 'Agroforestry is a collective term for systems and technologies of land use where perennial woody plants (trees, bushes, shrubs, scrub and, by assimilation, palms and bamboos) are deliberately cultivated on ground otherwise used for crops and/or stock rearing in a spatial or temporal arrangement, and where there are interactions at once ecological and economic between the woody plants and the other components of the system'. These interactions can take several forms, positive or negative, and do not necessarily remain stable in time.
'Desertification' is used here in the very wide sense given to the term to describe productivity loss due to plant and soil degradation, even in semi-humid zones which have nothing to do with the desert.
Desertification is the most serious environmental problem facing the world, and more especially Africa, today.
Agroforestry means much more than interplanting trees among crops or growing tree legumes; agroforestry systems can be complex, involving arrangement of the components in variations of space and time. To succeed, agroforestry requires studies and preparatory work, i.e. research covering environmental, technical, social and economic aspects.
The advantages of agroforestry tend to increase the biological productivity of soils. In this way agroforestry, where applicable, is really an excellent weapon against desertification.
The agroforestry approach is well-suited to small farming units and to great silvo-pastoral expanses alike, because it primarily uses local woody perennials, plants and animals that are familiar to the people and very often admirably suited to the conditions.
It is a principle of agroforestry not to aim at a single objective, such as increasing food production; but at the same time to meet several needs of the peasant as he himself sees them.
An agroforestry technological package suggested is aimed simultaneously at a series of multiple objectives, such as increasing and improving the quality of food production, producing forage and firewood, erecting hedges and creating shade.

Desertification will not be stopped by agroforestry alone and it will only be halted if all the nations agree to make a concerted effort. Despite the warning given by the United Nations Conference on Desertification, which stressed that it was a question of life or death for a part of the human race and perhaps in the long term for the whole of humanity, that appeal has gone largely ignored.
This publication explores the role that agroforestry may play in the fight against desertification by first exploring the causes and process of desertification in the ACP countries, the problems it presents, and the agroforestry systems which are suited to these countries. It then looks at the type of woody vegetation naturally occuring in dry zones. Effective agroforestry systems, however, depend on the will and participation of governments, and the final part is an examination of political will, land tenure and ownership of trees, and of technology and research.
'The potential role of agroforestry in combating desertification and environmental degradation', with special reference to Africa, is solely funded by CTA.

654 90 - 7/43

Agroforestry
Africa, humid tropics, study, ILCA, alley farming, small ruminants, economic analysis, fallow model

SUMBERG, J.E. et al.

Economic analysis of alley farming with small ruminants.

ILCA Bulletin, 28, 1987, pp. 2-6

Alley cropping is an agricultural innovation in which crops are grown between rows of densely planted trees.
The major difference between alley cropping and bush fallow is that soil fertility restoration is concurrent with cropping, thus allowing continuous cultivation. In southwest Nigeria where fallowing is usually practiced, alley cropping based on the leguminous tree *Leucaena leucocephala* has sustained moderate crop yields over 7 years on a sandy soil with low fertilizer inputs.
There have been several evaluations of the economics of alley cropping. None of these analyses have considered livestock. While alley cropping was conceived primarily for crop production, it offers considerable potential for integrating crop and livestock production by supplying mulch for crops and high-quality fodder for animals.
In humid West Africa, sheep and goat production is generally a minor enterprise using few inputs. Production is limited by a viral disease, "peste des petits ruminants" (PPR); control of PPR, especially in goats, can significantly reduce mortality and increase flock growth. However, realization of the potential of small ruminants, following PPR control, may eventually be constrained by feed resources. Alley farming, which is the addition of animals to an alley cropping system, offers the opportunity to realize this potential by producing high-quality feed year round. It would do so without the major new investments sometimes required by specialized fodder production, and without reducing staple crop production.
In this paper, alley farming models with small ruminants are evaluated, based on field and experimental data from southwest Nigeria, and compared with basic alley cropping and with fallow systems. The analysis is then used to define key management areas within alley farming, as well as areas where further information is needed.
These results indicate that under conditions found in southwest Nigeria, maize production with alley cropping is more profitable than with a 3-year fallow system. Alley cropping is less profitable with higher base maize yields. While alley cropping requires more labour than the fallow system, this is more than offset by the increased maize yields, and relative profitability of alley cropping is insensitive to changes in labour requirements.
The amount of tree foliage and the method of mulching affect alley cropping profitability. The models assume a low tree foliage yield of 3000 kg/ha/year based on difficulties of obtaining good tree

stands in village conditions. Low foliage yields reflect farmer's hesitancy to plant densely to obtain high populations. Better methods of tree establishment (or better instructional methods) that assure good stands would therefore add to the overall attractiveness of alley cropping. Mulch incorporation, particularly if done at tillage or weeding times and thus not requiring additional labour, can increase the profitability of alley cropping.

With PPR control, particularly for goats, increases in net output of 20 to 30% per dam from 25% supplementary feeding are needed to make small ruminant feeding competitive with maize production. The reproductive potential of West African Dwarf goats and sheep has been well documented; the principal goal of future research must be to demonstrate that supplementary feeding of high-quality fodder species such as leucaena and gliricidia is effective in realizing this potential.

It is interesting to speculate on the potential of alley farming in other tropical areas, particularly those where fallow has been replaced by continuous cropping. With a 100% decrease in clearing labour in the fallow system (continuous cropping) and a 100% increase in pruning labour, alley cropping with mulch incorporation is still 55% more profitable. In areas where production is constrained more by land than by labour, alley farming appears to be a technology which should be vigorously investigated.

655 90 - 7/44

Agroforestry
Africa, Rwanda, high-altitude, semi-arid zone, field trials, IITA, farming systems research, project, alley shrubs, multipurpose use

BALASUBRAMANIAN, V.

Alley shrubs in a high-altitude, semi-arid environment.

IITA Research Briefs, 9, (1) 1989, p. 3

Several characteristics are desirable in shrubs used for alley cropping. They need to be fast growing and pest resistant in order to establish a hardy hedgerow in the shortest possible time. Biomass production should be plentiful enough to provide green prunings for fodder and mulch, as well as woody stems for firewood and stakes for climbing crops.

IITA scientists working in the Rwanda Farming Systems Research Project have conducted a three-year trial of five alley shrubs, *Calliandra calothyrsus, Cassia spectabilis, Leucaena leucocephalus cv* K-28, L. *diversifolia cv* K-156, and *Sesbania sesban*.

Three-month old seedlings were used for all species, which were planted at intervals of 50 cm (except for cassia, which was planted at 100-cm intervals) between alleys 5 m wide. Nine months after planting, the sesbania was pruned, while the branches of the other species were trimmed; their first cutting came at 16 months after planting. The height of pruning was maintained at 60 cm from the ground for all species.

Despite excellent initial growth, sesbania did not withstand repeated prunings, and many plants died after two or three cuttings. The stumps showed severe nematode infestation. Sesbania was therefore replaced with *L. diversifolia*. All the other shrubs, after considerable variation in growth rate in the first nine months, showed little variation in height - from 285 to 337 cm after 16 months.

Cassia was the best producer of prunings over the three-year period, followed by calliandra and leucaena. The poor yield of prunings from leucaena, less than half of that reported from Ibadan, Nigeria, may be due to the harsh environment. The production of woody stems was highest from calliandra, followed by leucaena and then cassia. Firewood in Rwanda being as scarce as food, alley cropping may prove an important method of on-farm production of fuel.

The roots of leucaena penetrated deeper than those of the other shrubs in the plateau soils. Also, the bulk of leucaena roots (52 percent) were found between 30 and 60 cm depth, while 64 percent of cassia roots and 66 percent of calliandra roots were found between 15 and 30 cm.

All the species tested, except sesbania, appear equally suitable for alley cropping in the high-altitude, semi-arid environment of Kagasa, Rwanda. Farmers' preference among the species will probably be determined by the usefulness of their by-products for fuel and crop cultivation.
Author's summary, shortened

656 90 - 7/45

Agroforestry
Africa, Sub-Sahara, biomass energy, policy options, woodfuel crisis, sustainable development, gap theory, IIED, SIDA

MEARNS, R. and G. LEACH

Energy for livelihoods: Putting people back into Africa's woodfuel crisis.

Gatekeeper Series No. SA 18; International Institute for Environment and Development, Sustainable Agriculture Programme, 3 Endleigh Street, London, WC 1H ODD, UK, 1989, 17 pp., price £1.50 each inc. p. and p.

This paper outlines briefly the major arguments of a recent study commissioned by the Royal Norwegian Ministry for Development Cooperation. The eighteen-month study, carried out at the International Institute for Environment and Development (IIED), set out to identify the key issues and policy options in the field of biomass energy in sub-Saharan Africa. The full study is available as a book: Leach, G., and Mearns, R. 1989.
The woodfuel 'crisis' of developing countries was 'discovered' in the mid 1970s at the time the world was gripped by the energy crisis that followed the oil price shocks of 1973-74.
The woodfuel problem appeared to be a classic case of rising energy demand outstripping supply. Although the resources in this case were renewable - unlike oil, gas and coal - they were apparently being over-used at unsustainable rates.
The basic premise of the so-called "woodfuel gap theory" is that woodfuel consumption is the principal cause of deforestation and therefore of mounting woodfuel scarcities. To measure the scale of this imbalance, the first step is to estimate the consumption of woodfuels (and sometimes of timber, construction poles and other tree products) in a given region and compare it with the standing stocks and annual growth of tree resources.
This produces a figure for consumption that greatly exceeds the annual growth of trees. As for the Sahelian countries, for example: recent studies have found that woodfuel use exceeds the growth rate of tree stocks by 70% in Sudan, 75% in northern Nigeria, 150% in Ethiopia and 200% in Niger, with a small surplus of 35% in Senegal.
Criticism of the methods of gap theory should not detract attention from important facts. Supply-demand analysis, of which traditional gap theory is just one model, is clearly a valid tool for resource assessments at the national or regional level.
Legitimate criticism can be levelled at the serious practical flaws in gap theory as it has been, and still is, applied. By ignoring these flaws, gap methods have done much to exaggerate the scale of the woodfuel problem and foster inappropriate, large scale, energy-focused remedies at the expense of other actions which could have done much more to improve welfare, reduce deforestation, and generally assist the efforts of local people towards securing a livelihood on a sustainable basis.

The paper further outlines
- major flaws in gap theory,
- basic assumptions for energy-focused interventions and
- real scarcities in the woodfuel crisis.
Finally new remedies are discussed.
The more comprehensive and objective view of woodfuels now emerging recognizes that there are no single, simple answers and that the problems surrounding them are inseparably linked to the complex, diverse, extremely dynamic and multi-sectoral issues underlying Africas broader crisis of population, food, poverty, land and natural resource management.
Narrow specialism, false diagnoses of problems and top-down attitudes are found in all of the many disciplines and institutions which work, directly or indirectly, towards the better management of land and natural resources.
But despite the enormity of the task of devising new and appropriate kinds of remedies, important lessons have been learnt in the past such as seeking to build on local knowledge and management practices and addressing a number of problems at the same time.
The signs are encouraging that more and more people are beginning to see the need to put people's livelihoods first in the search for sustainable solutions to land management problems in all their complexity.

657

90 - 7/46

Agroforestry
Africa, Burkina Faso, semi-arid zone, farmers, project, semi-nomadic pastoralists, land-use, food security, tree growing, rock bunds, local participation, extension, land degradation

KERKHOF, P.

Project agro-forestier, Burkina Faso. (Agroforestry project, Burkina Faso).

In: Agroforestry in Africa - A Survey of Project Experience -, Publ. by Panos Publ. Ltd., Angel House, 9 White Lion Street, London N1 PD, UK, ISBN 1-870670-16-7, 1990, pp. 133-141

The average rainfall in Yatenga Province in the north of Burkina Faso declined in the 1970s and 1980s from an annual average of over 600 mm to 400-500 mm. Yet in spite of these worsening conditions, the population has continued to grow.
Production of food crops is often far below family needs. Many people, especially the young men, leave during the dry season in search of temporary employment in Côte d'lvoire.
The project discussed here began in 1979 by promoting the use of microcatchments to enable farmers to grow trees for wood. The technique was similar to that used in the Negev desert in Israel. It was felt that trees would be better than food crops in utilizing the water harvested by the microcatchments.
From the beginning the farmers showed little enthusiasm for tree planting. Seedling survival rates were also poor. Goats were identified as a major cause of damage and project staff started fencing the trees but this was a costly measure.
It became apparent that the root cause of the problem was that tree growing was not a priority for farmers. They were in favour of the microcatchments because they helped increase food production but they had little interest in the trees.
It then introduced a water-harvesting method based on the use of stone contour bunds which succeeded in raising agricultural production. This innovation has been widely adopted and is spontaneously spreading outside the project area. Now that crop yields have improved, the project is finding that farmers have become more responsive to suggestions that they should plant trees and improve natural regeneration.
In addition to the rock bunds, the project is also promoting a number of other improved agricultural practices. One of these is the "Zay" method of tillage. This is a traditional practice whereby a 20x20 cm hole with a depth of 10 cm is dug during the dry season and filled with mulch such as crop residue. This leads to increased termite activity which in turn increases the rate of water penetration when the rains come. Millet is planted in the individual Zay holes which also help to protect the seedlings from wind damage. The project also promotes the use of an improved compost heap as part of a national programme to improve composting by farmers.

Project staff have found that attitudes to tree growing tend to change once the project package has been implemented. In some villages, farmers are now prepared to plant trees along the bunds if they are provided with seedlings by the Forestry Department; equally important, they are also willing to provide protection against grazing animals during the dry season.
All livestock is now held in shaded enclosures and fodder is collected from the cultivated areas. The costs of stall construction and other extras are borne by the villagers themselves.
The principal lesson of the project is the importance of mobilizing the community. Many development projects have switched the emphasis to individual, or family-based, activities when they have run into difficulties in promoting communal action.
As time passed, however, it became clear that much of the work can only be done effectively if there is a community consensus. If, for example, rocks are not available nearby, their collection needs to be organized on a community basis; if land is to be protected from grazing, the animals of all farmers without exception must be controlled. The communal orientation, if it works, also helps to ensure that the poorer farmers are included among the project beneficiaries.
The project also recognizes that problems remain. So far, less than 10% of the farmers have constructed rock bunds on their lands. There are villages where, despite the evident success of the technique in some fields, adjacent farmers have not yet adopted it. A considerable amount therefore remains to be learned about the attitudes and constraints which operate at a local level.
There is also the question of uneven distribution of costs and benefits. Rock collection and construction of the bunds make heavy demands on the available labour, and probably most of all, on women. Rich farmers are also more likely to be able to mobilize and provide food for communal groups to build bunds on their land. Indeed, poor farmers may owe work to the richer farmers which makes it even more difficult for them to construct bunds for themselves.
The sustainability of the increased yields obtained when using the bunds is another cause of concern. Higher crop production means greater mineral extraction from the land. There is therefore a danger of long term soil depletion unless methods of increasing the input of organic matter and fertilizers can be put into operation. Thus the recovery of manure from stall-fed animals and the encouragement of composting assume a critical importance in the longer-term perspective.
The project accepts the need to identify and resolve such issues, but is fully aware that whatever solution or technical package it develops, they must be acceptable to the local population.

658 90 - 7/47

Agroforestry
Review, book, agroforestry systems, tropics, ICRAF, ATSAF

NAIR, P.K.R.

Agroforestry systems in the tropics.

Forestry Sciences, 31, Kluwer Academic Publishers/ICRAF, ISBN 90-247-3790-7 (HB), 90-247-3791-5 (PB), 1989, 664 pp.

This book consolidates the descriptive results of a pantropical project called Agroforestry Systems Inventory (AFSI), undertaken by the International Council for Research in Agroforestry (ICRAF) from 1982 to 1987. Since agroforestry was a relatively new term when the project was initiated, the main objective was to increase the understanding of and provide a state-of-the-art information based on existing agroforestry systems. Therefore, the project was designed to systematically collect, collate, synthesize, and disseminate information on existing agroforestry systems in developing countries. One of the major results of the project, descriptions of existing agroforestry systems, was published as a series of articles in Agroforestry Systems. These system descriptions form the bulk of this book.
For the purpose of this book, the word tropics is used in a general sense to also include subtropical developing countries that have agroecological and socioeconomic characteristics and land-use problems similar to those of the countries within the geographical limits of the tropical belt. The basic consideration of this book was to include examples of systems from as many geographical and ecological regions as possible.
The system descriptions and their analyses show their potentials on the one hand, and the obvious gaps in our understanding of these systems on the other. This points out the need to undertake systematic research efforts to fill these voids and improve the functioning of these low-input traditional systems that provide sustenance to millions of poorer sections of people in many developing countries of the world.
Abstract from ATSAF-Circular

659

90 - 7/48

Agroforestry
Asia, India, ICRISAT, semi-arid zone, Africa, pigeonpea, perennial, genotype, grain yield, soil fertility

DANIEL, J.N. and C.K. ONG

Perennial pigeonpea: a multi-purpose species for agroforestry systems.

Agroforestry System 10, 1990, pp. 113-139

A major constraint to the adoption of agroforestry systems in the semi-arid tropics is the severe competition between trees and crops for environmental resources. Mean grain yield reductions of more than 60% in annual crops have been reported in leucaena-based alley cropping systems. In addition, tree species including leucaena are notoriously slow in giving economic returns because of poor growth rate during the year of planting.
Pigeonpea was a promising crop during the early part of this century in Hawaii and was sometimes managed as a perennial crop for grain and forage. Though intrinsically perennial, pigeonpea is grown as a perennial crop (that is more than 12 months) only in backyards, around annual crops, on field bunds, or as boundary plants. Despite the potential to produce food, fodder and firewood, the use of pigeonpea as the perennial component in agroforestry systems is under-exploited.
Perennial pigeonpea is similar to the medium-duration types (5 to 7 months) except for the longer duration to flowering and maturity, lower harvest index, greater rationability and deeper rooting habit. The perennial nature enables it to withstand harsh environmental conditions and recover after the removal of stresses. It is an attractive choice for smallholders because an edible grain yield is not commonly obtained from agroforestry species.
This paper reports on the results of preliminary trials started in 1985 and reviews the relevant information with the objective to stimulate interest in research on perennial pigeonpea as an agroforestry species. Due to the limited information available on perennial pigeonpea in agroforestry systems, data from genotypes grown mainly for grain, irrespective of growth duration, are often cited in this review.
Growth of perennial pigeonpea, like that of medium-duration grain types (150 to 190 days) in intercropping systems with cereals, is slow during the first 3 to 4 months. Therefore, it requires minimum sacrifice in terms of yield of annual crops in the system during the first year and offers many of the benefits of tree species in subsequent years. Total dry matter production potential of perennial pigeonpea in peninsular India is more than 15 t ha^{-1} consisting of about 2.0 t of grain, 3.0 t of leaf litter, 9.0 t of stems and 1.0 t of residue made up of podwalls and twigs. In addition, pigeonpea improves soil fertility by nutrient cycling and biological nitrogen fixation. Susceptibility of pigeonpea to

diseases and negative effects on growth of annual crops are the potential constraints in the semi-arid tropics.
This paper has ignored the social constraints to adoption by farmers. Unlike the introduction of *Leucaena leucocephala* or *Gliricidia sepium*, perennial pigeonpea is already widely grown in south Asia and eastern Africa as a multi-purpose legume crop and its fodder is readily accepted by livestock. However, the introduction of perennial pigeonpea to new regions may suffer from the same adoption problems encountered by grain pigeonpea because the preference for pigeonpea grain is lower than for other grain legumes. The potential of perennial pigeonpeas as an agroforestry species was not widely appreciated until recently, even in India. Pigeonpea is easy to establish by direct seeding and can be useful in short rotations as an improved fallow. There is a need to develop appropriate management practices, since the requirement during the second year is different from the annual grain types, and to re-introduce perennial pigeonpea as a multi-purpose species on a wider and more organised scale than hitherto practised in farmers' fields.

660 90 - 7/49

Agroforestry
Africa, Lesotho, highland, agro-sylvo-pastoral system, sustainable production, trees, shrubs, environment, wood shortage, livestock, erosion, windbreak, frost shelter

POULSEN, G.

Introduction of the tree and shrub component of a sustainable agro-sylvo-pastoral production system adapted to the Lesotho Highlands conditions.

Final Report on a Consultant Mission; Lesotho Highlands Development Authority, Environmental Division, 1989, 51 pp.

The natural flora of the highlands of Lesotho which rise like a rocky island above the plains of southern Africa, has undoubtedly evolved in relative isolation from other zones in the world with comparable eco-climatic conditions.
This isolated position explains almost certainly to a large extent both the originality of the highland vegetation and, the almost complete absence of large naturally occuring, ligneous species.
In this same context, it should not be overlooked that the botanical composition may be significantly poorer now than it was maybe just 100 years ago. The introduction of domestic livestock in large numbers has led to the gradual extinction of many members of the original plant community that happened to possess highly palatable foliage. That such negative selection has taken place, actually, seems to be confirmed by the fact that hardly any of the shrub species which thrive on the highlands now-a-days are being browsed, except perhaps, at the very young stage.
The herbaceous ground cover and thickets of low shrubs which one may assume constituted the natural flora of the past, gave shelter and nutrition, almost certainly, to a much more numerous and varied fauna of mammals and birds, etc. than encountered at the present time.
More-over the vegetation undoubtedly provided a very effective barrier both against soil erosion and the more insidious loss of plant nutrients through leaching.
The presence within such an environment of small groups of semi-nomadic hunters and gatherers can be assumed to have affected the ecological stability no more than marginally, although fires used as a tool for hunting, may have done considerable damage.
What nobody could have foreseen at the time, was that the combination of high elevation, summer rain accompanied by a long dry season, thin soil layer in most places, and steep slopes, constituted an environment which would be extremely vulnerable to human abuses, to be introduced shortly, in the form of grazing of large herds of livestock, clearing of steep slopes for crop farming and, not least, heavy exploitation of the meagre forest resources for fuel and construction wood.
Nowadays trees and shrubs are very scarce in the Lesotho Highlands.

people use dung cakes as their principal fuel, supplemented by a little wood, crop-residues and various dry weeds.
The available wood resources probably suffice to cover basic requirements for roof construction and various other domestic needs.
Severe environmental deterioration in the form of sheet and, to a lesser extent, gully-erosion is already conspicuous practically everywhere. It has resulted from a combination of deforestation, overgrazing and crop farming, without adequate safeguards, sometimes being practiced on excessively steep slopes.
The planned development activities, including flooding of reservoirs, occupation of land by roads and civil engineering structures, are undoubtedly going to have very adverse effects on this already critical environmental situation.
The adversity is perhaps going to be felt most directly in the domain of wood supplies. A considerable proportion of the scanty vegetation of shrubs and trees, mainly confined to the valleys, is going to be totally lost.
Nonetheless, it is in the spheres of crop and pastureland, that the greatest harm can be expected. More land will eventually be cleared for cultivation on erosion-prone slopes. The concentration of livestock on the winter-grazing areas, in particular, will be raised above already excessive levels.
It is estimated that it would be necessary, in order to cover the requirements of the population with its future needs for timber and wood fuel, to afforest approximately 4000 hectares. The figure is assuming that people gradually will abandon their dependence on dung as their principal fuel resource.
It is advanced in this report that it will be unrealistic to attempt the establishment of woodlots on anything near this scale. Even assuming that some grazing may be allowed, after some years, among the trees, the reservation of so much land for forestry would almost certainly lead to unsurmountable difficulties in the spheres of pastoralism and crop-farming.
Large scale planting of fodder vegetation, herbs as well as shrubs, would constitute the main element of attention. These plants would either be established as protective 'bufferstrips' regularly spaced across crop and pasture land or be planted in the form of more compact stands, as a form of fodder-reserves, on steep and particularly erosion prone hillsides.
The main purposes of these two vegetation types would be to combine environmental stabilization with a large output of livestock feed. However, as the biomass harvested for fodder would comprise a residue of about 50% of unpalatable branchwood, the plantations can also be expected, as a side-effect, to develop into important fuel resources.
The productivity of livestock in the hills is often affected, adversely, by lack of shelter against the wind. It is also proposed to deal with this problem by tree planting.
These plantations may present the additional advantage of protecting the herbaceous pasture, among the trees, against the adverse effects of early night frost during the autumn.
Beside these efforts, it is also recommended to promote conventional afforestation, oriented more basically at producing

timber and fuel where land can be made available for such purposes without conflict.
In this context attention is drawn to the prospects for planting willows and poplars on a considerable scale - two tree species which already enjoy great popularity among the local people.
For the same reason, it is also proposed that people should be encouraged and helped to grow many fruit trees.
In the cases of many of the proposed species and techniques, little or no experience and data are available in Lesotho.
It should be strongly emphasized that the areas will not be covered by trees at the exclusion of crop-farming and grazing. On the contrary, it is assumed that it will be possible to adapt and introduce the agro-sylvo-pastoral practices so successfully that the general improvement of productive capacity will provide more than full compensation for land occupation by the involved trees and shrubs.

661 90 - 7/50

Agroforestry
Asia, Indonesia, Java, uplands, environmental degradation, land-use, economics, soil management, sustainability, ILEIA

PALTE, J.

Economics of agroforestry in uplands.

ILEIA Newsletter, 2, 1990, pp. 6-7

In this paper the uplands of the densely populated island of Java are dealt with.
The combined effects of climatic hazards (related to the high temperatures and the variation and intensity of rainfall), edaphic problems (i.e. extensive leaching, rapid breakdown of organic matter, poor soil structure) and biotic perils (the flourishing of weeds, fungi and parasites) quickly exhaust the fertility of the soil, and make continuous dry-land farming subject to risk of prolific weed growth, pests and diseases. Upland fields, which are situated on sloping grounds, are in addition exposed to the threat of soil erosion.
The pressure on agricultural resources is considerable: holdings are small (0.6 hectare on average) and permanent cropping is the rule.
Smallholder farming in Java's uplands is far from homogeneous. Differences in local resource base, unequal economic opportunities and different actions taken by the farmers in response to population growth have resulted in a great variety of agricultural practices.
The most wide-spread type of agriculture in Java's uplands is dry arable farming. In this system annual food crops (maize, cassava and grain legumes) grow interplanted on open fields. A few dispersed or peripheral trees may be found as well, although such perennials are not necessarily planted on purpose. The above mentioned problems rainfed tropical agriculture faces, are very much manifest on the rather open and unprotected fields. Only by applying farmyard manure and mineral fertilizers in rather sizeable quantities may the farmers obtain continuously satisfactory yields. However, most smallholders cannot afford such large amounts of external inputs. So in practice the soils under arable farming are more or less mined and their productivity is low and stagnant.
Terracing of the sloping fields is usually poor. In some parts of the uplands, the farmers spontaneously developed a type of cultivation in a multi-storeyed arrangement. This agri-silvicultural system, referred to in the local language as mixed gardening, in spite of its distinct advantages, has received little attention from agronomists and policy makers.
Insufficient soil management, which is characteristic for dry arable farming as practiced in Java's uplands, is largely responsible for the degraded condition of these areas.
The mixed gardens are characterized by a wide array of cropping patterns. Farmers may choose from dozens of woody and herbaceous

plants which they cultivate in various densities and combinations. Basic food crops, such as maize, are usually a major component. When the staple grows under a rather dense canopy of trees, rootcrops (esp. cassava) are preferred to grains which do not thrive in the shade. In addition, other annuals are cultivated which serve as vegetables or condiments (e.g. beans, egg-plant, chilies and ginger). Finally, the numerous perennial crops that grow in inter-culture with the annuals include both fruit trees and timber. Common species are coconut and Albizzia. The mixture of trees, shrubs and herbaceous plants of different height and size in this smallholder agroforestry system approaches the climax vegetation of the tropical forest and thus provides an excellent protection of the soil against excessive heat and rainstorms. As a result, run-off erosion is slight, even on those slopes that are poorly terraced. Besides, the integration of trees in the cropping pattern contributes to the capacity of the soil to store water. This is particularly the case with leguminous trees: more nutrients and more water is available under such trees.
Mixed gardens are quite remunerative. Even the food production in mixed gardens on farms of the same size category is higher.
Most products from the mixed garden are used by the household itself. Still substantial surpluses are available for sale, for example, lumber and fruits. Not seldom a few perennial products are grown exclusively for the market, such as coffee and cloves. The availability of cash enables the farmers among other things to purchase chemical fertilizers.
The availability of various perennial surpluses from the mixed gardens not only stimulates trade. Processing of agricultural produce too is done by the farm households and by craftsmen in the village. The relationship between such processing activities and agroforestry is apparent from the fact that log sawing, carpentry and making of palm sugar (from coconut nectar) are the most performed (home) industries.
The attractiveness of this smallholder agroforestry, as compared to arable dry-land farming, lies in its productivity, adoptability and sustainability. The output of mixed gardens usually suffices to feed the farm household and to provide income to satisfy its pecuniary needs.
Author's Abstract, shortened

662

90 - 7/51

Agroforestry
Review, defining agroforestry systems, ICRAF, land-use, agrosylvicultural systems, sylvopastoral systems, taungya, shifting cultivation, alley cropping

WESTLEY, S.B.

Defining agroforestry technologies.

Agroforestry Today, 2, 1, 1989, p. 21

Farmers have been practising agroforestry through the millennia long before researchers began investigating traditional practices and designing new ones. In principle, there could be as many ways to combine woody perennials with agricultural crops and/or livestock as there are sites in different parts of the world and farmers with different ways of working, resources and production goals.
Researchers in many organizations have been concerned with clarifying what they mean by components, practices, interventions, systems and other terms, and out of this has come the useful concept of an agroforestry technology. As defined at ICRAF, an agroforestry technology is a set of specifications for the functions, locations, arrangements and management of multipurpose trees and associated crops or livestock. These trees, crops and livestock are the components of the technology.
At ICRAF, the definition of agroforestry technologies also takes into account the need for simple, unambiguous terms that can be used to enter and search for information in computerized databases. Work is in progress to develop a Multipurpose Tree and Shrub (MPTS) Database and there are plans to develop a computerized Technology Register. These projects involve the formulation of a standardized, modular system for describing and defining agroforestry technologies, including elements such as temporal arrangement, spatial arrangement, management, primary and secondary products, service functions (e.g. soil enrichment, erosion control) and location within a land-use system.
The table given here was compiled at ICRAF. It represents one well-considered view, but there are other views, even within ICRAF:

- Mainly agrosylvicultural (trees with crops)
  . Rotational:
    Shifting cultivation
    Improved tree fallow
    Taungya
  . Spatial mixed:
    Trees on cropland
    Plantation crop combinations
    Multistorey tree gardens
  . Spatial zoned:
    Hedgerow intercropping (barrier hedges, alley cropping)
    (also agrosylvopastoral)
    Boundary planting

Trees on erosion-control structures
Windbreaks and shelterbelts (also sylvopastoral)
Biomass transfer
- Mainly or partly sylvopastoral (trees with pastures and livestock)
. Spatial mixed:
Trees on rangeland or pastures
Plantation crops with pastures
. Spatial zoned:
Living fences
Fodder banks
- Tree component predominant (see also taungya)
Woodlots with multipurpose management
Reclamation forestry leading to multiple use
- Other components present
Entomoforestry (trees with insects)
Aquaforestry (trees with fisheries)

For further information on the definition and description of agroforestry technologies, consult:
ICRAF, P.O.B. 30677, Nairobi, Kenya

663 90 - 7/52

Agroforestry
Review, book, soil erosion, agroforestry systems, soil fertility, research, ICRAF, SIDA

YOUNG, A.

Agroforestry for soil conservation.

CAB International, Wallingford, Oxon OX10 8DE, UK and ICRAF, P.O.B. 30677, Nairobi, Kenya; ISBN 0-85198-648 X, 1989, 271 pp. £14.95; available from ICRAF, Kenya

ICRAF's Science and Practice of Agroforestry series, initiated in 1984, covers a wide range of topics related to agroforestry. Volumes in the series include practical handbooks and manuals, descriptions of research methods, species/genus monographs, analyses of specific agroforestry technologies, accounts of agroforestry practices in different geographic regions and reviews on special aspects of agroforestry.
The series is aimed at a wide audience, including: scientists and development personnel in agroforestry and related disciplines; resource planners, administrators and policy makers; and students at the secondary and tertiary level.
This book presents the results of an ICRAF review of the potential of agroforestry for soil conservation, treated in its wider sense to include both control of erosion and maintenance of fertility.
The book is divided into four sections, dealing in turn with Soil Conservation and Agroforestry, Agroforestry for Erosion Control, Agroforestry for the Maintenance of Soil Fertility, and Agroforestry for Soil Conservation. The bulk of the text is found in the second and third sections, with the brief opening section setting the context for the review, and the final section discussing some attempts at modelling and the need for research, finishing with a most clearly written summary. The second section deals in detail with the role of trees in erosion control, both considering how they are used and offering suggestions as to why they may be successful in this role. The third section, occupying some 40% of the text, deals in detail with the effects of trees on soils, paying particular attention to the role of organic matter and the above and below ground organic components. It also summarizes the soil-improving properties of selected trees and shrubs, and the manner in which agroforestry practices can be incorporated in land management to maintain and improve soil fertility.
This book is a landmark review on tropical land management. Its impact on the level of knowledge and understanding of the potential of agroforestry to achieve the sustainable use of tropical soils will be considerable.
It provides a thorough analysis available up to now of the various hypotheses that trees and shrubs, if properly chosen and managed, have a potential to conserve the soil's productive capacity. Soil conservation is not seen in its traditional, narrow sense of

preventing water and wind erosion, but in the broader and much more important sense of maintaining soil fertility.
The main value of this book is that it brings together a substantial amount of information from fundamental research, applied research and observations of real farm and forest conditions.
In addition to the clearly written text, there are numerous tables and figures which further enhance the transfer of information from author to reader. There is also a substantial bibliography.

664 90 - 7/53

Agroforestry
Review, forestry, developing countries, nutritional aspects, income, sustainable food production, FAO

OGDEN, C.

Building nutritional considerations into forestry development efforts.

Unasylva, 160, 1989, pp. 20-27

This article first examines the linkages between forestry and nutrition and discusses efforts to promote greater awareness of these links and to stimulate the implementation of actual forestry/nutrition field-work. Special attention is given to a regional workshop held in Thailand in 1988. The article then turns to needs for further progress, and details an ongoing effort by FAO to develop a methodology and field guide for the incorporation of nutritional considerations into forestry development efforts.
Forest and trees contribute to nutrition in several ways. Most obviously, they provide many edible products. Wild leaves and fruits contain necessary vitamins. Seeds, nuts, roots and tubers supply fats and carbohydrates. Mushrooms, gums and saps provide protein and minerals. Wild animals often supply most of the protein consumed by local people. Forest foods contribute to diet diversity, supplying nutrients or making other foods more palatable, and they are important in minimizing seasonal or emergency nutrient shortfalls.
Access to forest products influences the time women spend participating in subsistence activities. In most societies women perform the critical functions of feeding and caring for the family. If women have to devote extra time to collecting fuelwood and fodder, they have less time for food production and preparation, income generation and child care.
Fuelwood, forest raw materials, employment in forestry activities and medicines bring essential income to many households. For example, villagers who engage in sericulture from mulberries can earn income to purchase essential foods or those necessary to balance otherwise monotonous diets, and medicines. In addition, medicines originating from tree products for both humans and livestock help reduce the incidence of infections that contribute to or worsen malnutrition.
FAO has been working to develop new approaches that link forestry and nutrition.
Two elemental parts of the methodology are the definition and harmonization of the respective roles of nutritionists and foresters, and the participation of community members. A brief exposition of the draft methodology is given in this paper.

665 90 - 7/54

Agroforestry
Latin America, Brazil, Amazon, fallow utilization, spontaneous community enrichment, fruit trees

UNRUH, J.D.

Iterative increase of economic tree species in managed swidden-fallows of the Amazon.

Agroforestry Systems, 11, 1990, pp. 175-197

Presently much attention is being placed on investigation and improvement of traditional subsistence farming systems which are able to provide sustained yields in tropical countries.
One such improvement with significant agronomic potential is the utilization of the fallow cycle of swidden (slash and burn) agriculture.
Little attention has been given to the fate of valuable fallow plants after the end of the initial fallow cycle, and over successive fallow cycles on a regional or inter-fallow level.
Obviously the difficulty of such a study lies in the great deal of time which would be required to monitor a typical single long-fallow cycle in the humid tropics (20-30 years).
This paper discusses the potential lasting effects of an existing fallow management design in the Peruvian Amazon, in the context of local ecological processes which promote an increasing abundance of spontaneously occuring, economically valuable plants in a cyclic or literative (swidden-fallow-swidden-fallow etc.) fashion. Evidence is presented which suggests that this particular arrangement results in long-term community enrichment of an area with economic plants of importance.
Following a brief description of the fallow management scheme, and managed fallow ecology, information is drawn from the ecological literature and the author's observations to describe how fallow management practices interact with specific aspects of the local ecology to enrich the fallow with a variety of valuable plants over successive fallow cycles.
The author concludes that the increase in the number of valuable plants in managed fallows with each successive fallow cycle will depend to a considerable degree on the favoured germination and establishment of these plants in the managed fallow. Seed of parent trees which were left uncut in the swidden may have a greater chance of surviving a burn, and would, below the parent tree, have greater access to nutrients for longer periods of time than regrowth plants elsewhere in the swidden. As the site is slowly abandoned and the fallow cycle is initiated, the germination and establishment of valuable plants would continue to be favored. The interaction between managed fallow canopy structure, and the composition, abundance, distribution, and dispersal strategies of valuable fallow plants (especially fruit trees), together with the foraging behavior of frugivores, has the potential to greatly

increase the number of successful establishments of seedlings of valuable plants in managed fallows.
The applied implications of the ecological evidence presented would seem to be that certain economic species are able to take advantage of the ecological processes which occur in conjunction with managed swidden fallows to successfully survive and increase their numbers over the long term. The agroforestry approach taken toward this form of fallow utilization should therefore include management techniques which encourage the ecological processes which are important in promoting a spontaneous presence of economic species. Such techniques would likewise be useful in the promotion of man-made community enrichment as well.
The presence of a greater number of valuable perennial plants in areas under swidden agriculture would encourage the management of a greater number of fallows. When the farmer decides to manage a fallow or not, the presence of valuable trees in the fallow about to be cleared is of primary importance.

666 90 - 7/55

Agroforestry
Tropics, coppicing technique, rules, trees, bushes, tree-management

PAWLICK, T.

Coppice with care.

Agroforestry Today, 1, 3, 1989, pp. 15-17

Coppicing is an ancient art that can bring profits to farmers and provide them with a ready source of fuel wood for home use.
Breaking any one of the rules for this time-honoured tree-management technique can lead not only to lower yields, but to dead trees, perhaps the loss of an entire planting.
Extension workers who are encouraging farmers to grow trees for cropping should keep the following maxims in mind:

- Choose correct species:
  Not all tree species coppice well. Some, like *Sesbania sesban* or *Casuarina equisetifolia*, coppice poorly, while most conifers don't coppice at all. Other species do better when cut at certain times of the year, or only when growing under specific soil or climate conditions. One species may yield good fodder for livestock but produce crooked or weak poles, while the leaves of a good pole producer may be useless as fodder for animals.
- Don't rush the first cut:
  To survive the trauma of the initial cut and go on to produce abundant, healthy shoots, a young tree must be well established. If it hasn't had time to develop an adequate root system, it may recover from the cut slowly, or even die. The average coppicing species is ready to take its initial cut when it has reached a height of three to four meters, usually from nine months to two years after planting.
  Before cutting, the grower should ascertain the optimum age for the species.
- Consider the seasons:
  Coppicing should never be done at the height of the hot, dry season, when plants are under drought stress and will recover poorly from additional trauma. The best time to coppice is just before the onset of the rains, when abundant moisture will help trees rebound from the stress of cutting. Growers should be cautious, however, about cutting once the rains are actually under way. Trees cut too far into the wet season may be vulnerable to fungus attack. Cutting 10 days to two weeks before the rains allows time for the wound to heal without getting wet.
- Plan rotations well:
  The frequency of subsequent coppicings after the initial cut depends in part on the species and health of the trees, on local conditions and on which products the grower intends to produce. In the humid lowlands of Costa Rica, for instance, farmers coppicing for fodder leaves may cut up to five times per year. In parts of Western Kenya where rainfall is only 800 to 1,000

millimeters (mm) annually, two cuts per year are probably the maximum.
Management for fodder, in which the goal is to produce leafy biomass, permits more frequent cutting than does management for fuel or pole wood.
In cases where the commercial market demands poles of a specific diameter, even fast growing species may require 18 to 24 months between cuttings.
The nearness of trees to agricultural field crops, which may be damaged by too much shading, must also be considered. In many cases, it is wiser to site pole-wood species along fence rows or hedges, where the shade they cast is less likely to inhibit the growth of field crops. Fodder or green leaf mulch species that are cut more often can be sited between crop rows and cut just before the onset of the growing season, thus providing mulch and fodder as well as keeping competition to a minimum.

- Cut at correct height:
  Cutting too low on the stem of a tree can encourage fungal attack or decay of the stump, while cutting too high often results in loss of sprouting vigour and poor shoot growth. The optimum initial cutting height for many trees seems to be between 30 and 50 centimeters (cm) above ground level, but this can vary with the species.
- Cut cleanly, with the right tools:
  A uneven cut is an invitation to insect, fungal or other infection of the tree, as is a cut that leaves bark hanging loose along the remaining stem. Spaces between the loose bark and stem, or between the edges of jagged cuts, trap moisture and provide breeding places for insects. Damaging the bark and stem may also lead to production of fewer shoots.
  Yet many farmers coppice with pangas (machetes), hacking away not only at individual shoots but damaging the main stem itself, sometimes with a dull or rusty blade. The best tool for a small farmer to use for coppicing is a single-grip bow or Swede saw.
  If saws are beyond a grower's budget, or not available in the area, only a well-sharpened panga should be used.
  This initial cut of the main stem should always be made at an angle, to permit rainwater to run off the top of the cut surface easily. Cutting of subsequent shoot growth should be done in an upward direction, rather than from the top down, preferably while the shoot is bent backward from the cutting blade. This prevents bark from stripping off.
- Thin the shoots for best growth:
  A freshly coppiced tree may send up 15 or more new shoots in an outburst of bushy vigour. Allowing all of them to grow, however, can be inefficient, particularly if the aim is pole wood production. In general, the larger the shoot size desired, the fewer shoots should be retained.
  Most farmers thin the shoots to a maximum of two or three per tree, retaining the straightest and largest-diameter shoots for eventual sale or use in construction. If harvesting for sale as fuel wood is the priority, up to five shoots may be retained.
  If leaf fodder is the management goal, more shoots can be permitted to grow, but growth may be slower and care must be

taken to assure that an over-abundance of shoots does not create a shading problem for adjacent field crops.
- Replant before yields decline sharply:
As a general rule, most popular agroforestry species can be coppiced through three rotations, after which their vigour declines and shoot growth is reduced sharply. At this point, it is wisest to harvest mature trees for their timber or fuelwood value and plant fresh seedlings.
When it is time to replace a coppicing tree, the stump can be killed by removing all of its bark, or by cutting it down to ground level and coating the exposed wood with oil.

Author's summary

667 90 - 7/56

Agroforestry
Latin America, Peru, Amazon, lowland, review, traditional agroforestry practices, shifting cultivation, ecological condition, tribal community, mestizo community, economics

PADOCH, C. and W. DE JONG

Traditional agroforestry practices of native and ribereno farmers in the lowland Peruvian Amazon.

In: Agroforestry: Realities, Possibilities and Potentials, Ed. H.L. Goltz, Martinus Nijhoff Publ., ISBN 90-247-3291-2, 1987, pp. 179-194

It has often been reported that shifting cultivators in Asia, Africa, and the Americas plant tree species within their fields. In the past, little attention was focused on the management and importance of perennials in most swidden systems. Changes in species composition in the later phases of swidden field succession, methods of cultivating or protecting planted or spontaneously occuring trees in swidden fallow fields, and variation in quantity and type of product harvested from older fields have tended to go uninvestigated and unmentioned.
In this article the authors describe five examples of traditional systems. These examples share some characteristics. All began as swidden fields; then perennials gradually replaced annuals as the predominant crops. Major differences are also notable, particularly in species richness and management patterns. Several of the fields described should perhaps not even be termed fallows. For instance, systems are described where management is both intensive and continued; the resulting fields might better be called permanent orchards. However, all the examples represent dynamic traditional agroforestry systems which change in composition and management requirements over time.
The few types that are presented should be considered neither exhaustive of the variations found, nor necessarily the most typical of agroforestry systems.
Out of the five agroforestry systems found in the vicinity of Iquitos, Peru, four are found not in tribal but in mestizo communities of the region. The information presented shows that basic traditional swidden-fallow agroforestry practices are adaptable to varying environmental and economic situations.
After presenting and comparing the examples of traditional resource use practices, a number of suggestions for further research is presented and several aspects of these systems which may serve in planning for enhanced agricultural production in the humid tropics are pointed out.

668 90 - 7/57

Agroforestry
Review, training sourcebook, Africa, Kenya, extension, agroforestry projects, modules, illustration, CARE, SIDA, ICRAF

BUCK, L.E.

Agroforestry extension training sourcebook.

CARE-International, New York, USA; Four manuals and support notes, 1989, 991 pp., available with: CARE-International, New York or SIDA, Sweden

The agroforestry extension community has awaited the publication of Louise Buck's Agroforestry extension training sourcebook with great expectations, which are amply fulfilled with its appearance. This is a guide for training agroforestry project staff to work effectively with farmers and other rural people in the design and implementation of agroforestry projects. The 'agroforestry diagnosis and design' sections represent a participatory extension version of ICRAF's 'diagnosis and design' (D&D) methodology, which came out of Buck's work with ICRAF.
The sourcebook is based on the author's early work with CARE-Kenya's agroforestry extension project in Siaya District, Kenya, expanded through her experience as CARE-International's Regional Technical Advisor for Eastern and Southern Africa. It was illustrated, designed and produced by a large and talented production team in Nairobi.
It consists of ten modules: Beginning Agroforestry Extension Training; Introduction to Agroforestry; Project Approach to Agroforestry Extension; Agroforestry Extension Communications; Land-use Diagnosis for Agroforestry; Agroforestry Design; Planning, Monitoring and Evaluating Agroforestry Extension Activities; Seed Supply; Nursery Management; and Tree Planting, Protection and Management.
Each module consists of general suggestions to the trainer, a series of lessons with exercises, and learning notes for the trainee. All are well illustrated. They are accompanied by support materials, including reproductions of papers, chapters and manuals related to specific lessons.
All this material is distributed in large loose leaf binders. These are bulky and heavy to carry, but were designed to enable a trainer with limited office facilities to keep and protect all training materials in one place.
The philosophy of the sourcebook is that the agroforestry extensionist is not a message-giver, but rather a thoughtful analyst of problems and agroforestry potentials, with good communications skills and the ability to work with farmers to identify and implement relevant agroforestry interventions. The extension communications module, in particular, focuses on promoting full participation of the community in agroforestry design and project implementation.

Distribution of the sourcebook is still limited. CARE-International projects and collaborators may receive copies directly from CARE-International in New York. Interested readers in Africa may wish to contact the Swedish International Development Authority (SIDA), which is distributing the sourcebook to several extension projects on the continent. ICRAF will also make some copies available to collaborators in the Agroforestry Research Networks for Africa (AFRENA) and to others actively involved in agroforestry extension projects.
Over the next two years, the sourcebook will be tested and improved. There are also plans to publish it in French.
Abstract by S.J. Scherr

669 90 - 7/58

Agroforestry
Africa, Kenya, survey, alley-cropping, tree border technology, monitoring and evaluation, on-farm research, agroforestry project evaluation, ICRAF

SCHERR, S.J. et al.

Surveying farmers' agroforestry plots: experiences in evaluating alley-cropping and tree border technologies in Western Kenya.

Agroforestry Systems, 11, 1990, pp. 141-173

There is a need for research methologies which can be used to document and assess existing agroforestry practices. Such methods are needed not only to evaluate agroforestry in household-managed cropland, but also agroforestry practices in grazing land, rangeland and woodland, and under communal management.
The ICRAF Agroforestry Systems Iventory generated agroforestry system descriptions from 129 sites around the world. But despite provision of general guidelines for this work, these studies are inconsistent in their detailed system descriptors, making comparative evaluation difficult.
It is common practice in agroforestry development projects, as part of the project planning phase, to assess existing types and uses of multipurpose trees by farmers. Such evaluations of existing systems tend to be rather superficial, emphasizing species mix and general establishment and management practices.
This paper presents a method which was used in western Kenya to survey farmers' alley-cropping and tree border plots in cropland. The approach is focusing on 'technology design'. A technology design represents the complete 'specification' of a particular agroforestry practice. The key information needed for a complete agroforestry design specification includes: type of user, type of site where used, priority functions, tree and crop components, spatial arrangements of the components, management of the components, expected yields and services, and inputs.
The survey approach was tested in a joint research activity between ICRAF and CARE International in Kenya's Agroforestry Extension Project. Because the survey was carried out on two quite different agroforestry practices, in three agroecological zones, with a large number of different multipurpose trees, it provided a useful case study of the problems and possibilities of agroforestry survey design.
This paper describes the context of the survey, and then discusses key issues of selecting survey objectives, questionnaire design, sampling procedure and implementation and analysis. Finally the paper summarizes key lessons learned from the survey experience.
A condensed version of the questionnaire is appended.

VIII HOMEGARDENS

670 90 - 8/27

Homegardens
Africa, Tanzania, horticulture, review, book, production, climate, market, vegetable processing, export, cropping plans

VERHEIJ, E.W.M.

Horticulture in Tanzania - position and perspective.

Communication 74 of the Royal Tropical Institute, Department of Agricultural Research, Amsterdam, The Netherlands, 1982, 146 pp.

The present book is a compilation of teaching material for lessons in aspects of horticultural development. It describes the structure of horticulture and the extent of horticultural activities in the country with emphasis on development trends. The book is largely based on local sources of information: published papers, reports, statistical data as well as on the author's personal experience.
In detail the contents of the book are:
- Chapter 1. What horticulture is; its position in Tanzania
- Chapter 2. Production and consumption statistics
- Chapter 3. Centers of horticulture
- Chapter 4. Horticulture in relation to the climate
- Chapter 5. Home gardening and market gardening
- Chapter 6. Production for processing
- Chapter 7. Production for export
- Chapter 8. References
- Annex 1. Cropping plans for vegetable gardens
- Annex 2. List of fruit crops

The book has been written for all those who are interested in horticultural developments in the country, in particular for horticultural students and graduates. The contents in many instances have been limited by lack of relevant information. Lack of information pertaining specifically to Tanzanian conditions is also the reason that the husbandry of horticultural crops is not dealt with. In order to partially make up for this omission a paper on cropping plans for vegetable gardens and a fruit tree list have been included in the annexes.
The book unites the many faces of horticulture into a coherent picture. It is a valuable contribution to the further development of horticulture primarily in Tanzania, but also in other countries with comparable conditions.

669 90 - 7/58

Agroforestry
Africa, Kenya, survey, alley-cropping, tree border technology, monitoring and evaluation, on-farm research, agroforestry project evaluation, ICRAF

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VIII HOMEGARDENS

670 90 - 8/27

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Africa, Tanzania, horticulture, review, book, production, climate, market, vegetable processing, export, cropping plans

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671 90 - 8/28

Homegardens
Study, Europe, F.R.G., vegetable, sprouts, nutrient content, protein, fat, minerals, nitrate content, vitamins

MEIER-PLOEGER, A. et al.

Sprouts as an alternative to winter vegetables.

In: Proc. of the 6th Int. Sc. Conf. of IFOAM, Vol. II, Eds. P. Allen, D. van Dusen, Univ. of California, Santa Cruz, 1988, pp. 705-714

Vegetables are an important part of a nutritionally fully balanced diet. There is however, a declining trend in vegetable consumption, even though the market offers a substantial number of new vegetable varieties. For example, with the increasing popularity of Asian food, the use of soybean sprouts has entered German kitchens.
Because of an increasing nitrate intake by consumers, mainly through water and vegetable consumption, alternatives to vegetables are under discussion. Vegetables grown in winter are considered the main source of dietary nitrate. Because of high use of soluble nitrate fertilizer and a rather low light intensity, the absorbed nitrogen is not metabolically transferred to protein, but is stored in plant cell vacuoles.
The absorbed nitrate itself is not dangerous for humans, however, toxicological concern is based upon the reaction of nitrate->nitride->N->nitrosamines. The reaction from nitrate to nitrite is possible exogenously as well as endogenously, the latter especially in babies due to the subacidity of infants' stomachs. Through oxidation of fetal hemoglobin, nitrate can lead to methemoglobinamia (cyanosis).
The other nutritionally relevant biochemical reaction takes place between nitrite and secondary amines or amides (present in all diets in considerable amounts) to the so-called N-nitrosamines. When applied exogenously, carcinogenic, mutagenic, and teratogenic influences of a number of nitrosamines were clearly demonstrated in experimental animals, including primates.
In Germany, the average daily nitrate intake per person is approximately 150 mg: up to 70% from vegetables, up to 75% from drinking water, with all other food stuffs accounting for the remaining 75%. Under unfavorable circumstances, the World Health Organization's accepted daily intake of 220 mg per person per day might well be surpassed. This has led to a demand by toxicologists that the nitrate intake from water and vegetables be reduced wherever possible.
One possibility in this respect, especially in regard to winter vegetables, might be the production of sprouts directly by the consumer. Although little information is available on their nutrient content, sprouts--the new shoots of growing plants--are frequently considered special vegetables of high nutritional value. Since very little sound data is available in this field, the study conducted focused on gaining basic knowledge about the nutritional

properties of sprouts grown under various conditions applicable to household situations.
Because of their nutritionally and physiologically relevant levels of nutrients and low-energy content, sprouts are nutritionally comparable to other vegetables. This is especially true for levels of ascorbic acid, iron, and dietary fiber. Nutritionally negative values are partially reduced during sprouting. However, sprouts of garden beans should not be consumed uncooked.
Alfalfa, radishes, and mung beans should be preferred over soybeans in terms of nitrate content. Because they provide high levels of plant protein, sprouts can be an improvement over the customary vegetables. In addition, the production of sprouts is reasonable in terms of cost and provides the consumer with fresh vegetables at all times. The use of sprouts is multiple as an addition to muesli and soups, in sandwiches or on bread, for baking, as a salad ingredient, etc. The following seeds can be used as sources for sprouts: all grains, pulses, buckwheat, radish, mustard, cress, sunflower seeds, etc. It is important that seeds used for sprouting have not been chemically treated.

672 90 - 8/29

Homegardens
Review, book, tropics, vegetable, fruits

MESSIAEN, C.M.

Le potager tropical. (The tropical kitchen garden).

Collection Techniques Vivantes, 240 FF, ACCT-13, Quai André Citroén, 75015, Paris, France

What interest is there to develop and to diversify vegetable growing in tropical countries? First there is a nutritional interest because food based on a small number of different vegetables has a risk of being deficient in proteines. Next there is an economic interest because it allows imports to be reduced and exports to be diversified. Last there is a social interest because being a vegetable grower can be a real trade.
Starting from an experience in Guadaloupe (a country where it is possible to observe and experiment under different ecological conditions) these advices could be applied in many tropical countries. In "Techniques Vivantes", a collection published by ACCT with the cooperation of Conseil International de la Langue Francaise, "Le potager tropical" assembles as completely as possible all know-how necessary for succesful vegetable growing in tropical conditions. It will be of interest for agricultural graduates, the extensionist and for the vegetable grower. It reminds of the basic notions of bio-climatic, agricultural and phytosanitary rules. Finally it mentions every vegetable with its specific needs and details of its growing and usage.
Abstract from SPORE

673 90 - 8/30

Homegardens
Review, manual, Africa, orchards, gardens, vegetable, fruits, crops, techniques, photographs, drawings, CTA, Terres et Vie

DUPRIEZ, H. and P. DE LEENER

Jardins et vergers d'Afrique (African gardens and orchards).

Terres et Vie Belgique, in association with Mac Millan Publishers Ltd., U.K., L'Harmattan, France; Enda, Senegal; Apica, Cameroun and CTA, Netherlands; French edition ISBN 2-87105-005-8, 353 p., 1987; English edition ISBN 2-87105-008-2, 1989; Postal address: CTA, P.O.B. 380, 6700 AJ Wageningen, Netherlands

African Gardens and Orchards is a practical manual but the theory is explained, because the right course of action has to be unterstood before it can be applied.
The research for this book has begun by visiting rural and urban food markets and listing the most common vegetables, fruits and condiments for sale. The supply-lines which send foodstuffs daily to large markets so that urban dwellers have a wide choice of provisions were traced back to their source. These supply-lines are mostly run by women.
Notable aspects of vegetable and fruit production are, first, the amazing variety of plants cultivated, second, the similar approach to gardening methods in all the countries visited, and third, the fact that information is not exchanged between men and women cultivators, even though they may come from comparable social groups, or from neighbouring regions, a discovery which led to the collection of as much concrete information as possible and to be the writing of African Gardens and Orchards.
African Gardens and Orchards covers the principles and practices of growing vegetables and fruits in the tropics and subtropics. It describes the requirements of these crops, the techniques of cultivation and full details of a very wide range of local and exotic vegetables and fruits. The text is supported by hundreds of photographs and drawings.
The book is divided into two parts. Part I forms the core of the book and deals mainly with gardening methods and practices. It should help cultivators to think about what they are doing and to experiment with plants in order to improve their yield and their nutritious qualities. It suggests ways of ensuring a more balanced diet, controlling pests, fertilizing the soil, choosing good seed, and many other aspects of gardening. The book is not a list of recipes, but rather a manual that should encourage vegetable and fruit growers to direct their efforts towards positive effects on their usual methods of cultivation. The text and the illustrations go hand in hand for this purpose.
Part II is more descriptive, and presents eighty-five plants, many of which can often be found in the market-place, but tend to be overlooked by agricultural advisers in books on the subject.

Certain conventions have been used in this book: all the technical words are printed in bold face and explained in the text, heavy print is also used for key words and ideas. The general index gives the first and subsequent pages on which these words appear.
Italics are used for scientific and vernacular names other than those in English. Italics are also used in some tables.
Space above and below the ground is often differentiated to make certain illustrations easier to understand. It is important to understand the exact meaning of the line representing the surface of the grounds which occurs in many drawings.
There is a glossary and two indexes at the end of the book. The glossary gives definitions of the botanical terms used in Part II, in so far as they are not already defined in Part I. The index of scientific (Latin) names is useful because it removes any confusion about the names of plants in English and other languages - French, Spanish, Portuguese, Arabic. Some common names in dialects of languages other than English are also found in Part II. Lastly, the general index gives the reference pages for the subjects treated.
The Terres et Vie series is aimed at practitioners and students of agriculture and rural development and associated vocational and technical skills. The books in the series treat tropics according to appropriate, smallscale and affordable technology taking into account traditional ways but adding relevant modern improvements. For training, they can be used in secondary schools and vocational training centres and colleges up to diploma and degree level, but they are chiefly meant to be used in the field, in practice. They are ideal for self-help, adult education and rural extension projects. They are written in a clear and highly illustrated style and thus can be used equally by those for whom English is a second language and by non-specialists. All the titles in the series are designed and produced as low-cost editions. Although based on African practice, the books are relevant to similar climatic regions in other continents.
CTA financed the translation of the book into English and actively promotes its distribution.
The CTA, Technical Centre for Agricultural and Rural Co-operation, has its headquarters at Ede-Wageningen, Netherlands.
The aim of the CTA is to collect and circulate scientific and technical information on agricultural and rural development, facilitate the exchange of information, promote technical popularization, and encourage research and training. It contributes to studies and publications, organizes specialist meetings, assists the documentation centres of the ACP States and has a question-answer service at their disposal.

674 90 - 8/31

Homegardens
Review, booklet, gardening guide, techniques, vegetable, planting directions, VITA

ATTFIELD, H.H.D.

Gardening with the seasons.

A VITA publication, Volunteers in technical assistance, 1815 N. Lynn St., Suite 200 Arlington, Virginia 22209, USA; ISBN 0-86619-124-0, 1979, 72 p.

Gardening with the Seasons has been adapted from a booklet prepared as part of an innovative and meaningful approach to community development in Bangladesh.
In summary, the "package" project involves amongst others extension work to promote production of vegetables.
The booklet is a manual that should encourage vegetable growers to improve their methods and techniques. The text and the illustations go hand in hand for this purpose.
The booklet contains the following chapters:
1 Deciding what to grow
2 Learning to sow
3 Step-by-step gardening guide
4 Planting directions for each vegetable

Volunteers in Technical Assistance (VITA) is a private, non-profit, international development organization. It makes available to individuals and groups in developing countries a variety of information and technical resources aimed at fostering self-sufficiency--needs assessment and program development support; by-mail and on-site consulting services; information systems training.
VITA promotes the use of appropriate small-scale technologies, especially in the area of renewable energy. VITA's extensive documentation center and worldwide roster of volunteer technical experts enable it to respond to thousands of technical inquiries each year. It also publishes a quarterly newsletter and a variety of technical manuals and bulletins.
For more information, write to VITA, P.O.Box 12438, Arlington, Virginia 22209, USA.

IX SEED PRODUCTION

675 90 - 9/15

Seed production
Latin America, Colombia, Peru, Mexico, Ecuador, Costa Rica, seed supply, pasture technology

CIAT

Overcoming seed-production problems.

CIAT Report 1989, Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia, 1989, pp. 58-60

The International Tropical Pastures Evaluation Network (RIEPT in Spanish), through which CIAT cooperates with national pastures research and development organizations in tropical America and the Caribbean, is focusing its efforts on getting improved pastures technology to the producer. One of the major constraints to the massive adoption of new pasture technology is the unavailability of seeds.
The program is doing several things to promote pasture seed supply development. Activities are well underway in Colombia, Peru, Mexico, Ecuador, and Costa Rica.
The idea is to promote the progressive participation of private seed enterprises in the production and commercialization of the new materials being developed.
In Colombia, for example, the Instituto Colombiano Agropecuario (ICA) and CIAT's Seed Unit are encouraging pasture seed enterprises to produce the newly released cultivars and a few highly promising selections e.g., *Stylosanthes capitata* cv. "Capica", *Centrosema acutifolium* cv. "Vichada" and *Brachiaria dictyoneura* cv. "Llanero". Production contracts as well as technical assistance are offered to these enterprises. Eight of the 10 existing seed companies committed themselves to some degree of participation. Seed crops have been established in five different geographic regions of the country.
It is estimated that about 6 tons of seeds will be harvested. This is enough seed to expand by about 2000 ha the area planted with improved grass-legume pastures in the Colombian savannas.
In Peru's case, there are no seed enterprises operating in the humid tropics. So, as a starting point, the Tropical Pastures Program is involving selected farmers as novice, artisanal seed multipliers. Assistance is being given from a nucleus of agronomists with experience. The Peruvian national program, Instituto Nacional de Investigaciones Agricolas y Agroindustriales (INIAA) and the Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA), are major participants in the effort, along with regional development organizations, such as Corporación de Desarrollo de Ucayali (CORDEU) and Corporación Regional de Desarrollo de San Martin (CORDESAM). To get greater production capacity with very limited resources, the project operates on the

basis of share-farming agreements with selected participants. A total of 12 farmers are now participating and seeds are becoming available. In 1988, approximately one ton of grass seeds and one-half ton of legume seeds were produced, principally *A. gayanus*, *B. decumbens*, and *S. guianensis*.
The Pastures Program scientists recognize that overcoming the problem of seed supply is a must. The participation of various national research and development entities to promote the new cultivars along with private enterprises, either existing or novice, to produce and sell the seed are essential components. A guaranteed purchase price is an important catalyst to both promote participation and reduce risk of the seed multipliers. There is good reason to believe that with an expansive participation, seed supply can be increased, and that one of the major constraints to adoption of new technology will be progressively overcome.

676 90 - 9/16

Seed production
Africa, Nigeria, Togo, IITA, cassava, rapid multiplication, ministem cuttings

OTOO, J.A.

A new method for rapid multiplication of cassava.

IITA Research Briefs, June 1989, p. 5

Because cassava is a vegetatively propagated crop, the production of adequate amounts of planting material is always a problem. This is particularly serious when attempts are being made to spread improved varieties, such as those developed at IITA in recent years, as widely and quickly as possible.
A technique to speed up propagation was developed several years ago at IITA. This involved ministem cuttings, each with one or two nodes, which were nursed in perforated polythene bags or nursery beds filled with garden soil. Water was applied regularly for 4-6 weeks before transplanting to the field.
A new technique for sprouting the cassava ministem cuttings in perforated polythene bags without soil is an improvement on the original technique. In avoiding the use of soil as a sprouting medium it affords the following advantages:
- Costs little and is simple to use.
- Obviates the need for transporting large amounts of soil.
- Avoids spreading soilborne diseases.
- Provides compact storage for ministem cutting for a few days, for instance during transport over long distances.

The presprouting procedure entails three steps:
- Ministem cuttings are prepared from the hardwood or semimature portions of the cassava plant. Those from the hardwood portion should carry one or two nodes, while those from the semimature portion should have three to five nodes. (The number of nodes per ministem depends on internode length and the diameter of the stem.)
- The ministems are dipped in a bowl of water containing a fungicidal suspension. Benlate and Demosan fungicides have been used successfully at the rate of 6g/liter of water. Other wide spectrum fungicides can be used.
- The ministem cuttings are placed directly in a polythene bag which has a few perforations for aeration. The polythene bag should not be more than about two-thirds full. The bag is tied at the top, permitting an empty space above the material, and is left in a shaded area or under a roof.

Depending on the variety, 95-100% sprouting occurs in 3-5 days. In Togo, 100% sprouting was achieved with the variety "nakoko" in 2-3 days. Some varieties, however, may require more than 5 days to give high sprouting percentages. High humidity and temperature inside the polythene bag seem to encourage rapid and uniform sprouting.
In an experiment at IITA the sprouted ministem cuttings were planted out in the field. Establishment percentage was good,

ranging between 86 and 89%. Further investigations were conducted to compare the establishment of ministem cuttings planted directly in the field (0 days) or sprouted in polythene bags for 5, 10, or 15 days before transplanting. The materials were transplanted under plastic mulch or bare soil conditions. A preemergence herbicide was sprayed after transplanting to suppress weeds at early stages of plant development.
There was no difference (P = 0.05) in field establishment between direct planting and sprouting in polythene bags 5 or 10 days for TMS 30572. However, sprouting in bags for 15 days reduced field establishment. For TMS 91934, however, there were no significant differences between direct planting and sprouting in polythene bags for 5, 10, or 15 days.

677 90 - 9/17

Seed production
Review, book, seed storage, traditional storage methods, pest control, store hygiene, CTA

APPERT, J.

Le stockage des produits vivriers et semenciers. (The storage of food grains and seeds).

Macmillan Publ. Ltd., London, UK, in co-operation with the Technical Centre for Agricult. and Rural Co-operation, P.O.B. 380, 6700 AJ Wageningen, The Netherlands, ISBN 0-333-44827-8, 1987, 143 pp. French edition: ACT and Maisonneuve et Larose, 15, Rue Victor-Cousin, 75005 Paris, France.

The food products which man has to preserve in order to feed himself are of animal or vegetable origin. The former - milk products, meat, fish, etc. - require expensive freezing and sterilizing facilities. The latter consist of "perishable commodities", such as roots, tubers, fruit and vegetables, which are not stored for long periods of time, and "durable commodities", such as cereals and legumes, which are preserved for several months and sometimes even for a number of years.
People living in the tropics are accustomed to supplementing their diet with legumes, cowpeas, dolichos beans, bambarra groundnuts, peas and haricot beans, etc., and perishables, the extent varying greatly according to region (an African's daily consumption of legumes is estimated at some 50g). Through their high protein content (20 to 30%), legumes correct the imbalance which a cereals-only diet would imply, particularly with regard to essential amino-acids and mineral salts. They are more difficult to preserve than cereals and more vulnerable to certain insects such as bruchids.
How can these foodstuffs be preserved under the best possible conditions, what facilities should be made, what precautions be taken, what mistakes should be avoided in order to ensure that stored crops, seed, and strategic stocks are not damaged or lost?
This book attempts to provide an answer to such questions. Thus, it deals in turn with the following subjects:
- Damage and losses
  . basic concepts
  . different causes of deterioration
  . the origin, nature and evaluation of losses.
- Storage practice
  . traditional and modern storage
  . facilities
  . store hygiene

In this manual, the numerous aspects of the dangers which threaten crops after they have ripened, and the extent of the losses which may result, are demonstrated.
It is necessary to call traditional methods into question and prevent the costly introduction of inappropriate technologies.

678 90 - 9/18

Seed production
Latin America, Mexico, study, maize, seed, storage conditions, germination, diseases

MORENO, E. et al.

Comportamiento de la semilla de maiz (*Zea mays* L.) bajo diferentes sistemas de almacenamiento. (Quality of maize seed stored under different storage condition).

Turrialba, 37, 3, 1987, pp. 267-274

Maize seeds, inoculated and uninoculated with stored grain fungi, and with moisture contents between 15.7 and 17.1% were kept for 60 days under three storage systems: hermetic, modified atmosphere and open. Both the hermetic and open storage samples, with uninoculated or inoculated seeds, had initial concentrations of 0.03% carbon dioxide and 21.0% oxygen. The modified atmosphere samples had an initial concentration of 92.0% carbon dioxide for the uninoculated seed and 88.8% for the inoculated seed, and 1.7% and 2.7% oxygen for the uninoculated and inoculated seeds, respectively. Results seem to show that carbon dioxide, at concentrations above 60%, has a phytotoxic effect on seed germination capacity. The germination capacity, with a 93% germination rate, was maintained when uninfected seeds were stored in the hermetic system. Seeds stored in the modified atmosphere and open storage had germination rates of 14 and 31%, respectively. In both systems infected seeds lost their germination capacity. Storage fungi did not grow from initially uninfected seeds either in the hermetic or in the modified atmosphere systems: however, a heavy development of *Aspergillus flavus* was observed when similar seeds were stored in a normal atmosphere. Storage fungi had a deleterious effect on seed germination when seeds were stored in a normal atmosphere.In infected seeds stored in the hermetic system, germination rate was affected by the storage fungi; the effect of fungi was difficult to determine in seeds stored in the modified atmosphere systems due to the severe phytotoxic effect of the high concentration of carbon dioxide.
Author's summary

679 90 - 9/19

Seed production
Africa, Burundi, seed extension methods, low-input cropping systems, varieties, CTA, seed programme, IAC

BONTE, E.

Considération sur la vulgarisation semencière. (Considerations on seed extension).

In: Proc. of the Seminar on Seed Production, Yaounde, Cameroon, 1985, Vol. I, pp. 49-74; Int. Agric. Centre, Wageningen-Ede, in cooperation with CTA, Wageningen-Ede, The Netherlands

This paper describes low-input cropping systems in Burundi and improvement of these systems through the introduction of new seed. The Burundi Government envisages the establishment of a national seed council in order to prepare a national seed plan to be executed by the National Seed Service. Seed extension plays a crucial role in the diffusion of new seed. The paper examines some basic issues with respect to seed extension: factors determining success and failure of seed extension programs; the adaptability of new varieties to traditional cropping systems; how the adoption of new seed can be improved. Seed extension methods, such as individual and group meeting, and the use of extension media are discussed. Finally, recommendations are made with respect to the choice of farmers participating in the seed programme.
Author's summary

680 90 - 9/20

Seed production
Review, book, developing countries, seed production, agricultural crops

KELLY, A.F.

Seed production of agricultural crops.

A Longman Publication; Longman House, Burnt Mill, Harlow, Essex LM20 2JE, UK, ISBN 0582 40410 X, 1988, £ 27.42

It is now recognized that crop production is limited by genetic potential and that improved varieties must be the foundation of any attempts to improve yield. However, not only must seed be of high genetic potential,it must also be harvested, cleaned and stored correctly if it is to retain good germination ability and vigour for seedling growth. Seed testing may also be necessary to determine germination, vigour and presence of disease, and seed treatments may be considered to protect seeds from seed and/or soil-borne diseases.
In Seed Production of Agricultural Crops, A. Fenwick Kelly has written a practical guide to the basic requirements for the correct production of seed for agricultural crops and the book contains enough fundamental information to enable readers to understand the reasoning behind the management practices discussed.
The author was Deputy Director of the National Institute for Agriculture Botany in England from 1970-83, since then he has been active in international organizations dealing with seed matters and has worked as a consultant with the FAO. Although he assumes knowledge of the basic principles of crop production, his book is largely self-explanatory on all major points and will be useful to all those responsible for developing seed production in the Third World.
Abstract from SPORE

681 90 - 9/21

Seed production
Review, proceedings, seminar, biotechnology, plant production, technical cooperatin, constraints, potentials, GTZ, DSE

CARLS, J. et al.

Potentiale und Grenzen biotechnologischer Verfahren der Saat- und Pflanzgutproduktion in der Technischen Zusammenarbeit. (Potentials and limitations of biotechnological methods for seed- and plant production in technical cooperation).

Proc. of a Seminar on "Potentials and Limitation of Biotechnological Methods for Seed- and Plant Production in Technical Cooperation"; German Agency for Technical Cooperation (GTZ); 1989, 285 pp.; Distributor: GTZ, Abt.4230, Postf. 5180, 6236 Eschborn 1, F.R.G.

During the last years cooperators of GTZ together with representatives from research institutions, politicians and people from the private sector have met several times in order to discuss aspects of plant- and seed production in technical cooperation.
In former seminars organisational aspects of the seed sector and questions of development policy were discussed, while this meeting was concentrating on technical production methods of seed and plant material.
During the last decade tremendous progress has been achieved in biotechnology. Traditional methods in plant breeding and seed multiplication are not substituted by modern methods, but they can improve and accelerate the procedures of seed- and plant production.
The results of these seminars are the basis for future project programmes in the field of seed and plant production.
The main results of the seminar are:

- on principle it is necessary to stimulate the cooperating partners to use the developed methods in their own responsability and to keep the technological gap to the industrial nations as small as possible.
- technical cooperation in the field of biotechnology should be oriented to the advantage of the economy as a whole and has to include accompanying measures with respect to the socio-economic situation of the country.
- biological security has absolute priority and technical cooperation can only be pursued if international security standards are guaranteed.
- only those projects should be improved whose results can be used practically and aimed at specific target groups.

Priority for biotechnological methods are seen in:

- the potential of a rapid increase of output by rapid multiplication techniques, especially for specific crops and crops of regional importance,
- the improvement of resistance and tolerance of crops to specific diseases and adverse environmental conditions.

682 90 - 9/22

Seed production
Review, book, seed, Africa, Asia, Latin America, plant breeding, economics, nutrition, varieties, policy, research priorities, ATSAF

LIPTON, M. and R. LONGHURST

New seeds and poor people.

The Johns Hopkins Studies in Development. The Johns Hopkins University Press, Baltimore, ISBN 0-8018-3795-2, 1989, 473 pp.

"Modern varieties" (MVs) of cereals, developed through plant genetics, currently add at least 50 million tons each year to Third World grain output. India, desperate for imports during 1965-7, now exports wheat in normal years. Yet most of Africa grows few or no MVs. In Africa and South Asia, poverty continues to increase. How have MVs achieved so much - yet so little? This book uses evidence from plant breeding, economics, and nutrition science to pinpoint what has been achieved, what has gone wrong, and what to do next.
The technical features of the MVs mean more employment, cheaper food and less risk for small farmers. Yet the gains bring new problems. By reducing crop diversity, successful but similar MVs increase the danger from pests. In areas unsuited to MVs, farmers often cannot compete. Workers are displaced as MV incomes help farmers to obtain weedicides or threshers. MVs may enlarge cereal stocks, yet the hungry are too poor to buy. Meanwhile, some researchers fine-tune grain quality, rather than increase the yield, robustness, or regional spread of MVs. Through it all, rural population - and labor supply - continue to grow.
The authors conclude that technical breakthroughs alone won't solve deep-rooted social problems. Only new policies and new research priorities - agrotechnical and socioeconomic - will increase the choices, assets, and power of the rural poor.
Abstract from ATSAF

683 90 - 9/23

Seed production
Review, book, Africa, Kenya, directory, seeds, trees

TEEL, W.

A pocket directory of trees and seeds in Kenya.

Publ. of Kenya Energy Non-Governmental Organizations (KENGO) P.O.B. 48197, Nairobi, Kenya, Repr. 1988, 142 pp.

There was a time, not so long ago, when trees were taken for granted in Kenya. There were so many, often so thick with dense undergrowth that walking through was a hard task. Today that time has gone. Trees no longer dominate Kenya's high potential land. In areas of lower rainfall and less agricultural potential, trees are disappearing rapidly, being cut for timber, charcoal, or just to clear the land. As they become more scarce, the awareness of just how important trees are, grows.
In the recent past, seed collection and distributing had been centralized through the government's relevant ministries. This continues to be the case for certain species of timber trees, such as Cypress and Pine, to ensure the best provenance selection. These government sources are not always able to deal with the wide variety and extent of today's locally rising demand. To meet this demand, it has been found that a decentralized approach to seed collection and distribution is essential. Advice is increasingly available f.e., that is part of the function of directories like this one.
This directory is divided into six chapters:
Chapter 1: Questions and answers
A list of questions which are normally asked about species selection and seed collection is compiled. The answers given provide some basic information about choosing which trees to grow, how to collect seeds and briefly, how trees propagate. The section also includes some general information on how to store and treat seeds before sowing.
Chapter 2: Locational climate type list
The range within which a tree can be planted is determined primarily by rainfall and temperature. Rainfall and temperature zones overlap but can be differentiated into a total of 33 zones in Kenya, according to the Agroclimatic Zone map published by the Kenya Soil Survey. For purposes of simplicity, some temperature zones have been combined in the list. The climatic types are identified with the name of the most representative town found within that type.
Chapter 3: Climate type/tree species list
For each of the climate types, this chapter provides a list of all the trees which grow, or could grow in that area. This is only a selection of trees which may be recommended with priority. It may be possible that some of these trees will grow in areas for which they are not listed.

It is almost certain that all the trees listed under a given climate type can grow in that area, but some will perform better than others. For this reason an asterik has been placed after those species known to grow best in this climate type which is recognised as the climax zone for these species.
Chapter 4: Individual tree species profiles
This chapter provides information about each of the recommended tree species. It contains a choice of 90 tree species; indigenous, exotic and fruit, listed in alphabetical order by botanical name. Following this, for both indigenous and exotic trees, is a brief look at their uses and even briefer descripton of the tree itself. The preferred climatic type of the tree is then given and, if known, the most common growing sites. Next, information about the seed is provided. This includes approximate size and weight, estimated seeding time, length of viability and best germinating techniques. Last comes the list of potential seed sources to contact if seed cannot be found in the local area.
Fruit trees, because of their importance as a food source, are listed separately. The information on fruit trees is also treated in a slightly different manner. Seeds and seedling suppliers are listed by province at the end of the section. The list of fruit trees available as seedlings from these suppliers follows the provincial listing.
Chapter 5: References and resource people
This chapter is a list of sources used for the information in this book, as well as others which could be relied upon to provide further information about growing these trees. For most of the indigenous trees information is scarce, limited generally to botanical literature. There is considerable information available about fruit trees.
Chapter 6: Information exchange
This chapter gives information where to go, or whom to ask for answers. The idea is to help spread knowledge around and this chapter suggests how to do it.