1172 92 - 7/86

Agroforestry
Review, book, Africa, Sahel, semi-arid zones, wood, legume species, natural regeneration, seed dispersal, seed predation, seedlings, seed germination, ecological conditions.

TYBIRK, K.

REGENERATION OF WOODY LEGUMES IN SAHEL.

Publ. of Botanical Institute, Aarhus, University in cooperation with DANIDA Forest Seed Centre, Denmark; ISBN 87-87600-35-8, 1991, 90 pp.

Woody legumes are a major feature of the semi-arid vegetation zones of West Africa and are very important economically in the region, but there is little published information on their natural regeneration. In this short book, Mr. Tybirk gives an overview of the regeneration strategies of 36 species found in West Africa's Sahelian and dry Sudanian zones. Most of the legumes covered are indigenous, but the author also includes a few exotic species.
He discusses in separate chapters four phases in the natural-regeneration process - seed dispersal, seed predation, germination of hard-seeded plants, and growth of young seedlings. Based on the morphology of the diaspore, personal observations and the literature, he suggests that about 50% of the species covered are dispersed primarily by wind (hemi-legumes or samaras), nearly all species are dispersed either primarily or secondarily by passage through animals (most by ungulates and a few also by birds and/or primates), and a few species are secondarily dispersed by water.
The chapter on seed predation focuses mainly on predation by the beetle family Bruchidae, which has a major ecological and economic impact on woody legumes in the region. Lists of host-predator associations, host-predator-parasite associations, and seed-predation percentages are compiled from the literature.
The chapter on seed germination presents a general description of seed characteristics, dormancy-control mechanisms, seed banks in the soil, the germination process, and environmental factors affecting germination in the region. The chapter on seedling growth describes seedling development, vegetative regeneration, and environmental factors influencing growth.
The author emphasizes throughout the text that successful natural regeneration depends on complex ecological interactions involving dispersal, predation, germination, timing, grazing, fire, drought, soil type and other factors. He illustrates this complexity with many examples, some of which have important implications for ecosystem management. In the last two chapters, he discusses some general implications for long-term management and sustainable use of woody legumes in the region and provides a useful summary of regeneration characteristics for each species.
This book is a valuable contribution to our understanding of the natural regeneration of woody legumes in the Sahel. It should also stimulate further research in this important area.

1173 92 - 7/87

Agroforestry
Developing countries, review, medicine, medical drugs, plant screening, forests, future strategies

SPORE

MEDICINES FROM THE FOREST.

SPORE, 37, 1992,. p.5

The medicines in the United States show that 38% contained one or more products of plant origin as the therapeutic agent. Not all plant-derived drugs originated in the tropics but many did so and tropical forests are the richest potential source of new medical agents.
In Ghana, for example, more than 800 woody plants and many other herbaceous species are known for their medical properties. In Asia and the Pacific it is estimated that over 4% of indigenous flora has been utilized in traditional medicine. Latin America and the Caribbean, particularly the Amazon forests, are widely recognized for their contributions to human health in the past and their potential for future discoveries.
Over half of all plant species are natives of tropical forests.
It is estimated that half of the tropical forests have been cleared already. Destruction continues at 25 to 30 million hectares per year and the majority of plant species are vanishing before they have been recorded or investigated. The fund of knowledge carried by the forest dwellers who are displaced is also being lost.
New strategies must be developed to safeguard them.
The best hope for saving the remaining forests, the potential medicines that they contain and the peoples who know most about them may be in developing what has been termed "chemical prospecting". This permits commercial organizations to collect and identify plant materials with potential for medical uses in exchange for proper remuneration to the host country.
A similar strategy is to develop "extractive reserves" for sustainable development of forests where forest dwellers would collect rubber, nuts, coca, palm products and medicinal plants for sale. Brazil already has some such reserves and the World Wide Fund for Nature (WWF) supports a project in Cameroon in collaboration with the Cameroons Centre for the Study of Medicinal Plants. In eleven villages local people helped researchers investigate the plants of the surrounding forest, leading to a collection of hundreds of herbal remedies.
A UK company acts as a broker to find potential buyers for medicinal plants on behalf of tropical countries and has supplied major pharmaceutical companies with plant material from Africa and Asia.
To-date the main focus of activities appears to be in Central and South America and parts of Asia.

1174 92 - 7/88

Agroforestry
Tropics, Caribbean, study, protein production, legumes, trees and shrubs, livestock production, CTA

CUMBERBATCH, R.N.

POTENTIAL FOR PROTEIN PRODUCTION FROM TREE AND SHRUB LEGUMES.

In: Proc. of a Seminar "Forage Legumes and other Local Protein Sources as Substitutes for Imported Protein Meals", Kingston, Jamaica, 1987, pp. 50-55

This paper attempts to outline and give some information on the production of protein from tree and shrub legumes.
Certainly it does not attempt to cover all that is known about the more widely used and adapted legumes in the tropics. The author feels that there is need to investigate the legumes that are not so widely used, thereby exploiting the natural sources that may exist within the tropical cattle grazing areas.
In the tropics, forages usually have inadequate levels of proteins and minerals. The low levels severely affect livestock production, resulting in restricted growth rates, slow maturation and lower production.
The leguminous trees and shrubs have not only persisted but have become more diverse, with more than 18,000 known species. The tree legume family is thus one of the most numerous due to its adaptive traits and efficient use of the earth's natural resources, especially through the symbiotic mechanisms developed in its root structure.
Their rapid growth and high protein content makes them useful as a forage supplement. At the same time, the chemical linkages between the phenolic substances and the leaf proteins makes these resistant to bacterial attack, thereby making them more valuable as sources of nutrients.
Livestock producers are placing greater emphasis on the use of forage legumes in developing ruminant production systems. These legumes are fed either fresh, or are preserved in the form of hay or silage, to be used as a high protein supplement in the diet.
The tree and shrub legume species mentioned in this paper are:

- *Aeschynomene americana* L. is a tropical annual adapted to flooded soil conditions, exhibiting much diversity in plant form and growth habit.
- The crude protein content of Aeschynomene is higher than that of alfalfa, with beef cattle making greater weight gains on Aeschynomene than alfalfa in Florida.
- *Codariocalyx gyroides*, is a shrub indigenous to Southern Asia, reaching heights of over 3 m under fertile conditions.
- *Cajanus cajan* L. although not usually used as a forage legume in the tropics, does possess excellent characteristics. It is an annual or, more usually, a short-term perennial shrub growing up to 4 m high and woody at the base.

- *Desmodium ovalifolium* is of Asiatic origin and used widely in plantation agriculture as a cover crop.
- *Desmanthus virgatus*, a small nearly erect shrub, 2 to 3 m tall, found in the West Indies and from Florida to Argentina, is not widely used as a pasture species. The legume grows in sandy soils under a rainfall regime of 1000 - 1500 mm and prefers soils of pH 5.0 to 6.5.
- *Indigofera hirsuta* L. is a legume native to tropical Africa and Asia. The plant grows from 1 to 2.5 m tall, having an erect habit with few lower branches and with medium to fine stems becoming woody as the plant matures. The literature states that Indigofera can be used as a green manure or cover crop producing up to 5 tonnes of organic matter, and with proper management can make an excellent livestock feed, because of its high protein value and digestibility.
- *Stylosanthes guianensis*. The genus Stylosanthes has many species, which could be considered as shrub type legumes. Because of the apparent lack of importance of the other species, only *S. guianensis* is discussed.
- *Gliricidia sepium* (syn. *Gliricidia maculata*) trees grow up to 5-15 m in height. The plant is native to Mexico and the West Indies, with a wide usage including live-fencing, wind breaks, shade trees and fodder.
- *Leucaena leucocephala* has it origin in Mexico but has spread throughout the tropics. It is a good browse species but prefers alkaline soil conditions.

The development work with tropical tree foliages as protein sources has been in the field of ruminant production systems. The positive results obtained in early trials proved to be sustainable under a wide range of commercial farm conditions and the rate of uptake of the technology by farmers has been rapid.
Attention should being given to their potential role in the diets of monogastric animals, with special emphasis on their use as supplements to liquid fibre-free feed resources such as sugar-cane juice and molasses. The first observations with pigs indicate that it is feasible to reach forage intakes that theoretically will satisfy the protein needs.

1175 92 - 7/89

Agroforestry
Review, book, economic analysis, finances, incentive schemes, technical issues, economic modelling, cost benefit analysis

PRINSLEY, R.T.

AGROFORESTRY FOR SUSTAINABLE PRODUCTION; ECONOMIC IMPLICATIONS.

Publ. by the Commonwealth Science Council; Commonwealth Secretariat Publication, Marlborough House, London, SWIY 5HX, K, ISBN 0-85092-342-5, 1992, 417 pp., price £6.50

If a country's man-made assets (factories, machinery) depreciate faster than they are replaced, it is clearly living beyond its means and economic growth is not sustainable. In conventional economics no such concept applies to the depletion of natural resources. As they are used up, no decline in value is registered to reflect the fall in future potential production. For developing countries which are more dependent on natural resources for income, the danger of treating natural resources as valueless is even greater. There is a clear need for estimates of the costs and benefits of investment in their conservation and use, and Agroforestry for Sustainable Production addresses that need.
The book takes the form of a collection of papers presented at a Commonwealth Science Council workshop held in Swaziland in 1989. Part I is a discussion paper of the key issues involved in the financial and economic analysis of agroforestry. Part II includes papers about incentive schemes, technical issues, economic modelling and cost benefit analysis.

1176 92 - 7/90

Agroforestry
Review, tropics, living fences, agroforestry technology, ICRAF

WESTLEY, S.B.

LIVING FENCES. A CLOSE-UP LOOK AT AN AGROFORESTRY TECHNOLOGY.

Agroforestry Today, 2, No. 3, 1990, pp. 11-13

Living fences are lines of trees or shrubs planted on farm boundaries or on the borders of home compounds, pastures, fields or animal enclosures.
Their mean purpose is to control the movement of animals or people. This purpose is what differentiates them from other agroforestry technologies based on trees planted in lines, such as boundary plantings, contour strips or hedgerow intercropping. Besides their main function to control human and animal movement living fences may provide fuelwood, fodder and food, act as windbreaks or enrich the soil, depending on the species used.
In Central America many farmers adopted living fences. The reasons are:
- Increasing population, decreasing farmland, and declining food subsidies were forcing more intensive agricultural production.
- Living fences do not require a large labour input - generally less than one day's work for planting and one or two hours a month for maintenance.
- Living fences provide a secondary benefit in the form of fuelwood.

Living fences/hedges are permanent, densely spaced, single or multiple lines of woody plants. They are regularly pollarded and trimmed.
Live fenceposts are permanent, widely spaced, single lines of woody plants that are regularly pollarded. They are used to support wire or other inanimate material, such as sticks or dead branches.
Living fences/hedges may be thicker than live fenceposts and may comprise more than one species, including trees, shrubs and smaller plants. They usually do not include wire or other inanimate material.
Farmers in Costa Rica and Honduras supplement their incomes by selling branches from their live fenceposts to neighbours wishing to establish new fences.
Many different tree species are used for living fences, depending on the ecological zone, the availability of stock and the specific needs of farmers. The most common species in Central America, northern south America and several Caribbean countries are *Gliricidia sepium, Bursera simaruba, Spondias purpurea* and *Erythrina berteoana*.
Living fences of *G. sepium* and *Erythrina* spp. are harvested to provide fodder for cattle, goats, rabbits and chickens (providing up to 25% of total intake), and the thicker branches of *Gliricidia* are used for fuelwood. Edible fruits and flowers can also be

important, for example the 'jacote' fruit of *S. purpurea*, which is sold in markets in many Central American countries.
Living fences are a familiar feature throughout much of the African landscape. They appear on the densely populated hillsides of western Cameroon and in Rwanda and Burundi, marking small cultivated plots. In the dry rangelands of Northern Africa and the Sahel they form livestock enclosures and pathways to protect croplands and pasture from moving animals.
Species used for living fences in Africa include plants with good natural defence systems, such as long thorns, spines or unpalatability. Examples are *Dovyalis caffra* (kei apple), *Agave sisalana* (sisal) and *Euphorbia* spp. Depending on site conditions and available plant material, a variety of other woody species may be used, including *Ziziphus mauritiana*, *Z. mucronata*, *Commiphora africana*, *Erythrina abyssinica* and *Gliricidia sepium*.
As the trees and shrubs grow, they must be pruned, usually on an annual basis. Otherwise, they may take up too much space or cast too much shade on adjacent crops. Root competition may also be a problem.
Well-established living fences may be difficult and expensive to remove, so they should be sited carefully before planting. If planted on a boundary, a living fence will affect more than one land user, so it is important that all land owners and users should agree on its establishment.

1177 92 - 7/91

Agroforestry
Asia, Bangladesh, survey, evaluation, project, homestead agroforestry, land-use system, ICRAF

LEUSCHNER, W.A. and K. KHALEQUE

HOMESTEAD AGROFORESTRY IN BANGLADESH.

In: Agroforestry Systems in the Tropics; Ed. P.K.R. Nair; Kluwer Academic Publishers in coop. with ICRAF, Dordrecht, Netherlands; 1989, pp. 197-210

This paper evaluates the general conditions with respect to homestead agroforestry in Bangladesh and reports the results of a field survey.
Trees in the homesteads play an important role in the rural economy of Bangladesh. Often called homestead forests, such plantings are particularly important sources of fuelwood because fuelwood cannot be transported long distances from existing forest areas.
In the absence of other wood sources, improved village forestry and homestead agroforestry are important to the development of Bangladesh and the well-being of its people.
The Homestead Agroforestry Research and Development Project, being formulated by the United States Agency for International Development (USAID) - Dhaka Mission, has been proposed as a means to increase fuelwood supplies from homestead agroforests.
The many woody species grown in the homesteads are a significant source of fuelwood; they also provide fodder, building materials and other forms of wood. In the context of the prevailing shortage of fuelwood and excessive deforestation in Bangladesh, this homestead agroforestry system needs to be strengthened.
A field survey was undertaken to assess the prospects and feasibility of initiating a programme for the improvement of homestead agroforestry systems.
Concluding, the authors state that the conditions in Bangladesh seem favourable for the successful implementation of a homestead agroforestry project. Many persons there own their own homesteads and farms, thereby eliminating the disincentive of planting trees which someone else will harvest. Moreover the farmers are familiar with trees and their cultivation, and they believe that they have room to plant more trees. Thus the level of basic knowledge and perception of opportunity among the farmers is satisfactory.
Channels of distribution for planting stocks must exist or be built. Plant varieties better adapted to local growing conditions, generally improved growing stock and exotic can enhance programme success, although management practices for these plants must often be taught. Existing government nurseries and extension services are appropriate institutions for distribution and teaching to start with.
Forest services have traditionally managed only trees grown in large forested areas. Many foresters consider working with other

species unprofessional or demeaning. Foresters must shift part of their emphasis from the traditional forest trees to multipurpose trees which people desire. In addition, management practices for multipurpose and other species are important. These should include practices for individual and small groups of trees, as well as large planted areas.
The study shows that women play an important role in collecting fuel and in planting and cultivating trees. This implies that programmes should strongly consider modules to inform women of the new plant materials and to teach them new cultural and management practices.

1178 92 - 7/92

Agroforestry
Review, book, guidelines, rapid appraisal, agroforestry research, extension

ABEL, N.O.J. et al.

GUIDELINES FOR TRAINING IN RAPID APPRAISAL FOR AGROFORESTRY RESEARCH AND EXTENSION.

Publ. of School of Development Studies, University of East Anglia Norwich NR4 7TJ, UK, ISBN 0-85092-337-9, 1989, 117 pp.

The Commonwealth Science Council and the Forestry Commission of Zimbabwe collaborated in a training and research exercise in Shurugwi Communal Area in Zimbabwe in 1988, which resulted in the publication of "Guidelines for Training in Rapid Appraisal for Agroforestry Research and Extension", published by the University of East Anglia UK, and funded by the Ford Foundation.
The guidelines will help research and extension personnel in rapid appraisal methods for the development of agroforestry in peasant land-use systems.
The authors say that four key principles underlie the methods used: the first is "interactive research" whereby agroforestry interventions are identified and developed through working with and learning from farmers and the local community, as well as through conventional resource assessment. The second, "learning by doing", assumes that interactive research is best learned through real application rather than through lectures or classroom exercises and simulations. The third principle is "inter-disciplinary", and is the key to successful interactive research. Finally, agroforestry interventions are developed from an understanding of constraints and conflicts existing within the rural community over access to production resources.
This is a practical, easy-to-read, spiral-bound book, which takes the reader through the project step-by-step with charts, diagrams, clear text, and colour photos.

1179 92 - 7/93

Agroforestry
Review, tropics, Central America, multipurpose tree, Erythrina, legume tree, CATIE

RUSSO, R.O.

ERYTHRINA (LEGUMINOSAE: PAPILIONOIDEAE): A VERSATILE GENUS FOR AGROFORESTRY SYSTEMS IN THE TROPICS.

J. of Sustainable Agriculture, 1, (2), 1991, pp. 89-109

Some of the most common uses of Erythrina species are discussed in this review related to specific agroforestry applications.
Although common throughout the tropics, the many species of Erythrina have not received much attention from researchers or development workers. Yet these trees of the family Leguminosae grow quickly and have considerable potential for supplying fodder, fuelwood and other products, for providing shade to coffee and tea, and for restoring eroded sites.
The genus *Erythrina* is of special interest in the development of agroforestry systems because of its adaptability to several uses (e.g., live posts for fences, shade trees for perennial crops such as coffe and cacao, forage for livestock, and others).
They thrive in hot climates, with mean annual temperatures from 30° to more than 38°C. Although well adapted to drought, they also grow well in areas with annual rainfall of up to 1200 millimetres. They can survive in soils with a pH of 8.7 and up to 0.11% salt concentration.
With their rapid growth and extraordinary nodulation, the Erythrinas are a good source of organic matter for green manure. Dry foliage contains from 1 to 3% nitrogen. When incorporated into the soil, it improves fertility, moisture, nutrient retention and general tilth.
In Costa Rica, for instance, the use of *Erythrina* for shading or nursing other crops is a common agricultural practice in both coffee and cacao plantations. There is a great deal of evidence showing its value as a "natural fertilizer" supplier and nutrient cycling helper. The calculated figures show that the return of nitrogen to the soil and nutrient cycle in coffee, cacao, and also in maize, can save up to 200 kg N/ha per year.
A considerable research effort in working with this genus has been done in the Tropical Agricultural Center for Research and Training (CATIE), Turrialba, Costa Rica through the *Erythrina* Project.
This research project supported by the International Development Research Center (IDRC) from Canada, produced a large amount of research and also compiled a substantial bibliography on the genus.
Field trials would be useful to compare different Erythrina species and varieties in terms of growth rates and fuelwood and fodder quality. There is also a need to test the potential of different species as sources of good-quality paper and pulp.

VIII HOMEGARDENS

1180 92 - 8/41

Homegardens
Asia, proceedings, workshop, household gardens, sustainable development, nutrition, projects, failures, successes, AVRDC

MIDMORE, D.J. et al.

HOUSEHOLD GARDENING PROJECTS IN ASIA: PAST EXPERIENCE AND FUTURE DIRECTIONS

AVRDC Technical Bulletin No. 19; Workshop Report, Bangkok, Thailand, Mai 1991; price developing countries USD 3.50, elsewhere USD 5.00

Food production near human settlements has been a major food security and survival strategy, particularly in the developing world. Since household gardens have been around almost since the beginning of agriculture, they have been taken for granted and their benefits sometimes go unnoticed.
At AVRDC the household garden concept is receiving renewed attention because of its considerable potential as a development tool. Such food gardens contribute substantially to the nutritional and economic status of the poor.
The benefits and advantages of household garden projects as well as the constraints and implementation strategies were among the issues discussed in a 3-day workshop organized by AVRDC, the Users Perspective with Agricultural and Rural Development (UPWARD) and the International Development Research Centre (IDRC) for practioners in Asia and elsewhere on 12-15 May in Bangkok.
Participants came from Bangladesh, Indonesia, the Philippines, Sri Lanka, Taiwan, Thailand and the USA.
The participants discussed the constraints and factors that have contributed to the success and failure of particular garden projects.
Too often, homestead or underutilized marginal land is the only resource available to the landless and near-landless groups and urban slum dwellers. Intensive gardening can turn this space into a productive source of food and economic security. The technology requires little capital investment and risk.
Household gardens are efficient users of soil, water, sunlight and household wastes, and therefore present an ecologically sound land management system. As a multiple cropping system, they prevent depletion of soil nutrients and represent repositories of diverse plant genetic resources. They also do not use toxic chemicals in contrast to field-based agriculture.
Household gardens are also an efficient way of using limited resources such as time, energy, money and land among the low-income groups. They offer women, who are usually the providers of family meals, with an important means of earning income without overtly challenging cultural and social restrictions on their

activities. In addition, other family members such as the children and the elderly can provide labor.
One of the glaring reasons identified by the participants for the failure of garden projects was the lack of a long-term commitment of development and funding agencies and project personnel. This can be attributed to the perception that household food production is easy to promote, which is hardly the case.
Reaching the poorest segments of the population is actually more difficult than getting through to the large-scale commercially-oriented farmers due to psychological, educational, social, motivational and behavioral barriers.
Promoting household food production requires qualified and committed project personnel who understand the local situation. Furthermore, there is a need to develop technologies that are compatible with household needs and resources.
To ensure the long-term success of this development intervention, integrated support for family gardens within the existing national agricultural development framework must be promoted.
A summary of the recommendations of the participants for successful implementation of garden projects follows below:

- Build upon user needs from the beginning of the project.
- Use secondary information and cost-effective appraisal techniques to assess the limiting constraints in the project.
- Formulate clear and achievable objectives.
- Use already available potential solutions to constraints faced in household production.
- Offer complete technology packages to promote household gardens since marginal households are selective and adaptive in their adoption and use of recommended practices and technologies.
- Emphasize locally-adapted species, but not to the complete exclusion of commercially exotic species.
- Direct training at users, through community-based garden promoters and the judicious siting of demonstration plots.
- Employ social marketing techniques to build up motivation and provide nutrition education.
- Exercise caution in evaluating the difficult-to-assess social benefits of garden projects.
- Motivate project participants to take up household production for its own intrinsic value rather than for free inputs which distort incentives and affect the sustainability of results.

1181 92 - 8/42

Homegardens

Developing countries, Asia, Africa, Latin America, strategic plan, vegetables, economic value, agroecological zones, production systems, research, training, technology, transfer, monitoring, international cooperation

AVRDC

VEGETABLES RESEARCH AND DEVELOPMENT IN THE 1990s - A STRATEGIC PLAN

AVRDC Publication No. 91-362; AVRDC, P.O.B. 205, Taipei 10099; ISBN 92-9058-050-x, 1991, 61 p.

This 10-year strategic plan outlines the nature of the challenge and describes AVRDC's vision of the future. It reviews AVRDC's current status as an institution and analyzes the choices it has made in revising its strategy and planning its future activities and programs.
Vegetables are important foods and vegetable production, marketing and processing are significant contributors to income. Population growth and urbanization are creating increased demand for food, and concerns are rising about malnutrition, especially in peri-urban areas. There is also growing concern that unenlightened methods of vegetable production are having adverse effects on the environment.
Economic trends suggest that vegetables will increasingly contribute to improved diets in the developing countries in the future. The adoption of improved varieties and efficient methods of vegetable production has the potential both to raise incomes and give greater equity in their distribution, while improved cultural practices will help to protect the quality of the environment and conserve natural resources. But several obstacles - technical, economic, and institutional - stand in the way of achieving this potential.
Increased production and improved handling of vegetables have great potential to enhance the nutrition of the rural and urban poor in the developing countries, as well as to increase their incomes and provide greater opportunities for employment. Unfortunately, the national institutions charged with the responsibility for vegetables have, for the most part, only limited capacity to solve the problems and accelerate progress. Consequently, there is tremendous scope for international collaboration to meet these needs for vegetables in ways that have already proved successful with the cereals and other staple food crops.
In its evolving program strategies, AVRDC will position itself to exploit the special strengths of an international center. It will help accelerate capacity building of its national partners and promote synergy and complementation among them and with its own efforts. It will move progressively towards greater emphasis on

strategic research, forging new links with advanced research laboratories to keep abreast of the rapidly advancing frontiers of science and technology. It will strengthen its activities in all aspects of the conservation and distribution of genetic resources; expand its information services; and reorient its training program to focus on research training at headquarters and conduct most of the production training in its regional programs.
While retaining its emphasis on crop improvement as the most cost-effective means of increasing productivity, AVRDC will support an integrated set of research activities aimed at improving both the crop and the environment in which it is grown. It will restructure its programs to give a more comprehensive coverage of problems in vegetable production - from seed production to postharvest handling and distribution.

1182 92 - 8/43

Homegardens

Tropics, vegetables, biotechnology methods, clonal propagation, disease elimination, plant breeding, axillary branching, adventitious shoot formation, crops, analysis of the situation

QUERESHI, A.

BIOTECHNOLOGY DEVELOPMENTS IN TROPICAL VEGETABLES.

In: AVRDC Publ. No. 90-331, ISBN 92-9058-043-7, 1990, 194 p.

This paper gives an overview of recent developments in biotechnology in vegetables, where plant tissue and cell culture techniques have been most effectively used.
The primary goals of the in vitro propagation of vegetable crops include production of large numbers of plantlets from species in which plant development from seed is difficult, clonal propagation of a large number of genetically identical plantlets, production of virus-free materials, crop improvement through various techniques of genetic modification, enhanced axillary branching using stem tips and lateral buds as the explants, an adventitious shoot formation.
Biotechnological methods are applied in the following way:
- Clonal propagation:
  It is possible by conventional breeding to produce one whole shoot from one cutting under perfect natural conditions. Thus the asexual multiplication of rare and elite varieties of crops has to be handled with great care. It is possible through tissue culture techniques to produce millions of identical shoots from one portion of a plant within a very short span of time. Thus, rare genotypes can be multiplied and conserved.
- Disease elimination:
  A reasonable assumption is that all plants that are propagated asexually by traditional methods (e.g. by cuttings, grafting, bulbs, tubers, etc.) are often infected with one or more pathogens, particularly viruses and other agents. Plant tissue culture is also an asexual method of breeding plants. The superiority of the technique is warranted by the fact that perfectly healthy clones could be produced by the technique of meristem culture. The philosophy of the methodology is that the terminal 2-3 mm portion of plants (meristems) are almost free from viruses, because cell divisions in such parts are very rapid and active. Virus particles, on the other hand, divide comparatively slowly after heat treatment and lag behind. Such meristems could be made to grow into complete healthy shoots, on nutrient media, under controlled environmental conditions.
- Plant breeding:
  Plant breeding by tissue culture could save time, space and money. These techniques can be used to aid traditional means of breeding. Embryo culture can be used to overcome incompatibility barriers that exist in nature, while ovule, ovary, pollen and

anther culture are being employed to reduce the breeding cycle by producing homozygous lines in the first or second generation. Cell and protoplast culture are new developments for an efficient screening system for mutations. Homozygous mutations can occur even in somatic tissue culture giving this technique an edge over conventional mutation breeding.

- Axillary branching:
The advantage of this type of micropropagation is that very little callus is formed and the degree of genetic abnormalities is often reduced. Once the explants are established and axillary bud development enhanced, the cultures can be subcultured for many generations, resulting in increased shoot formation. Shoots, can be excised after elongation and generally rooted either in vitro or in a growth chamber or greenhouse environment. Vegetable crops that have been micropropagated using these techniques include asparagus, broccoli, brussels sprouts and sweet potato.
- Adventitious shoot formation:
Adventitious shoot formation has also been used to propagate vegetable crops in vitro. Lettuce and cabbage are examples of vegetable crops in which adventitious plantlets have originated directly from the primary explant. Adventitious plantlet formation from callus has been reported with asparagus, broccoli, brussels sprouts, chives, cabbage, carrot, garlic, kale, lettuce, pepper, potato, tomato and sweet potato. The disadvantage of adventitious plantlet formation is that genetic variability often increases, especially when the plantlets are derived from callus. The genetic variability generally tends to increase as the length of time the callus remains in culture increases. The genetic variability commonly observed in these cultures includes variation in phenotypic expression, yield variability and loss of organic potential, and is generally the result of chromosome abnormalities and/or ploidy changes in chromosome number.

A state of the art report regarding the various methods used in vegetable production is outlined in this article.
Concluding it can be said that biotechnology offers considerable scope for the improvement of most tropical vegetables. Such techniques can be safely used in conjunction with conventional breeding practices to boost vegetable production.

1183 92 - 8/44

Homegardens
Asia, Philippines, China, developing countries, food production, sustainability, small-scale households, low-input system, recycling, space-intensive, labour-intensive, water conservation, appropriate technology, nutrition, pest control, genetic resources, ecology

GONSALVES, J.F.

CHARACTERISTICS OF THE BIO-INTENSIVE APPROACH TO SMALL-SCALE HOUSEHOLD FOOD PRODUCTION.

AVRDC Publ. No. 87-273, Proc. of the Vegetable Improvement Gardening Workshop; AVRDC, Shanhua, Tainan, Taiwan, ISBN 92-9058-028-3, 1988, pp. 93-99

The bio-intensive approach, as the name suggests, is a biological (as opposed to chemical) form of agriculture in which a small area of land is intensively cultivated with the use of nature's own ingredients to rebuild and then maintain the soil's productivity.
At the heart of the approach is the effort to improve the soils capability to nurture and sustain plant life. What a bio-intensive gardener tries to do on his small plot is to stimulate or replicate a natural forest (with the constant recycling of nutrients and maintenance of soil, moisture, and microbial conditions). Many countries of the world (and China is particularly notable) have farmed biologically for thousands of years and have been able to sustain output levels over those years. In sharp contrast the "efficient" but short-sighted approaches being used in many Western and Third World countries have often been disruptive of the natural resource base.
Farmers in many parts of the world are experiencing the fact that they have to use steadily increasing quantities of fertilizers and pesticides to sustain previous yield levels.
In the bio-intensive approach being recommended here for small-scale plots, the soil is gradually enhanced and the composition of beneficial microbial life actually improves from season to season. The soil structure and humus content is also supported. The nutrient content of the soil is built up, rather than depleted, after each crop. A healthy soil means a healthy stand of plants, and that means less insects and diseases. In the bio-intensive approach, yields continue to rise for the first few years and then tend to stabilize at an overall higher yield. Such systems and the outputs (i.e. yields) are easily sustained at that level for many years with unchanging or even reduced levels of material and labour inputs.
The bio-intensive system is characterized by a greatly reduced dependence on expensive inputs that are generally used in conventional food production approaches. Many of these nonrenewable inputs, such as chemical fertilizers and pesticides, are produced at high energy costs (usually petroleum-based). Instead of chemicals, plant and animal wastes and natural mineral

substitutes are used. In the methods being advocated here, the inputs required are bones, wood ash, eggshells, compost, ipil-ipil leaf meal or fish meal.
Locally available seeds are advocated rather than hybrid and other imported substitutes. Experience suggests that it is feasible to achieve a 100% self-reliance in recurring input needs. Other than hand tools, all material inputs are usually available locally or within easy access. This reduces significantly or eliminates the need for cash outlays. It also provides the producers with a sense of control over the required production resources. Finally, by emphasizing the use of local and biological resources, rather than energy-intensive, fossil-fuel-based chemical imports, a small step is being made in the direction of conserving the world's nonrenewable resources.
The bio-intensive approach to food production at the household level differs considerably from the conventionally introduced gardening systems because of its stress on deep-bed preparation, nutrient recycling, building up of the soil's biological base, diversified cropping, and a balanced and integrated ecosystem.

1184 92 - 8/45

Homegardens
Asia, Africa, feed garden, fodder production, legume trees, shrubs, grasses, marginal lands, livestock, integrated systems

SUSTAINABLE AGRICULTURE

INTENSIVE FEED GARDEN.

Sustainable Agriculture, 3, No. 1, 1991, 14-16

The concept of an Intensive Feed Garden (IFG) was adapted and tested in the Philippines by the International Institute of Rural Reconstruction (IIRR), based on a design originally developed by the International Livestock Centre for Africa in Ethiopia. IFG aims at maximizing the cultivation of fodder production per hectare through intensive cultivation of leguminous trees/shrubs and grasses on a small area (10m x 20m). This technology is recommended for marginal lands, areas where land is scarce, areas where it is compulsory to confine livestock and is most appropriate for areas where feed is not readily available for a cut-and-carry system.
An IFG provides renewable sources of nutritious and palatable fodder, fuel and green manure; curbs soil erosion, conserves soil moisture and increases soil fertility; increases the productivity of a given piece of land by interplanting diverse species of fodder trees, shrubs and grasses; provides a stable agricultural system for the semi-arid tropics; and reduces the danger of toxicity problems from noxious weeds and contaminated poisonous fodder.
An intensive fodder garden is usually established on a small piece of land (10m x 20m). Larger plots may, however, be used, depending on the number of animals to be maintained. One of the recommended designs of an IFG (yield: 20 tons dry matter/ha) incorporates legume trees, shrubs and grasses. A spacing of four meters between rows of trees is maintained. The space between trees in the row is one meter. The grasses are spaced 75 cm, between rows and 30-40 cm between hills. While grasses and leguminous shrubs/vines are mature for cutting in six to eight weeks, they should be cut on a 10-12 week cycle for optimum productivity. More frequent cutting will reduce total productivity.
The land should be cleared of all weeds before land preparation and planting. Since forage grass (i.e., *Panicum*) seeds are small, they require a fine seedbed. If vegetative planting materials are used, a rough seedbed is tolerated. *Flamengia*, *Rensonni* and *Gliricidia* can be planted either on a flat or ridged land and must be planted ahead of the forage grass to minimize shading for the first six weeks. Forage trees may be planted by direct seeding or by nursery seedlings. Direct seeding is easier, cheaper and feasible in areas where annual rainfall is 1,200 mm or more with a minimum growing season of about 200 days. Planting of seedlings is recommended at the start of the rainy seasons. If irrigation is available, planting can be done anytime of the year. The ideal

depth of planting should be about 2.0 cm, with two to three seeds per hill.
The following fodder trees, grasses and legumes are recommended:
- Fodder trees: *Gliricidia sepium, Leucaena leucocephala, Cajanus cajan, Sesbania grandiflora.*
- Grasses: *Pennisetum purpureum, Panicum maximum, Brachiaria mutica, Cynodon plectostachyus, Digitaria decumbens, Pennisetum clandistinum, Dicanthium aristatum, Bracharia decumbens, Chloris gayana.*

On fertile land, fertilizer may not be necessary; however, on moderate to low fertility soils, decomposed animal manure could be incorporated in the soil at least two weeks before planting. If manure is not available, a side dressing of 15-15-15 fertilizer (in the initial year of establishment only) at about 150 kg per hectare (four to six weeks after planting) can boost the initial growth of tree seedlings and forage grasses. After one to one-and-a half year of establishment, the fertilizer requirements of the grasses can be met by returning 50 to 70 percent of the cut leaves from the tree species back to the soil in the form of mulch. All the grasses and one-half to one-third of the tree leaves can then be used as animal feed.
In the first year, IFG production in a plot measuring 200 square meters would be sufficient to supply 25 percent of the daily intake of 3.6 small ruminants (goats or sheep). Foliage yields in the first year range from 9 to 20 tons/ha dry matter. Increased yields can be expected during subsequent years. To maintain a cattle fattener, there is a need to develop 400 meters of intensive feed garden area.

1185 92 - 8/46

Homegardens
Africa, Latin America, study, cowpea, leafy vegetable, grain legume, post harvest, quality loss, handling, storage

BITTENBENDER, H.C.

HANDLING AND STORAGE OF COWPEA *VIGNA UNGUICULATA* (L.) WALP. AS A LEAF VEGETABLE.

Trop. Agric. (Trinidad), 69, No. 2, 1992, p. 197-199

This study examines the effects of temperature and package ventilation on the storage life of fresh cowpea leaves.
Cowpea, *Vigna unguiculata* (L.) Walp., is a popular leaf vegetable and grain legume in many parts of Africa.
Most commonly, leaves are served boiled to accompany a starchy porridge; fried and fresh in relish are other popular methods.
The cowpea has many desirable horticultural characteristics not usually associated with leaf vegetables. It is an efficient nitrogen-fixing, heat- and drought-tolerant legume. A single planting yields leaves, immature pods, and immature and mature seeds. Cooked leaves contain two-thirds the protein, seven times the calcium, three times the iron, half the phosphorus, eight times the riboflavin, five times the niacin and several hundred times the asorbic acid and beta-carotene of the cooked seed. Amino acid composition indicates that cowpea leaf protein is superior to seed protein.
Drying boiled or blanched cowpea leaves is a widespread method of preservation.
"Vita 7", a erect cowpea cultivar with short trailing vines was selected for the study.
It was released by the International Institute for Tropical Agriculture, Ibadan, Nigeria, for its high yields and adaptability throughout Africa and Brazil.
Storing cowpea leaves in shaded, closed polythene bags or any container with minimal ventilation at ambient temperature increases storage life of cowpea leaves compared with open storage. Minimal cooling lengthens the period of storage, but temperatures below 15°C will induce chilling injury. If leaves are cooked immediately after removal from cold storage as would be expected if leaves were stored in the home, chilling injury might not be detrimental. Leaves in cold storage below 15°C at the whole sale or retail level would not remain edible after purchase.
Additional research should determine if ventilation greater than the closed bag but less than the next level tested (25 times greater) can extend the storage life and reduce the development of off-odours at high temperatures due to reduced oxygen levels.

1186 92 - 8/47

Homegardens
Africa, Niger, dry season, gardening projects, Lutheran World Relief

COTTINGHAM, R.

DRY-SEASON GARDENING PROJECTS, NIGER

In: The Greening of Aid; Ed. Czech Conroy and Miles Litvinoff; Earthscan Publ. Ltd. and IIED, London, 1988, pp. 69-73

The Lutheran World Relief (LWR) programme in Niger started in 1974 a project. This project was designed to truck seeds from Nigeria to the southern parts of Niger and Chad.
The villagers' immediate need was for vegetable seeds. While tomato and okra seeds could be dried and collected, and manioc cuttings could be replanted, other vegetables which would broaden the diet and nutritional base were generally not available. Composting was almost unheard of and difficult in dry areas, and with the loss of livestock and their manure these people were left to grow a few food items in low-quality soil. These factors generated the first few modest project attempts. The larger amounts of food grown using chemical fertilizer gave encouragement to the men and women involved, but success was short-lived.
Insecticides in small amounts were imported to control the nematodes. Villagers were encouraged to hand-exterminate external pests, while the Nigerian agriculture services demonstrated the safe use of insecticides and distributed them. It was rediscovered that nitrogen-fixing legumes (chickpeas) not only provided nutritional vegetables for additional food but were easy to dry, store and replant. If intercropped with other vegetables they provide nitrogen to the needy soil and cut down on nematode infestation.
Strong, hot wind caused erosion and sand dunes and sapped the life out of vegetables struggling to survive the intense heat. In response, a number of indigenous trees and bushes were planted on pond perimeters and around garden plots. These local varieties of hedges became a simple, effective way to keep out livestock and counter the relentless winds. The effect was to reduce water consumption, to add the new colour of green on vegetables and to strengthen wilting varieties of legumes; the shade given to the earth in the gardens greatly lowered ground temperatures.
Traditional well problems took longest to solve. Work was begun on designing a simple technology to meet the requirements of local replicability and durability.
This technology solved well cave-in and dirty water problems and had the advantages of low cost, simplicity and ease of maintenance.
The most easily measured economic impact is the increased availability of garden vegetables. People have increased food for themselves, which was the primary goal, but most gardeners have surplus vegetables to sell.

Less easily measurable economic benefits are increased production of animal feed from the use of windbreaks and live fencing.
Environmental effects are positive. Live fencing utilizing indigenous species is possible and within the capabilities of local people. Its use has reduced pressure for the use of live and dead thorn-tree branches.
Twelve years' experience in Niger has shown that these dry-season gardens are self-sustaining. People are aware that rain-fed agriculture may never be as it was in past years because of the decline in rainfall.
Dry season garden projects and wells have been replicated in more than 20 areas of Niger with the same success as in the original 8. Burkina Faso, Mali, Senegal and Western Sudan were surveyed for areas with water tables that would allow replication of most of the components of these dry-season gardens.

IX SEED PRODUCTION

1187 92 - 9/34

Seed production
Review, study, guide, audiotutorial unit, handbook, CIAT, developing countries, tropics, subtropics, bean seed, management, ecology, production, harvest, standards, activities, evaluation

DOUGLAS, J. et al.

GOOD QUALITY BEAN SEED.

Study Guide, CIAT, Apartado Aéreo 6713, Cali, Colombia; Series 04eB-12.03, 1981, 36 pp.

An effective seed program comprises many and diverse elements and activities which must be coordinated to attain the principal objective: produce and distribute good quality seed of improved varieties. Therefore, the success of a seed program is founded on producing and providing a sufficient quantity of good quality seed, at the required time, at a reasonable cost, and at a location where it is needed, so that the majority of the farmers can enjoy the benefits provided by using this seed.
This study guide is complementary material to the audiotutorial unit "Good-Quality Bean Seed". Its principal objective is to provide useful information relating to the practices of production, quality control and processing of bean seed.
The audiotutorial unit is a translation of the Spanish unit entitled "Semilla de Frijol de Buena Calidad" which was produced by CIAT through a special project on the development and utilization of training materials on improved agricultural production technology.
The handbook contains the following chapters:
- Objectives
- Introduction
- What is Good Quality Seed?
  . Varietal purity
  . Physical purity
  . Good germination
  . Freedom from seed-borne diseases
- What is needed to produce Good Quality Bean Seed?
  . Varietal pure seed
  . Freedom from seed-borne diseases
  . A site that provides an unsuitable environment for development of pathogenic organisms
  . A suitable field
  . Special management of the crop
  . Removal of foreign, off-type and diseased plants
  . Harvest of the seed

- Steps to follow after harvesting Good Quality Seed
  . Drying
  . Cleaning
  . Treatment
  . Sampling
  . Evaluation
  . Storage
  . Transport
- Activities of Different Groups in Obtaining Good Quality Seed
  . Seed certification authorities
  . Research programs
  . Seed growers, seed enterprises and marketing groups
- Evaluation
- Bibliography

This handbook together with the audiotutorial unit provides useful information for the practice of quality bean production.

1188 92 - 9/35

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 distribution 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: Local 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 recognized as the climate 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, exotical 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 description 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.

1189 92 - 9/36

Seed production
Review, developing countries, book, practical guide, agricultural crops, varieties, crop production

KELLY, A.F.

SEED PRODUCTION OF AGRICULTURAL CROPS.

Longman House, Burnt Mill, Harlow, Essex CM20 2JE, UK, ISBN 0582-40410 X, £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 Agricultural Botany in England from 1970-83, since when 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.

1190 92 - 9/37

Seed production
Asia, Philippines, case study, seed potato, physiology, pathology, production systems, CIP, GTZ

CRISSMAN, C.C.

SEED POTATO SYSTEMS IN THE PHILIPPINES: A CASE STUDY.

International Potato Center, Lima, Peru; ISBN 92-9060-136-1, 1989, 82 p.

This report is one of a series of case studies on seed potato systems in selected countries. The main objective of the individual case studies is to identify strengths and weaknesses in organized seed potato programs. To do this effectively, the organized potato program must be examined in the context of its environment. Thus a systems approach is adopted in these studies to categorize and evaluate the role of an organized program within the larger seed system.
Potato production in the Philippines is centered in the high and mid-elevation areas of Benguet and Mountain Provinces in the agricultural region of Ilocos in Northern Luzon.
The data show a rapid expansion in production during the last ten years at an average annual rate of 8.3%. Most of that growth is explained by expansion in area and the rest is due to changes in yield.
The government efforts have centered on a cooperative project with the German government to establish a seed production scheme in the highlands of northern Luzon.
The concept of system used in this study stresses function rather than structure as the basic device by which to classify the system parts. Special attention is paid to linkages between the different agencies which have roles in the organized seed programs and the linkages between these agencies and the informal farmer-based seed system.
The format of the report proceeds from the general to the specific. First there is a brief discussion of trends in the potato sector and the potato in the Philippine food system in terms of production, consumption and marketing. Next is a presentation of the larger elements which influence the seed system, the physical and socio-economic environment and the government. An overview of the RP German seed potato project is presented in the discussion of government activities.
After this overview the discussion follows the chain of activities found in the Philippine seed system. These steps are:
- provision of adequate varieties
- the initial creation of seed supplies, a step crucial for overcoming the slow rate of reproduction while moving from foundation material to sufficient quantities of basic seed, and
- the building of seed supplies, which includes the organization of farmer cooperators for bulk multiplication but also for quality control.

- Next the work of the private sector is discussed, the components of crop protection and storage are introduced, and an overview and discussion of results are presented.

The gradual build up of diseases in seed stocks obliges farmers to replace their seed stock periodically. In the absence of widespread certified seed, the source of the replacement seed requires careful consideration. In developing countries this usually means that seed from higher altitude zones would be preferred. Thus there often exists a distinctive flow of seed from one location to another. Once on the farm, the farmer can use various methods to slow the rate of degeneration of the seed. These methods include proper post-harvest handling and storage, field or post-harvest selection, and pre-planting treatment.

1191 92 - 9/38

Seed production
Latin America, Brazil, study, field trials, maize, field bean, trace elements

PRIMAVESI, A.

SEED ENRICHMENT WITH TRACE ELEMENTS.

In: Proc. of the 8th Int. IFOAM Conference, Budapest, Hungary, 1990, pp.131-133

Little or no attention is given to seed nutrition. It is considered that, automatically, seeds, produced by plant breeding, may give rise to healthy, vigorous plants. If this does not occur, soil is improved by heavy NPK application, and agro-toxics have to protect the high yielding crops attacked by pests and diseases.
The author worked with copper enrichment to paddy seeds and found that only plants of treated seed responded to a copper fertilization; seeds of plants fertilized with copper did not respond to enrichment. Paddy with copper gave higher yields, had a better grain quality, breaking on seldom when husked, and had a strong resistance to *Pirucularia oryzae*. Even in fields infected with *Piricularia oryzae* and planted with infected seeds, no diseased plant appeared.
Seed treatment of maize and beans was very efficient. The soil roots of maize, given boron to seeds, are deeper. *Spodoptera frugiperda* attack was reduced to 2% instead of 55% on the test plots. Nearly all plants had two to three ears. Ears were greater and grains heavier. During storage of six months, no worm attacked. With zinc sulphate there was no attack of Elasmopalpus, which killed 20% of the seedlings on the testplot. Zinc additionally to the soil made the plants more drought resistant.
Seed enrichment to field beans protected them against parasites when followed by two leave applications, whilst the test plants had to be sprayed with pesticides five times. Those plants with seed enrichment and leave fertilization did not need to be protected.
It is assumed that plant protection against parasites by seed enrichment and trace element fertilization may be due to the nutritive effect. Micronutrients are enzyme activators or part of the prosthetic group or incorporated in the enzyme itself. A stronger enzymatic activity may be assumed as facilitating the formation of organic substances improving the biological value of plants.
The seeds could be treated with a surprisingly high concentration of multi saline solution. It may be supposed that trace elements in balanced proportion with others, like iron-manganese or copper-molybdenum may be used in much higher concentrations without a toxic reaction. On the other hand, even potash is toxic in mono saline solution.
It may be concluded that well-nourished or enriched seeds are more resistant against parasites. Plant health may be improved by seed

enrichment and micronutrient fertilization. At the same time this increases yield and biological quality. Crop production with enriched seeds is less expensive and risky than conventional agricultural technology.

1192 92 - 9/39

Seed production
Review, tropics, cassava, planting material, production methods, stakes, cutting methods, mukibat system, handling, chemical treatment, CIAT, CIP, IITA,UNDP

LEIHNER, D.E.

CURRENT PRACTICES IN THE PRODUCTION OF CASSAVA PLANTING MATERIAL.

In: Proc. of a Reg. Workshop, Cali, Colombia, 1983, pp. 41-45

This paper reviews some of the current practices in stake production and points out some elements necessary for improvement.
Selection of stakes:
A conscientious selection of mother plants according to nutritional and health status, followed by a careful selection of stakes from these plants, is hardly ever done in traditional production systems.
In traditional systems, hardly any selection is made with regard to the maturity of the stake. This means that along with stakes of adequate maturity (recognized by a relation of total to-pith diameter of between 2:1 and 3:1), a large number of either too young, i.e., succulent stakes, or too old, i.e., very lignified stakes, are selected. This leads to plant loss and a patchy, uneven sprouting of stakes.
Cutting and preparation:
- Cutting methods:
  A great variety of cutting methods are presently practiced worldwide. In one of the common methods, the long stem is placed on a base.
- Stake length:
  As with cutting methods, farmers use a great variety of stake lengths in commercial plantings. Stakes as short as 10 cm with only two to four buds may be used by some, whereas others cut and plant stakes of 40 cm or more.
- Mukibat system:
  The traditional and rudimentary methods of selecting and preparing cassava planting material stand in contrast to a very careful and elaborate system known as the Mukibat system. A well-selected *Manihot esculenta* stake is used as a stock onto which a *Manihot glaziovii* scion is grafted.

Handling before planting:
- Transport:
  The majority of cassava planting material is transported in the form of long stems to facilitate handling and reduce moisture loss.
- Chemical treatment:
  Chemical treatment of stakes for pest control and protection against soil-and air-borne fungi after planting is not a common practice among cassava producers. Many farmers simply do not know about this way of stake protection.

Concluding cassava planting material is obtained in a very simple manner from low-value raw material and probably for this reason no refined stake production technology has developed among farmers. It is suggested that in order to improve stake production technology, the primary considerations are selection of stakes for healthiness and adequate maturity, non-damaging cutting practices and the use of appropriate stake lengths.

1193 92 - 9/40

Seed production
Review, ideotype breeding, Australia, alternative yield improvement

MARSHALL, D.R.

ALTERNATIVE APPROACHES AND PERSPECTIVES IN BREEDING FOR HIGHER YIELDS.

Field Crops Res., 26, 1991, pp. 171-190

This paper considers strategies for increasing commercial yields of crops by plant breeding, both directly by increasing yield potential, and indirectly by improving the expression of yield potential in practice.
Little attention was given to crop improvement by considering morphological or physiological traits which could directly contribute to higher yields. Whilst his ideotype approach has generated considerable interest, there has been limited adoption of ideotypes in breeding programmes, and limited success in terms of yield improvement.
The development of model plants or ideotypes has been adopted as a major breeding philosophy by relatively few programmes. The reason for this is that most breeders have formed the view that the ideotype approach offers no advantage over the available alternatives, in terms of yield improvement in their crops. Breeders may have reached this conclusion either because of perceived difficulties or disadvantages with the ideotype approach, or perceived advantages of alternative approaches.
This is discussed in this paper in relation to conceptual and practical difficulties in the implementation of ideotype breeding, including the difficulty of identifying yield-enhancing traits, and the lack of genetic diversity for such traits in some agricultural crops.
Alternative strategies for yield improvement include using techniques such as heterosis in FI hybrids, and the identification and manipulation of individual 'yield' genes (particularly using the recombinant DNA technology of restriction fragment length polymorphisms (RFLP). However, an emphasis on the 'defect elimination' approach to plant improvement will continue to be relevant, as many Australian farm crops yield well below their genetic potential. Substantial progress is likely to be made by addressing the control of air- and soil-borne pathogens, mineral deficiencies and toxicities, appropriate phenology, and resistance to frost damage during heading in cereals.
Increased yield is regarded by most plant breeders as an important, high-priority objective. There are two ways commercial yields can be increased by plant breeding:

- Directly, by increasing yield potential per se above that of standard varieties in the same environment. This may be done by increasing total dry-matter production, or by increasing the proportion of the total dry-matter converted to economic yield, or both; or
- Indirectly, by improving the extent to which the true yield potential of a crop is realized in practice. This may be done by genetically removing or overcoming biotic (e.g. diseases and pests) or abiotic (e.g. frost, drought, salinity, mineral deficiencies or toxicities) constraints on crop production.

X PLANT PROTECTION

1194 92 - 10/121

Plant protection
Review, integrated pest management, control methods, pest management approaches, sustainable agriculture, transfer of technology model, research, extension, institutional reform, policy aspects, training, IIED

PIMBERT, M.P.

DESIGNING INTEGRATED PEST MANAGEMENT FOR SUSTAINABLE AND PRODUCTIVE FUTURES.

Gatekeeper Series No. 29; Int. Inst. for Environment and Development (IIED), London, 1991, 21 pp.

The introduction of commercial pesticides revolutionised pest control. These modern presticides have helped to control and reduce crop and livestock losses to a remarkable degree.
The use of these pesticides has created some of today's major environmental and health problems: reduction in the abundance and diversity of wildlife, human health hazards associated with acute or chronic exposure to dangerous products in the workplace, and contaminated air, food and water.
The self-defeating nature of the chemical control strategy that dominates today's crop and livestock protection efforts has also become more apparent in recent years. Repeated applications of synthetic pesticides have selected pesticide resistant pests worldwide, and there are now at least 450 species of insects and mites, 100 species of plant pathogens, 48 species of weeds resistant to one or more products. The deaths of natural enemies has allowed previously harmless organisms to reach pest status.
For these reasons, crop protection specialists are increasingly being asked to develop pest control methods that are more compatible with the goals of a sustainable, productive, stable and equitable agriculture. To meet these aims, research must seek to integrate a range of complementary pest control methods in a mutually enhancing fashion, namely as Integrated Pest Management (IPM). IPM focuses on five control areas:
- cultural pest control: the manipulation of sowing and harvest dates to minimise damage, intercropping, vegetation management and crop rotations;
- host plant resistance: the breeding of crop varieties that are less susceptible to pests (insects, diseases, nematodes, parasitic weeds;
- biological control: the conservation of natural enemies, manipulation of natural enemy populations, and the introduction of exotic organisms;
- the wise and judicious use of pesticides: chemical, microbial, botanical pesticides used along with information on economic thresholds;

- legal control: the enforcement of measures and policies that range from quarantine to land and water management practices. This approach to pest management must involve area-wide operations that include many rural households and are enacted for the common good of both farmers and society at large.

Amongst users and promoters of IPM, such as researchers, donors, policy makers, pesticide companies, and extension staff, there are significant differences in emphasis and approaches.
Some of the more fundamental differences are briefly discussed in this paper to identify IPM approaches that reflect and reinforce the goals of sustainable and equitable production systems:
- IPM systemic adjustment or structural change,
- The relative importance given to self-sustaining control methods,
- The stocks of knowledge used by IPM practitioners,
- Research for IPM,
- Changes within IPM science and extension,
- Institutional and policy reforms.

Concluding, there will be a need to focus on structural changes in agroecosystems, give greater importance to self-sustaining control methods, and draw on the local stocks of knowledge useful for pest management.
Future self-sustaining designs that minimize the need for pest control interventions will require more understanding of complex ecological systems. The move towards system design to minimize pest outbreaks calls for knowledge and decision making as IPM becomes more broadly coordinated with land and water management, conservation of biodiversity, public health protection and socio-economic development.

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Plant protection
Review, USA, biotechnology, sustainable agriculture, herbicide tolerant crops, human health, environment, economics, sociology

GOLDBURG, R. et al.

BIOTECHNOLOGY'S BITTER HARVEST: HERBICIDE-TOLERANT CROPS AND THE THREAT TO SUSTAINABLE AGRICULTURE.

A Report of the Biotechnology Working Group, USA, 1990, 73 pp.; available from Environmental Defense Fund, 257, Park Avenue South, New York, NY 10010; price USD 10.00

The objective of this report is to examine the impacts of herbicide-tolerant crops, trees and to recommend changes that will discourage the development and adoption of such crops and trees in U.S. agriculture and forestry.
Modern agriculture depends heavily on herbicides-chemical plant killers-to control weeds. Nearly 80% of the herbicides used annually in this country are applied in agricultural settings. Consumers, farmers, farmworkers, domesticated plants and animals, wildlife, and their habitats are exposed to weed killers.
Against the background of agriculture's current dependence on herbicides, biotechnology, agrichemical, and seed companies, as well as the U.S. Department of Agriculture and state agricultural institutions, are using genetic engineering to develop crops and trees resistant to herbicides. Widespread adoption of these crops and trees will lead to increased use of particular herbicides.
Biotechnology's Bitter Harvest examines the impact of agricultural biotechnology's first major product - crops genetically modified to tolerate chemical weed killers, or herbicides. Crops are being given genes that will enable them to tolerate or resist the toxic effects of herbicides. A major research focus of public and private research institutions, herbicide-tolerant crops involve most agricultural crops, including a number of food crops, in the United States.
First, the report examines the extent of current herbicide use and the research sponsored by corporations, federal and state governments on crops and trees that tolerate herbicides. Then, it briefly discusses the human health, environmental, social, and economic impacts of herbicides and herbicide-tolerant plants. Next, the report examines the promises against the realities of widespread use of herbicide-tolerant crops, exposing a variety of detrimental effects herbicide-tolerant crops and trees will have on farmers, consumers, and the environment. Finally, it outlines the promise of sustainable agriculture to provide alternative methods of weed control. Based on its analyses, the report makes recommendations to discourage the development and adoption of herbicide-tolerant crops and trees.
To those with high hopes for the environmental benefits from biotechnology, herbicide-tolerant crops are at best a distressing misstep, at worst a cynical marketing strategy. Both industry and