

Agriculture

Productive agricultural land is the most fundamental resource for all rural communities and nations. An agriculture which forms a basis for rural and national self-reliance in food production depends upon equitable distribution of this resource. Without secure access to land, the tenant farm family is not in a position to carry out many of the long-term improvements (such as terracing, composting, and tree planting) that may be needed, nor are they in the position to benefit from the multitude of small farm programs sponsored by national agriculture departments and international and bilateral aid agencies. The landless farm laborer is often ignored entirely, though he or she is most vulnerable to unemployment from mechanization. Participation in agricultural production, it has been repeatedly demonstrated, is the only clear guarantee of participation in food consumption.

The concentration of land holdings in a few hands appears to be a major engine of environmental destruction as well, forcing subsistence cultivators onto marginal lands and hillsides. The loss of topsoil that follows is swift and often irreversible. Deforestation becomes a way of life as existence is scratched from the land in a capital-consuming, desperate process.

The amount of productive land lost to deforestation and desertification is staggering, and the rate of loss is increasing. A central concern of agriculture must therefore be a sustainable resource base—soil conservation, an assured supply of nutrients, and a buffer from the inflationary costs of inputs that accompany the fossil fuel-based agriculture of the rich countries. The elements needed for ecologically responsible agricultural systems exist in most parts of the world. In developing such approaches, indigenous agricultural systems deserve special

attention, for they often reflect important ecological interactions and yield a variety of crops.

In any agricultural system, crop diversity is usually a key to sustainability. There must be a balance between production of cash crops for income, and production of subsistence crops for direct consumption. Cash crops can allow a greater flexibility and access to crucial tools and inputs that would otherwise be unobtainable, and they usually mean a higher value production from a particular piece of land. Yet cash crops often bring with them dependency on global market forces for the sale of produce and for the supply of fertilizers. They also tend to bring a reduction in crop diversity. All of these factors significantly increase the risks facing farmers. Cash crops can lead to a mixing of agricultural soils for short-term gain, reducing both short-term food supplies and long-term productivity of the land. Cash cropping also contributes to the concentration of landholdings, displacement of tenant farmers, and abandonment of traditional social mechanisms of redistribution and collective welfare.

The social aspects of the organization of agriculture are major considerations in the search for appropriate agricultural strategies. What does a new agricultural system do to social relations, the extent to which extended families continue to take responsibility for all their members? What does a new agricultural system do to the composition and character of rural communities?

In recent years there has been a rethinking of the role of the small farmer in agricultural research. There is now strong evidence that to be successful, research programs must include small farmers in thinking about what changes might be tried, and in testing and evaluating proposed improvements in the farming system before widespread dissemination is attempted. When typical farmers are partners in the research teams, experience has shown that innovations coming out of the research program are far more likely to be acceptable.

When all of these concerns are taken into account, several avenues for appropriate technologies seem evident. There is a need for increased emphasis on intensive food production. Growing fruits and vegetables in home gardens can be done by nearly every family. Relatively high production can be obtained from a small area, and the increased variety in the family diet has clear nutritional advantages.

Farming systems that combine agriculture with forestry bring a varied and higher total production from multiple tiers of plants and trees. Reduced pest problems result, as a more diverse plant environment offers less shelter to pests and more to their predators. More stability over time is also assured as differing crops provide protection from weather and market fluctuations. Alternating tree crops with row crops enables a sustainable productive agriculture as protected topsoil and variety of plant life mean that soil fertility can be maintained. The addition of animals, including livestock, fish, and bees into these farming systems can also be important in providing additional food, income and fertilizer

These complimentary themes can be found throughout the entries included in this chapter; more synthesis needs to be done in actual programs.

As You Sow paints a saddening picture of the negative social consequences in small communities that have accompanied the transitions from family farms to huge agribusiness operations in California. This process of decay through growth in landholdings involves a substantial reduction in the number of opportunities for rural people to develop basic business, managerial, and entrepreneurial skills.

The Art of the Informal Agricultural Survey provides excellent advice to anyone gathering information, emphasizing "cheap, practical, and fast Grubbing

out information infields, market places, bars, and fly-ridden tea shops. " The same techniques can be applied in urban areas as well. If your project requires effective information gathering, you must read this piece.

Small Farm Development is an exceptionally valuable and highly readable book. It illuminates the dynamics, characteristics, and constraints of small farms in the tropics. It should be required reading for those working on farming systems, tools and equipment, and related activities such as farm co-ops.

Two Ears of Corn is filled with valuable advice on how to successfully work with a local community to improve agricultural practices. **Training and Visit Extension** documents a low-cost extension approach which can help farmers improve their basic practices with almost no cash investment, yet with a high chance of achieving higher production. This approach relies heavily on village-level workers with a low educational background, a strategy somewhat similar to the use of "barefoot doctor" health workers.

Many of the publications included offer insight and practical considerations relevant to the creation of sustainable agricultural systems and agroforestry combinations. The journals also provide contact with the worldwide network of enthusiastic and imaginative people working in this field.

Reference books on soils, seeds, crops and fertilizers are reviewed. Soil testing, seed production, composting and soil conservation (controlling erosion and gully formation) are some of the topics covered here. The proper protection of workers from pesticides is addressed by several books, while **Integrated Pest Management** reviews the techniques used to control pests while minimizing pesticide use.

Three volumes introduce the technical considerations for small-scale irrigation efforts. Irrigation is the biggest single factor in raising farm yields. As its proper planning from a technical and environmental viewpoint can be quite complicated, these are welcome references.

Intensive gardening is the topic of ten entries. The manuals from Bangladesh, Peru, Jamaica, and the Philippines are highly recommended references, to go with **How to Grow More Vegetables** from the United States.

The last section includes a number of books on raising animals under various climatic conditions. The final entry in this group is the encyclopedic **Tropical Feeds**, a unique reference covering nutritional content and uses of 650 tropical feeds, most of them plants.

Small Farm Development: Understanding and Improving Farming Systems in the Humid Tropics, MF 05-214, book, 160 pages, by Richard Harwood, 1979, Westview Press, out of print.

The author states, "In our impatience with 'backward' small farmers and in our haste to rapidly 'commercialize' them, we have overlooked key aspects of their farming systems that could enhance efforts to increase food production and improve rural well-being. To accomplish the development of a greater number of the world's small farms, shifts in emphasis must be made in our thinking, in our technological research, and in our communications with farmers."

Better understanding and analysis of the bulk of the small farm production systems in the South is the theme of this important book. The author discusses with great depth and sensitivity the issues and options facing resource-limited small farmers in the tropics. He suggests that a "purposeful blending of traditional and modern technologies may well prove the key to starting the most disadvantaged

farmers along a more rapid development path."

In the first part of his book, Harwood presents an overview of small farms from subsistence hunting-gathering to primary mechanized operations. He endorses a development approach of scientists, extension workers, and farmers working in close cooperation in farming areas. "The agricultural development specialist must remain constantly aware of—and on guard against—the natural tendency to superimpose his own values on those of the farmer. The reality that faces the farmer who ekes out his existence from a mere half-hectare of poor land can only be understood—if it is seen as he sees it."

The second part of the book reviews critical factors in small farm development which are often overlooked or given little emphasis in development programs. Some examples of these factors include:

Animals in Mixed Farming Systems:

"Despite the almost universal interest of farmers in mixed crop-animal systems professionals in both crop and animal production commonly pursue research in pure crop systems or pure animal systems, without reference to the interactions between the two that increase the productivity of both. Fortunately, most farmers have no such inhibitions or prejudices. Science should do more for them."

Noncommercial Farm Activities:

"Fence rows are often used for noncommercial plantings as well as for their primary functions as field boundaries, enclosures for containment or exclusion of grazing animals, and erosion controls. There is evidence to indicate that the plant diversity and permanence of the fence row makes it a refuge for beneficial insects and predators. The relative rarity of pest outbreaks in highly diversified small farm areas where hedgerows and farmyard plantings are extensively used may be due to the net benefits of these traditional features."

Other chapters deal with resource and economic limitations of intensive and multiple cropping systems; economic determinants and resource optimization of micro-enterprises; farm mechanization requirements; and stability in farming systems. An excellent annotated bibliography is also included.

Technical charts and graphs are balanced by photographs of farm families at work. All in all, this book is a fine blending of reasoned arguments for new directions in agricultural development projects. It should receive wide circulation among agriculturalists and development workers concerned with agriculture in the humid tropics of the South.

Two Ears of Corn: A Guide to People-Centered Agricultural Improvement, MF 05-224, book, 264 pages, by Roland Bunch, 1982, \$7.95 from World Neighbors, 5116 North Portland Avenue, Oklahoma City, Oklahoma 73112, USA; also available in Spanish and French; also available from TOOL.

A program beginning with a redefined goal of agricultural improvement which emphasizes the development of indigenous participation and capability rather than simply introducing production-raising techniques is more likely to yield long-term benefits, according to this guide for village-level program leaders. The importance of small-scale, local cultural values, feedback, and non-paternal methods of leadership is established in an informative, insightful text which draws from examples of both failures and successes throughout the world's villages. Includes advice for program planning, encouraging participation, technology choice, employee policy, socio-cultural surveys, marketing, and eventual phase-out of

outside assistance. Applicable to non-agricultural programs also.

Highly recommended.

Understanding Small Farmers: Sociocultural Perspectives on Experimental Farm Trials, MF 05-258, paper, 9 pages, by Robert Rhoades, 1982, from International Potato Center, Aptdo. 5969, Lima, Peru; or order publication no. PNAAN869, \$1.17 from AID Document and Information Handling Facility, 7222 47th St., Suite 100, Chevy Chase, Maryland 20815, USA.

This is a good quick introduction to the reasons why understanding the farmer's perspective is vitally important to the success of efforts to develop improved agricultural practices through farm trials. The author points to seven essential questions: "1. Is the problem to be solved important to farmers? 2. Do farmers understand the trials? 3. Do farmers have time, inputs, and labor required by the improved technology? 4. Does the proposed technology make sense within the present farming system? 5. Is the mood favorable for investing in certain crops in a region? 6. Is the proposed change compatible with local preferences, beliefs, or community sanctions? 7. Do farmers believe the technology will hold up over the long term?"

"In the end, the acceptability of a technology depends on what the farmers actually do. This may not, as we have stressed, be the same as what they have told us. We can discover this only in a final stage of farmer testing where farmers themselves take over the new technology and incur all risks, costs, and benefits. Until this final step is taken, all other evaluations remain only suggestive of the technology's potential."

Insights of Outstanding Farmers, MF 05-238, book, 114 pages, IRRI, 1985, \$8.30 to highly developed countries, \$2.50 to developing countries, plus \$1.00 surface mail or \$3.00 airmail postage, from Publications Office, International Rice Research Institute, P.O. Box 933, Manila, Philippines.

IRRI has brought together the stories of 14 outstanding rice farmers from different countries in this excellent book. These people provided their own background information and were interviewed for additional details. The result is a fascinating view of the circumstances, thinking and decision-making of these farmers. Many of them are very systematic in experimenting in their own fields. While these people are more representative of "leading" farmers than "average" farmers, their stories give the reader a better understanding of the small rice farmer and the technological changes that may benefit her or him. |

Readers with varied interests in rural development will find this a revealing book.

Farm Management Research for Small Farmer Development, FAO Agricultural Services Bulletin 41, MF 05-280, book, 145 pages, by John I. Dillon and J. Brian Hardaker, 1981, \$16.00 from UNIPUB.

Persons working on the improvement of small farm equipment, the development and introduction of new varieties and techniques, and any other innovations that affect the small farm as an enterprise will find this a valuable reference. The reader is reminded that small farmers usually make efficient use of their available resources, that important crop-crop and crop-animal interactions

exist on most small farms, and that a good understanding of existing farming systems is necessary before potentially useful improvements can be identified. Most of the manual explains the elements essential to good survey strategies and techniques, interpretation of data, modeling of farm activities, and economic/financial evaluations of alternative choices.

This book should help the reader to systematically identify research project possibilities that are likely to lead to useful and economically viable technologies. This approach is far more likely to succeed than the common practice of choosing topics based on incomplete information and incorrect assumptions about what farmers are actually doing.

Agricultural Extension: The Training and Visit System, MF 05- 127, booklet, 55 pages, by Daniel Benor and James Harrison, 1977, \$6.95 from World Bank Publications, Box 7347-8619, Philadelphia, Pennsylvania 19170-8619, USA.

The System "has been put into operation in areas where the need is to improve the level of agricultural production by large numbers of farmers cultivating mostly small farms using low-level technology and usually traditional methods The cost to farmers is very small The smaller cultivators, who have an abundant supply of labor, may benefit at least as much as the larger farmers."

This low-cost extension system "uses village-level workers with comparatively low educational standards supported by subject matter specialists"

"In the Seyhan project in Turkey, farmers increased cotton yields from 1.7 tons to over 3 tons per hectare in three years. In Chambal, Rajesthan (India), farmers increased paddy yields from about 2.1 tons to over 3 tons per hectare in two years. Combined irrigated and unirrigated wheat yields in Chambal, Madhya Pradesh (India), rose from 1.3 tons to nearly 2 tons per hectare after one season and have since risen higher."

The author describes the common problems with extension programs: multiple roles (not just agricultural) expected of the extension worker, excessively large area of assignment for each worker, and theoretical pre-service training with no in-service training.

For a reformed extension service, the author recommends that extension workers report directly and only to the agricultural department, spend full time on agriculture, and make regular visits to farmers. "Contact farmers must be willing to try out practices recommended by the extension workers and be prepared to have other farmers visit their fields. But they should not be the community's most progressive farmers who are usually regarded as exceptional" and are not often followed by their neighbors.

After the simpler field management practices have led to higher incomes, extension workers should recommend to farmers "the minimum quantity of fertilizer which would noticeably increase their net yields and incomes, and teach the farmers how to make the best use of this amount—for example, when and how to apply it, and how to combine it with organic fertilizers."

"To remain effective, extension must be linked to a vigorous research program, well-tuned to the needs of the farmers. Without a network of field trials upon which new recommendations can be based and without continuous feedback to research from the fields, the extension service will soon have nothing to offer farmers, and the research institutions will lose touch with the problems real farmers face."

Training and Visit Extension, MF 05-256, book, 202 pages, by Daniel Benor and Michael Baxter, 1984, \$17.95 from World Bank Publications, Box 72478619, Philadelphia, Pennsylvania 19170-8619, USA.

This volume contains a more complete description of the extension system presented in **Agricultural Extension: The Training and Visit System**. The T&V system is essentially an intelligent simplification of conventional extension structures to create closer links between farmers and researchers, and, in particular, to make better use of farmers' resources with basic agricultural practices that require little or no investment of cash but some additional labor (e.g., "better seed, seedbed preparation, cultivation and weeding").

The initial dramatic success of this system in Turkey and India has led to a great deal of interest in applying it elsewhere. In some countries, a tendency to adopt the name and some of the form, but not the substance of the system, has meant disappointing results.

The successful functioning of an extension system requires more than simply a good organizational structure. In apparent recognition of the many forces that affect and hamper the effective functioning of the T&V system, in this volume the authors give considerable attention to the essential elements of the system that cannot be changed without diminishing its effectiveness. "Leadership of the extension service must be strong, active, innovative, and field oriented For T&V extension to have an impact, research must support it strongly, coordinate with extension, and tackle farmers' immediate problems; production recommendations taught to farmers must be relevant to their needs and resource conditions, be economically viable, and require only inputs that are actually available; and regular and special training of extension staff must be timely and specific to their needs. Most importantly, hard decisions have to be made in setting priorities, requiring concentration of efforts on a small number of feasible goals and a commitment to this system of professional agricultural extension. If any one of these requirements (or any of a number of other basic features of the system) is ignored, or is weak relative to others, the impact of the entire system is compromised."

There is much good advice here that is relevant to all kinds of appropriate technology development and extension activities.

Agricultural Extension, MF 05-230, book, 308 pages, by Michael Gibbons and Richard Schroeder, 1984, available free of charge to development workers from Peace Corps; available to others from ERIC (order no. ED241775) and NTIS (accession no PB85 247278/AS).

Agricultural extension used to be conceived of as a one-way flow of technical information from a central source to the farmer to encourage him or her to undertake "correct" agricultural practices. This volume provides convincing evidence and examples of why it is important to understand the farmer's position and viewpoint, and to work with the farmer to identify priorities for improvements, before any "answers" are proposed. This volume emphasizes that small farmers are expert at what they do and are very familiar with the micro-environmental details of their land. Full of good advice based on long experience, this book should help new fieldworkers avoid many of the mistakes that have bedeviled agricultural extension programs in the past.

Alternative Agriculture, MF 05-277, book, 448 pages, by the Committee on the Role of Alternative Farming Methods in Modern Production Agriculture, National Research Council, \$22.95 to U.S., \$26.25 overseas, from National Academy Press, 2101 Constitution Avenue, N.W., Washington, D.C. 20415, USA.

Alternative agriculture has moved from the fringe to the mainstream with this study that has worldwide significance. The U.S. Government's National Research Council has issued a very enthusiastic report on the growing movement among farmers to "take greater advantage of natural processes and beneficial on-farm biological interactions, reduce off-farm input use, and improve the efficiency of their operations."

Alternative agriculture is defined as "... any system of food or fiber production that systematically pursues the following goals:

- More thorough incorporation of natural processes such as nutrient cycles, nitrogen fixation, and pest-predator relationships into the agricultural production process;
- Reduction in the use of off-farm inputs with the greatest potential to harm the environment or the health of farmers and consumers;
- Greater productive use of the biological and genetic potential of plant and animal species;
- Improvement of the match between cropping patterns and the productive potential and physical limitations of agricultural lands to ensure long-term sustainability of current production levels; and
- Profitable and efficient production with emphasis on improved farm management and conservation of soil, water, energy, and biological resources."

The history and evolution of U.S. agriculture and the economic and environmental consequences of prevailing practices are first reviewed. Next is a presentation of the basic science underlying the most common practices of alternative agriculture: crop rotations, alternative crop nutrient sources and management strategies, integrated pest management, biological pest control, and alternative animal management systems. An evaluation of the economic potential of alternative agriculture follows.

"The report concludes with 11 case studies describing 14 farms managed with an efficient combination of alternative and conventional practices. Detailed descriptions of the practices and financial performance of five crop and livestock operations, seven fruit and vegetable farms, one western beef operation, and one rice farm are presented. The case studies provide insights into the operation of alternative farms in different regions producing different crops by the use of different methods. Each farm is tailored to the limitations and potential of its soil, water, and climate and the local economy.

"Farmers have a history of adopting new systems. While much work remains to be done, the committee believes that farmers, researchers and policymakers will perceive the benefits of the alternative systems described in this report and will work to make them tomorrow's conventions."

Understanding Traditional Agriculture: Bibliography for Development Workers, MF 05-273, book, 114 pages, by Hans Carlier, 1987, Dfl. 19.50 or US \$8.50 to Europe, Dfl. 22 or US \$9.50 elsewhere, from ILEIA, P.O. Box 64, 3830 AB Leusden, The Netherlands.

"Why does science pay so little attention to the wisdom of peasants?"

Conventional agricultural development has proceeded from the notion that traditional agriculture consists of foolish practices carried out by ignorant people. People who have worked with small farmers know that this is not true and that small farmers are very efficient users of the variety of resources available to them.

In order to help small farmers, it is necessary to better understand the real constraints and opportunities facing them. The best agricultural development programs involve small farmers directly in their research. There is also much that can be learned from the written reports and studies others have done around the world.

This bibliography is a valuable attempt to begin a worldwide compilation of information sources on traditional agriculture. Hundreds of articles and books, most of them in English, are listed. In some cases, addresses are provided while in others, only the title and publisher are given. Unfortunately, a great many of these entries are articles which will be hard to obtain outside of libraries that have a good collection of periodicals on development issues.

The Technology Applications Gap: Overcoming Constraints to Small-Farm Development, MF 05-278, book, 144 pages, by Deborah Sands, 1986, from FAO or UNIPUB.

This is a review of the literature, focusing on key problems and mistakes that have repeatedly led to disappointing results in new technology programs.

Case studies and recommendations form the core of this book. Perhaps the most interesting case involves the rapid diffusion of beekeeping in a part of Mexico:

"Since the early 1970's approximately 9000 farm families in Yucatan have developed small-scale beekeeping enterprises which complement subsistence maize production by providing a cash income essential for the household. They produce honey for export using the European bee, *Apis mellifera*, and the introduced technology of the moveable frame hive. *These beekeepers supply between 5 and 10 percent of the honey traded in the international market.*"

"The new technology was actively adopted by small farmers with little government promotion or extension support for production. Although the technology was different from anything employed locally, it was easy for the small farmer to adopt. The equipment had been tested and demonstrated to be successful in the region by large-scale commercial producers in the 1960's. It is relatively simple and can be made locally by village craftsmen. It is divisible so that it can be purchased in small units which allows for incremental investment of scarce cash resources. It generated high yields and the market was relatively stable and accessible to the small farmer. This resulted in good net returns for the farm family to both labor and cash invested."

"The success of the new technology can be attributed to four basic factors which can serve as general criteria for evaluating proposed technologies developed for small farmers. First, it was profitable under the production conditions of the small farmers. Secondly, it engaged surplus labor and did not conflict with the production cycle or factor allocation patterns of food crop production, the primary

agricultural activity of the farm families. Thirdly, the market was established and the marketing conditions were relatively favorable for the small producer. And finally, it met a primary goal within the household economy by providing cash income without threatening the household's ability to provision itself with staple foods."

An annotated bibliography makes up the second half of the book.

As You Sow: Three Studies in the Social Consequences of Agribusiness, MF 05-131, book, 560 pages, by Walter Goldschmidt, 1978, Allanheld, Osmun and Company, out of print.

For the past several decades, American agriculture has been held up as a model for poor countries. This approach has been criticized for many different reasons. **As You Sow** documents the negative social consequences, within the U.S., of an agriculture that increasingly depends on large-scale farms. Goldschmidt notes, for example, that the number of skilled people in communities with small farms is much higher than in communities with a few large farms. Small farms allow the widespread development of entrepreneurial and management skills that are essential to the development of other rural enterprises. Large farms restrict this process, concentrating management and business learning opportunities in the hands of a few.

Environmentally Sound Small-Scale Agricultural Projects: Guidelines for Planning, MF 05-170, book, 103 pages, VITA/CODEL, 1979, revised 1990 edition \$12.95 (overseas orders add \$3.00 for surface mail, \$5.00 for airmail) from VITA; also available in French and Spanish; also available from ITDG and TOOL.

A sustainable agriculture must be ecologically sound. Practices that are not will degrade and consume the natural basis of agriculture. This book explains why this is true, discussing basic ecological principles and the implications of human alterations of naturally stable systems. Much of the book shows the importance of water supply, soil, and pest management in good planning.

"What are the effects of using groundwater for irrigation?" "What is pesticide persistence?" These are examples of questions posed and answered, with clear text and line drawings. Questions aimed at the effects of different alternatives are especially useful. For example, when considering chemical pesticides and/or Integrated Pest Management techniques: "Can a species-specific pesticide be used?... Does the project design recognize the possibility that the target species will develop resistance to the pesticide? ... Are similar pesticides being used locally for health purposes, such as malaria control? ... Are there plants with pesticidal properties which could be used?"

Also included is an "easy-to-use-in-the-field methodology for planning and benefits/costs analysis of small-scale projects." This chapter emphasizes the importance of intelligent questions, readiness to learn from local experience, and flexibility.

However, this book does not focus on the tropical and semi-arid conditions which are found in most developing countries; and it does not provide specific details on any techniques suggested (such as building terraces for erosion control, or monitoring local conditions).

One Straw Revolution, paperback book, 224 pages, by Masanobu Fukuoka, 1978, \$17.95 from Rodale.

This thought-provoking book is considered a classic text for advocates of what has been called "natural farming" or "permaculture" (see review of **Permaculture II** in this section). The author was trained in microbiology, specializing in plant disease, in industrializing pre-World War II Japan. His studies stressed high inputs of energy, capital, and chemicals to control and, if necessary, combat natural forces. He began to question the wisdom of these practices, and returned to his village to try an alternative approach. Over the years, Fukuoka, through painstaking observation and experimentation, developed a method of farming which mimics the natural succession of plant communities and the self-regenerating aspects of ecosystems. He claims that farming units can produce food and fiber in an almost effortless fashion without chemicals or cultivation.

This low-energy system of agriculture contains the following four principles:

No cultivation—do not turn the soil over, and so avoid injuries that divert productive activity;

No chemical fertilizer or prepared compost—let the plants and animals that make the soil go to work on the soil;

No weeding by tillage or herbicide—use the weeds; control them by natural means or occasional cutting;

No dependence on chemicals—insects and disease, weeds and pests, have their own controls—let these operate, and assist them.

One Straw Revolution is a very readable book, with photos of the author practicing his techniques in the fields. While it is inspirational, some caution should be used in considering its relevance to tropical and developing countries. First, Fukuoka has successfully practiced his "natural farming" only in the temperate climate of Japan. Attempts to make the system work in North America are as yet inconclusive. We have heard of no attempts to promote Fukuoka's system in the tropics.

Second, the system requires a great deal of patience, perseverance, and knowledge, possibly only gained by years of experience. Most traditional farmers in the South do not have the margin of error for experimentation available to nonconformists in developed countries. The immediate problem for most farmers is one of survival, not sustained yields. However, these farmers often do have highly evolved systems of cultivation and extensive traditional knowledge about soils, plants, and local ecology. Quite often they do practice minimum tillage and marginal use of chemicals. Perhaps a dialogue between concerned scientists, development field workers, small farmers, and natural farming advocates could lead to further refinements and broader applications for farming systems such as this one.

Ideas such as those proposed in this book may be seen by many today as wild and unrealistic. Still, Fukuoka's methods may yet prove to be the last straw if the world's heavily subsidized and centralized food and energy systems were to crumble.

Permaculture II: Practical Design for Town and Country in Permanent Agriculture, MF 05-201, book, 150 pages, by Bill Mollison, 1980, Australian \$20.00 plus postage from Tagari Publications, P.O. Box 1, Tyalgum, NSW 2484, Australia.

Permaculture II is the second, more practical volume in a series of two

fascinating publications that present an approach to permanent agriculture. These books are based on the author's experience in rural Tasmania and the semi-arid areas of Australia. He and his family are part of an intentional community practicing self-reliance in food, energy, and shelter. "Permaculture" is "primarily a consciously designed agricultural system ... a system that combines landscape design with perennial plants and animals to make a safe and sustainable resource for town and country. A truly appropriate technology giving high yields for low energy inputs, and using only human skill and intellect to achieve a stable resource of great complexity and stability."

The author argues for species-diversity in combined agricultural-forestry systems in place of the energy-intensive mechanized monocultures that are standard in developed countries (and increasingly in developing countries). His book is an impassioned appeal with numerous design sketches, references, and anecdotes to back up his points. "Without permanent agriculture there is no possibility of a stable social order. We can see the departure from productive permanent systems, where the land is held in common, to annual, commercial agricultures, where land is regarded as a commodity. This involves a departure from a low to a high-energy society, the use of land in an exploitive way, and a demand for external energy sources, mostly provided by the Third World."

Permaculture II builds upon the philosophy of Fukuoka and his book **One Straw Revolution** (see review in this section) "of working with, rather than against nature; of protracted and thoughtful observation rather than protracted and thoughtless labor; of looking at plants and animals in all their function, rather than treating any area as a single-product system."

This is essentially a design and planning workbook which provides practical details of how plant, animal, and human communities can be organized as a unit. **Permaculture II** claims to be a realistic and optimistic, yet not utopian book. A strong emphasis is given to water resource management and homesite integration into the overall plan. Mollison's group employs a method of soil and water conservation known as the Keyline System, with which unproductive and sterile soils can be rehabilitated. Soils are reconditioned by the use of chisel plows and no-tillage implements where tractors or animal traction are available (since these may have been the cause of compacted conditions), or with deep-rooted plants. These efforts, combined with innovative rainwater catchments, contour irrigation dams, ditches, wells, and fishponds, help to provide adequate irrigation water for the next phase of development. Mixed tree crops and field crops are planted successively, as gardens are laid out and kept nourished by plant litter. Planted and built shelters are devised for humans and livestock, and are incorporated into the perennial-based plant community.

This is, of course, an oversimplified account of the Permaculture system, which becomes increasingly complex and organized over time. The author provides only brief overviews of how a Permaculture system might operate in semi-arid and humid areas of the tropics. Since the species selected are applicable to the southern hemisphere and Tasmania specifically, many adaptations would be required before this system could be attempted in other areas. For its insight and inspiration, however, this book deserves wide circulation.

Recommended.

Lost Crops of the Incas: Little-Known Plants of the Andes with Promise for Worldwide Cultivation, MF 05-270, book, 407 pages, by National Research Council, 1989, \$27.95 to U.S., \$33.00 overseas, from National Academy Press, 2101 Constitution Avenue N.W., Washington, D.C. 20418, USA.

"At the time of the Spanish conquest, the Incas cultivated almost as many species of plants as the farmers of all Asia or Europe. On mountainsides up to four km high along the spine of a whole continent and in climates varying from tropical to polar, they grew a wealth of roots, grains, legumes, vegetables, fruits, and nuts."

"Without money, iron, wheels or work animals for plowing, the Indians terraced, irrigated and produced abundant food for fifteen million or more people Storehouses overflowed with grains and dried tubers."

The "Spaniards who conquered Peru repressed the Indians, suppressed their traditions and destroyed much of the intricate agricultural system Crops that had held honored positions in Indian society for thousands of years were deliberately replaced by European species ... that the conquerors demanded be grown."

"Forced into obscurity were at least a dozen native root crops, three grains, three legumes, and more than a dozen fruits This botanical colonialism closed off from the rest of the world a major center of crop diversity."

Fortunately, these species have not actually been lost, and are still cultivated by small communities. These plants have great potential for use in many other places around the world, and the prospects for each species are explored. Color and black-and-white photos and line drawings provide excellent illustrations. This book was written for use by "administrators, entrepreneurs, and researchers in developing countries as well as in North America, Europe and Australasia ... to provide a brief introduction to the plants selected ... it is intended as a tool for economic development rather than a textbook or survey of Andean botany or agriculture."

The Art of the Informal Agricultural Survey, MF 05-284, booklet, 40 pages, by Robert E. Rhoades, 1982, \$1.00 from International Potato Center, Apartado 5969, Lima, Peru.

This short booklet is an extremely valuable guide to doing effective information gathering among farmers. The same techniques can be applied in urban settings as well. The voice of experience highlights the pitfalls that can ruin the effort.

"The informal survey is in fact a form of appropriate technology: cheap, practical, and fast. If properly executed, such surveys can produce at minimum cost a rich description of life in a farming community; an understanding of how farmers, merchants, extension workers, and others perceive their conditions and make decisions. On top of this, a properly conducted informal survey can give an accurate comprehension of local farming ecology and practices.

"And anyone can do it—agronomists, extension workers, biologists, and social scientists. All you need is a little time (a few days to two weeks), pencil, paper, common sense, and a down-to-earth approach to farm people and their circumstances."

"... (T)he informal survey places project implementors in contact with their clients for the first time and on the clients' home turf (It) is methodologically simple but usually physically tough. And dirty. It normally can't be accomplished by driving along a main road looking at fields, although a 'windshield survey' may be a way to begin. The successful survey may require sloshing through muddy fields,

scrambling along rocky paths and dangerous slopes, or whiling away hours in fly-ridden tea shops casually talking with farmers. The surveyors must be country-oriented, grubbing out information in fields, market places, bars, or wherever farmers' daily routines carry them. Those unwilling to face a few village hardships have no business doing informal surveys."

"The successful informal survey also requires mental and methodological flexibility. It does not proceed like the formal questionnaire survey where pre-determined hypotheses are tested. Instead, important questions and the direction of study emerge as information is collected Secondary materials, especially government statistics, should be taken as suggestive of possible lines of inquiry and not as gospel truth "

"... (S)ee out 'key informants,' those talkative individuals with great depth of experience and knowledge about farming. Don't fall into the bias of interviewing only men."

This is a very readable piece that we are tempted to continue to quote at length.

Highly recommended.

How to Perform an Agricultural Experiment, MF 05-188, book, 30 pages, by G. Pettygrove, 1971, revised 1981 edition \$7.25 (overseas orders add \$3.00 for surface mail, \$5.00 for airmail) from VITA; also available in Spanish and French.

"Improved varieties, new fertilizer practices, irrigation, pesticides, new feed mixtures, and improved harvest procedures are just a few of the more important innovations which must be thoroughly tested at the local level before they are passed on to the farmer by extension methods The purpose of this paper is to provide local agriculturalists with an understanding of the basic considerations in the design, execution, and measurement procedure of an agricultural experiment."

The Farmer's Guide, MF 05-171, book, 1053 pages, by the Jamaica Agriculture Society, 1962, out of print.

Written for use on the Caribbean island of Jamaica, the Guide contains more than 1000 pages of text on topics of interest to farmers in tropical regions, including soil maintenance, irrigation, animal husbandry, a wide variety of field crops, pest control, and much more. Some of the material is now dated.

Recommended.

Agro-Forestry Systems for the Humid Tropics East of the Andes, M F 05- 128, booklet, 25 pages, by John P. Bishop, Estacion Experimental Napo/Centro Amazonico Limoncocha, Instituto Nacional de Investigaciones Agropecurias, Apartado 2600, Quito, Ecuador, 1980, out of print.

This is a set of two papers by Dr. John P. Bishop, an agricultural researcher located in Ecuador. Bishop works with traditional farmers, who are called "colonists," "uncontrolled migrants," "shifting cultivators," and other less favorable things. Bishop is convinced that traditional farmers have an understanding of species, soils and ecology that can be put to use in modified "permanent agriculture" models (see review of **Permaculture II**).

The papers are entitled "Integrated Foodcrop, Swine, Chicken and Fuelwood Production," and "Integrated Timber and Cattle Production." The first covers small

farmholdings of 1 to 10 hectares. The second describes a supplemental scheme requiring an additional 30-40 hectares. Included are charts of cropping system timelines and systems models.

Since this information comes from monitoring real farms, it could be directly relevant to conditions in the delicate humid American tropics and of interest to people in other regions of the world.

Handbook of Tropical and Subtropical Horticulture, MF 05-185, book, 186 pages, by E. Mortensen and E. Bullard, 1964, USGPO Stock No. 044-001-000225' out of print in 1981; see reviews of **Guide for Field Crops in the Tropics and Subtropics** and the intensive gardening manuals.

"Based upon an extensive survey of available literature ... (this manual) is written in layman's terms so that it may be understood by the non-specialist who is called upon to work with farm families in solving their agricultural problems. It also serves as a reference and guide for teaching courses."

"Major tropical fruit, nut, and tree crops are discussed in the second chapter with emphasis on such important points as spacing, pruning, fertilizing, budding, and disease and insect control. A few temperate zone fruits are included to stress that they can be grown only at higher elevations in the tropics due to chilling requirements. Crops are listed alphabetically and scientific names are given for reference purposes."

"The Handbook continues with a description of all major vegetable crops. Information is presented on seed storage, vegetable varieties, fertilizer recommendations, plant spacing, temperature requirements, soil and cultivation. Major diseases with their controls are presented in a table for easy reference."

This handbook is heavily slanted toward row-cropping, the use of synthetic fertilizers and toxic chemicals, and a highly technical approach to agricultural development. The information it provides, however, on plant varieties, nutrient needs, and nutritional content is very helpful to anyone working in the field. To people seeking locally available organic resources and techniques, a great deal of this book must be disregarded.

Recommended as a secondary reference resource.

Guide for Field Crops in the Tropics and Subtropics, MF 05-184, book, 321 pages, edited by Samuel Litzenberger, reprinted by Peace Corps in 1976, out of print.

"In the tropical and subtropical areas of the world, food grains make up the bulk of the diet for most people. Food grains together with fiber and specialty crops are also principal cash producers. It is with these commodities that this Guide concerns itself The Guide is designed for use by foreign assistance personnel and cooperators The text (composed of 40 chapters) is written in layman's language ... The first four are general introductory chapters and treat rather extensively the important subjects of climate, soil, cropping, and farming systems as related to the tropics and subtropics. The other 36 chapters are divided as follows: 6 on cereal crops, 9 on food legumes, 6 on oil crops, 7 on root or tuber crops and bananas, 6 on major fiber crops and 2 on other cash crops. These chapters do not attempt to deal with the factors of providing inputs such as national supplies of fertilizer, insecticides and fungicides."

This manual is quite a balanced textbook for development workers with interests or skills in agriculture. Of special interest are the chapters entitled "The

Tropical Environment for Crop Production" and "Farming Systems for the Tropics and Subtropics," which provide useful information on traditional farming models and tropical ecology.

"There is a possibility that the functions of the slow restoration of soil productivity by native vegetation can be duplicated by man's management of soils without removing them from continued farming. The first step should be to extend the years of continued crop production by the adoption of technology for individual crops. Such technology is outlined in the 36 chapters on the different crops. An important feature is the addition to soil organic matter by the return of crop residues to the soil and by the use of manures and compost for producing crops. Adequate fertilization will certainly increase substantially the annual addition of crop roots to the total soil organic matter A second step, when feasible, may be to grow green manure crops to restore soil organic matter. These may follow a regular crop or replace a year of crop production. The green manure crops may be utilized for feeding livestock, but the green manure should be plowed under so that decaying roots and tops will add to fertility. Small farmers are usually not in a position to grow green manure crops. More appropriate would be for them to produce an economic crop as recent research has shown that, with the use of soil amendments, most soils can be maintained in food production returning only crop residues to the soil."

This book clearly favors field crops and makes little mention of perennials and agroforestry. We do feel that it can be a helpful supplemental handbook for agricultural students, rural development volunteers and extension agents.

Soils, Crops and Fertilizer Use, MF 05-218, book, 103 pages, by Dave Leonard, 1969, free to Peace Corps workers and development organizations in developing countries from Peace Corps; also available from ERIC (order no. ED241778) and NTIS (accession no. PB85 239184).

Developed for Latin America-based volunteers, this book presents basic information on the physical and chemical characteristics of soils, plant nutrition, and soil fertility. The author is openly skeptical about the practicality of organic fertilizers. He emphasizes the use of chemical fertilizers and soil amendments, such as lime, as a means of achieving higher yields in agricultural development projects.

This book should be used along with a training program consisting of actual field analysis of soil structure and texture, chemical soil tests, and pot or plot trials. This will help avoid wasteful use of chemical fertilizers where no net benefits are likely. Although no previous agricultural education is necessary, the reader should have at least a secondary school command of English.

This manual is way over on the chemical side of the chemical fertilizer/organic fertilizer debate. It should be used as a reference if balanced by other publications that describe the advantages of and techniques for organic fertilizers.

Soil Tillage in the Tropics and Subtropics, MF 05-255, paperback book, 310 pages, by R. Krause, F. Lorenz, and W.B. Hoogmoed, 1984, DM 33.50 plus postage from GTZ.

"This book is intended primarily for agricultural specialists and their colleagues, extension workers and farmers and also for teachers and students of agricultural engineering and agronomy in the tropics and subtropics. Part I deals with the objectives, principles, and problems of soil tillage in different climatic

zones while Part II examines the main implements and systems from the point of view of their purpose, limitations, method of operation and technical data on such topics as linkage and drive systems, etc."

"In many cases the results of subsoiling are scarcely positive and may even be detrimental as regards not only the soil structure but also the financial benefits. The operation requires a high energy consumption and is effective only when there is a genuine hardpan which can be shattered under dry soil conditions. Subsoiling operations must be given careful consideration, especially in developing countries where only limited energy and equipment are available."

This book provides very comprehensive coverage of the various aspects of soil tillage—the preparation, maintenance, and ideally, the enhancement of soils for effective crop production and other agricultural uses. The specific implements and practices for primary and secondary tillage, seed preparation, weeding and other related operations are discussed in great detail with clear illustrations. The book focuses on the delicate and diverse soils of the tropics and subtropics and primarily features mechanical means to increase cropping intensity. Handtools and draft animal implements are not reviewed, except for a brief discussion of the rice paddy tools. Despite higher investment costs and potential social problems, mechanical tillage is considered a suitable alternative to handtools and animal power by many agronomists when used in areas where land is extensive and/or labor is not readily available during critical periods. This book is a very helpful addition to the literature on agricultural mechanization, providing a balanced review of environmental impacts and good insights and design criteria for the development of new tools.

Intercropping in Tropical Smallholder Agriculture with Special Reference to West Africa, MF 05-240, paperback book, 312 pages, by Kurt R. Steiner, 1982, GTZ, out of print.

"There are many advantages of intercropping for smallholdings, and this is obviously the reason why farmers have not abandoned their traditional systems in spite of the efforts of extension services to introduce sole cropping.

"The main advantages of intercropping can be summarized as follows:

—better use of limited resources (light, water, nutrients) resulting in higher yields per unit area and unit of time;

—increased yield stability and reduced probability of incomes falling below the subsistence level;

—reduced crop losses due to weeds, pests and diseases;

—contribution towards soil fertility maintenance through reduced erosion and nutrient leaching; and,

—more balanced distribution of labour requirements throughout the season, as labour peaks for land preparation and weeding are reduced."

This is a valuable reference book for agronomists, extension agents, and agricultural policymakers on the practice of growing several crops on the same piece of land at the same time. The very scientific language and technical illustrations (particularly of the sections reviewing currently available research and literature) make it less appropriate for use by local development workers of farmers. More information on intercropping in West Africa is contained here than has previously been assembled. The author has effectively organized a large body of data and information to make a persuasive case that traditional and improved intercropping systems are a viable approach to optimizing crop production in West Africa. The

book includes an overview of intercropping in small-holder agriculture in tropical Africa, detailed descriptions of the agronomic and socio-economic aspects of this approach, and conclusions and recommendations for further research and extension. This last section is excellent, though lamentably too brief. An appendix contains a number of very useful maps and tables, such as good crop combinations for specific countries and the region. Hopefully, this publication may provide stimulus and helpful guidelines for the compilation of similar information for other countries and regions of the world.

Guide for Small-Holder Coffee Farmers, Job No. Q4217-AGO, MF 05281, book, 38 pages, by Department of Agriculture, Zambia, 1983, out of print, available in microfiche form from David Lubin Library, FAO.

A set of simple, illustrated instructions showing recommended steps in planting, growing and harvesting coffee. Prepared for small-holder farmers in Zambia; reproduced by FAO.

Better Farming Series, booklets, 29 to 63 pages each, 1979 FAO English edition, \$5.00 each from UNIPUB; series also available from TOOL.

Twenty-seven titles have been published in this series of handbooks for a two-year agricultural training course. In each case, the text is very simple, containing only basic but useful information and many drawings. The United Nations Food and Agriculture Organization (FAO) has published this English set. These booklets were originally produced by the Institut Africain pour le Developpement Economique et Social (INVADES) in French for use in Africa. (French language editions are available from INVADES Formation, 08 B.P. 8, Abidjan, Ivory Coast.)

1. The plant: the living plant- the root (MF 05-137)
2. The plant: the stems, the buds; the leaves (MF 05-138)
3. The plant: the flower (MF 05-139)
4. The soil: how the soil is made up (MF 05-140)
5. The soil: how to conserve the soil (MF 05-141)
6. The soil: how to improve the soil (MF 05-142)
7. Crop farming (MF 05-143)
8. Animal husbandry: feeding and care of animals (MF 05-144)
9. Animal husbandry: animal diseases; how animals reproduce (MF 05-145)
10. The farm business survey (MF 05-146)
11. Cattle breeding (MF 05-147)
12. Sheep and goat breeding (MF 05-148)
13. Keeping chickens (MF 05-149)
14. Farming with animal power (MF 05-150)
15. Cereals (MF 05-151)
16. Roots and tubers (MF 05-152)
17. Groundnuts (MF 05-153)
18. Bananas (MF 05-154)
19. Market gardening (MF 05-155)
20. Upland rice (MF 05-156)
21. Wet paddy or swamp rice (MF 05-157)
22. Cocoa (MF 05-158)
23. Coffee (MF 05-159)
24. The oil palm (MF 05-160)

25. The rubber tree (MF 05-161)
26. The modern farm business (MF 05-162)
27. Freshwater fish farming (MF 09-324)

East African Crops, book, 252 pages, by J.D. Acland, 1971, £8.50 from ITDG; also available from TOOL.

The FAO sponsored this reference book on common field and plantation crops in Tanzania, Kenya and Uganda. Horticultural and fodder crops are not covered. Plant characteristics, ecology, field operations, harvesting, pests and diseases are each discussed for each crop. The length of the text varies, presumably with the crop's economic importance, from 30 pages for Arabica coffee to 2 pages for pigeon peas. The importance of some of these crops has likely changed significantly since this book was published in 1971.

Underexploited Tropical Plants with Promising Economic Value, MF 05-225, book, 188 pages, National Academy of Sciences panel report, attached summary in French and Spanish, 1975, accession no. PB-251656, paper copies \$23 domestic, \$46 foreign; microfiche \$8 domestic, \$16 foreign; from NTIS.

This is a remarkable survey of rarely utilized or under-exploited plants which offer promise as sources of food, forage, or industrial raw materials for developing countries. Compiled by a panel of international agricultural experts. 37 species of cereals, tubers, vegetables, fruits, oilseeds, forage, and miscellaneous crops are presented.

What makes this book especially valuable is the inclusion of selected readings on each crop and personal contacts for research and seed sources. The reader can immediately put the information to use. A sampling of the entries:

Grain Amaranths (*Amaranthus* species): The seeds of these almost totally neglected Central American grain crops have extremely high levels of protein and the nutritionally essential amino acid lysine, which is usually deficient in plant protein.

Wax Gourd (*Benicasa hispida*) This large, melon-like vegetable is easy to grow and can yield three crops per year. Its outstanding feature is that the fruit can be kept without refrigeration for as long as 12 months.

Durian (*Durio*): The common durian is a large, spiny fruit that is enjoyed by many for its taste and disliked by others for its odor. Newly discovered odorless species might be more aesthetically acceptable and could open a world market for this crop.

Joboba (*Simmondsia chinensis*): This subtropical, North American desert plant is unique in the vegetable kingdom; it secretes liquid wax in its seeds instead of the glyceride oils secreted by other plants. Liquid waxes are important in industry. They are difficult to synthesize, and the only other source is the sperm whale. The development of joboba as a crop promises to provide important economic benefits to arid tropical and subtropical regions.

Tamarugo (*Prosopis tamarugo*): A hardy, leguminous tree, native to the forbidding Atacama Desert in Chile, tamarugo grows through a layer of salt sometimes 1 meter thick. The nutritional quality of its pods and leaves allows sheep to be stocked at rates approaching those of the best forage areas of the world.

Spirulina (*Spirulina platensis* and *Spirulina maxima*): These high-protein algae grow in brackish and alkaline waters. Unlike some other algae, spirulina's

large clumps make it easy to harvest by net or other simple means. It is palatable and is already eaten in Chad and Mexico.

The Winged Bean: A High-Protein Crop for the Tropics, MF 05-228, booklet, 27 pages, 1975 (2nd edition 1981), National Academy of Sciences panel report, accession no. PB84-215714/LL, paper copies \$15 domestic, \$30 foreign; microfiche \$8 domestic, \$16 foreign; from NTIS.

Edible legumes are excellent sources of dietary protein and oils. This report focuses on the exceptional promise offered by a minor tropical legume that has received little scientific attention. The panel that produced this booklet consisted of people who are familiar with this bean. They are convinced that "with research the winged bean can become a significant food crop in the humid tropics," and that this bean may be as important as the soybean in the future. Currently the winged bean is eaten throughout Southeast Asia, although it is not nearly as important a food source there as it could be.

This booklet presents an overview of what is known about the winged bean, its potential and research needs. The booklet is intended for development assistance agencies and institutions concerned with agriculture in tropical countries. A list of researchers who might supply seeds or advice is included.

The winged bean has these characteristics: 1) it grows in humid zones but can also be grown in drier or higher altitude zones (up to 7000 feet); 2) the entire plant is rich in protein, and the tuberous roots have ten times the protein concentration of cassava, potatoes, sweet potatoes, or yams; 3) its nitrogen-fixing capacity enables it to grow in poor soils; 4) the whole plant can be eaten and it does not have the bitter, beany flavor of the soybean, but is quite tasty; and 5) it is suited to the small farm, requiring staking and harvesting over many months instead of all at one time

Tropical Legumes: Resources for the Future, MF 05-223, book, 331 pages, by the National Academy of Sciences, 1979, \$12.00 from BOSTID, HA-476E, National Academy of Sciences, 2101 Constitution Avenue N.W., Washington, DC 20006, USA; also available from ITDG and TOOL.

This book features over 30 members of the Leguminosae family of plants, commonly known in English as legumes. These highly valued plants can improve soil conditions and are excellent sources of protein. Rhizobium bacteria attached to growths (nodules) on certain legume roots capture nitrogen from the air, which gives the plants the power to grow in areas subject to erosion, low fertility, and other adverse conditions. Root crops, pulses (beans), fruits, forage crops, fast growing trees, luxury timbers, ornamental and miscellaneous species from within this vast plant group are discussed in this well-documented and illustrated text. Brief descriptions of each species—advantages, limitations, and research needs—are provided. There is a very good chapter that illustrates how legumes can be used for green manures, soil reclamation, and erosion control. Also included are charts of comparative nutritional values for the various species; address lists for seed and germplasm sources; and listings of research correspondents around the world.

A National Academy of Sciences panel selected each plant on the basis of:

1. Its potential to help improve the quality of life in developing countries;
2. The present lack of recognition of this potential;
3. Its need for greater attention from researchers and farmers, and increased investment by organizations that fund research and development projects.

Some of the more remarkable species include:

African Yam Bean. "This root crop from Africa produces a nutritious seed, as well as edible tubers and leaves. It can be grown in inherently infertile, weathered soils where the rainfall is extremely high. Although highly regarded among people of tropical Africa, the crop is virtually unknown elsewhere. It has received essentially no research attention or recognition from agriculture researchers."

Moth Bean. "An exceptionally hardy South Asian legume that thrives in hot, dry, tropical conditions, the moth bean produces nutritious seeds and green pods, leafy forage for hay or pasture, and a soil-building 'living mulch' to complement orchard crops and to protect and improve fallow land. Nonetheless the moth bean remains virtually untouched by modern science and unknown outside the Indian subcontinent. It has characteristics that could make it valuable for torrid, semiarid regions throughout the tropics. It is likely to prove very useful in extending agricultural production into marginal regions—especially those bordering tropical arid zones"

Carob. "The sugar-rich, mealy pulp contained in carob pods has for millennia been a favorite of people in hot, dry areas of the Mediterranean basin. The handsome, drought-tolerant carob tree deserves more research and widespread exploitation in semiarid areas, for in addition to pulp it provides a chocolate substitute, high-protein flour, and an industrial gum, as well as shade, beautification, erosion control, and forage."

Sesbania grandiflora. "This Southeast Asian tree grows exceptionally fast and provides an amazing range of products: edible leaves, flowers, and gum, as well as forage, firewood, pulp and paper, and green manure. It is also used as a shade tree, ornamental, nurse crop, and living fence. It has extraordinarily prolific nodulation and could become valuable for village use and for large-scale reforestation throughout much of the tropics."

A Farmer's Primer on Growing Rice, MF 05-236, book, 221 pages, by Benito S. Vergara, 1979, \$6.00 (\$2.40 for Third World) plus \$1.00 surface mail or \$5.00 airmail, from IRRI, P.O. Box 933, Manila, Philippines; also available from TOOL.

"A progressive rice farmer should understand *why* and *how* the improved rice varieties and farm technology increase production. But recommendations given to farmers often fail to answer questions such as why a farmer incubates seed, why he or she applies fertilizer, or how and when that fertilizer should be incorporated.

"The farmer needs this knowledge to adjust his practices to suit his own unique farm situation."

More than 150 full-page line drawings illustrate the important basic concepts surrounding rice production, particularly production with the new high-yield varieties. Text is limited to a few sentences explaining each illustration. This makes the book accessible to those who don't read well. Non-literates will be able to use the book with the help of a fieldworker who can explain the illustrations. The limited text also makes it easy to produce translations of the English version, and a number of such translations have already been published. The illustrations can also be enlarged and used as training aids in a poster format.

This book has proven popular in the field, and we recommend it.

Root Crops, Crop and Product Digest No. 2, book, 280 pages, by Mrs. D.E. Kay, 1985, free to recipients of British aid, £13.50 to others, from NRI.

This book covers 40 varieties of root crops.

One underexploited root crop is the Jerusalem artichoke. It is "relatively free from serious attacks of pests and disease in the field, although if grown where the drainage is poor, root rot, *Sclerotium rolfsii* can be troublesome The tubers are ready for harvesting when the leaves begin to wither and die and are usually lifted manually with a fork as required, since they can be 'field-stored' without any deterioration in their quality or flavor. When grown for pig feed, the animals are often turned loose on the plot and root out the tubers."

Guayule: An Alternative Source of Natural Rubber, MF 05-183, book, 90 pages, by National Academy of Sciences, 1977, Commission on International Relations, National Academy of Sciences, Washington, D.C., out of print.

"This report examines the state of knowledge and the future promise of guayule *Parthenium argentatum* Gray, a little known shrub native to the desert of southwest Texas and northern Mexico that was a commercial source of natural rubber during the first half of this century."

This perennial shrub thrives in arid conditions and can survive heavy frosts. Guayule, after thorough drying, has been found to contain as much as 26% rubber. This rubber can be used to make vehicle tires or any other item currently made with natural rubber. It is a promising plant for use in reforestation of desert fringe lands and is easy to grow. Extraction of the rubber is not technically difficult; in fact, small-scale household extraction is possible. The plant can be cut down to the ground and will grow again from the roots.

The book covers: background and history, botanical information, rubber extraction, agricultural production, rubber quality, economics, research needs, selected readings and recommendations. There are no lists of sources for seeds.

"When guayule grows actively, it produces little or no rubber. If the plant is stressed, growth slows and the products from photosynthesis are diverted into rubber production. Thus when growth slows during cold weather or because of reduced moisture supply, the rubber content begins to increase."

Jojoba Publications, from the Office of Arid Lands Studies, University of Arizona, 845 North Park Avenue, Tucson, Arizona 85719, USA.

Jojoba, a plant native to the Sonoran desert in North America, produces a liquid wax with a wide variety of potential uses. This liquid wax possesses "qualities not to be found in any other vegetable oil." One major use is to replace sperm whale oil as a lubricant for high-speed machinery. Historically, the plant has had a wide range of uses among the native American populations in the area.

Much of the research has focused on plantation cultivation of jojoba. **Jojoba and Its Uses** (MF 05-193, Hease and McGinnies, eds., 81 pages, \$5.00 plus \$3.00 overseas postage) is a 1972 conference report, including a paper on the potential of using rainstorm runoff farming techniques to increase jojoba yields. A major drawback of plantation cultivation of jojoba is the length of time needed before significant production can be achieved—up to ten years. Recent developments indicate that it may be possible to greatly reduce this gap between planting and full production.

Several bibliographies with over 750 entries were incorporated into one volume (**Jojoba: A Guide to the Literature**, MF 05-195, by A. Elias-Cesnik, \$5.00 plus \$3.00 overseas postage) in 1982. The Office of Arid Lands Studies acts as a clearinghouse for information on jojoba activity, and arranges for distribution of jojoba seed. **Jojoba Happenings** (MF 05-194) is published by John Turner Public Relations six times a year, and is available for \$15.00 in the U.S., \$20.00 foreign (add \$9.00 for airmail) from Jojoba Happenings, 805 North 4th Avenue #404, Phoenix, Arizona 85003-1304, USA. Back issues from 1983 are available for \$2.50 each.

Vegetable Seeds for the Tropics, Bulletin 301, MF 05-259, 40 pages, by G.J.H. Grubben, 1978, Department of Agricultural Research of the Royal Tropical Institute Amsterdam, SKAT, out of print.

"This bulletin is meant to give guidelines for local seed growers, for extension workers and for vegetable growers, both commercial and non-commercial, to obtain ... the best quality imported seeds and how to improve the quality of the locally produced seeds. It is not a guide for large-scale commercial seed production Bad seed gives an irregular stand, weak seedlings, a low yield and an inferior product. Good seed means a good start for a high yield of good quality vegetables." Climate, day length, seed drying and storage, seed testing, and recommended varieties are discussed. A list of sources is provided.

The Nursery Manual, MF 05-245, book, 456 pages, by L.H. Bailey, 1922, out of print.

This out-of-print classic, first published in 1891, is still an authoritative reference on the propagation of plants by means of seeds, layers, cuttings, buds, grafts, and other techniques. The manual was part of a set of one-volume encyclopedias (known as "The Rural Manuals") edited by Dr. Bailey for small farmers and agricultural extensionists. The various means of multiplication are defined and described in detail with excellent line illustrations. Also included is an illustrated account of the main diseases and insects of nursery stock, which would be most useful to commercial growers. In this case, the remedies for specific infestations need to be reevaluated in light of the current understanding and practice in integrated pest management. For example, some of the milder controls such as applying soap or tobacco solution (nicotine sulphate) may well be worth using, while extremely toxic pesticides such as lead arsenic should be avoided. One third of the book contains an alphabetic list of plants with full directions for propagation of each of them. Unfortunately, given the book's intended North American audience, crops from other climates are inadequately covered here.

Growing Garden Seeds: A Manual for Gardeners and Small Farmers, MF 05-182, booklet, 30 pages, by Robert Johnson, Jr., 1976, \$1.95 plus \$2.50 postage and handling from Johnny's Selected Seeds, Organic Seed and Crop Research, Albion, Maine 04910, USA.

The author of this booklet is the founder of a successful small-scale vegetable seed production and distribution company. The booklet is informative and easy to understand and apply. A brief description of the process of selecting, harvesting, and storing seeds is followed by instructions for producing seeds from 33 of the most common vegetables grown in North America and Europe. No special tools, expensive facilities, nor education are necessary to master the techniques described.

"Adaptation, usefulness, and quality characteristics of a vegetable variety can be improved ... by selection. The basic type is 'Natural Selection', caused by environmental pressures. For example, in the North in a given year, perhaps only half of the plants of a corn crop will produce mature ears and kernels. Naturally, the ears selected for seed would be chosen from these earlier maturing ears. In this way, Nature forces a crop to either adapt or perish."

"The other type of selection is accomplished by the gardener. For instance not only would one choose for seed ears of corn which did mature well, but further select the most desirable ear types from what are considered to be the best corn plants." This is of course what traditional farmers have done for centuries in most places.

The main drawback to using this booklet in other parts of the world is that the vegetable varieties are from temperate zones, and many can't be grown in tropical regions except in highland areas. Groups in developing tropical countries could adapt this information to suit their own conditions, by including other crops and consulting with local farmers and extension agents about the best local practices.

Small Farm Weed Control: An Annotated Bibliography, MF 05-215, book, 175 pages, by J.A.F. Compton, ITDG, out of print.

Weed control can play an important role in raising the productivity of small farms. This bibliography surveys literature on weed control tools and techniques for use in rice paddy, highland and temperate zones, humid tropics, and the semiarid tropics. A useful "Overview" introduces the reader to the options available and provides references to specific reviews within the bibliography. Ordering addresses for copies of the reviewed papers are given for readers who are unable to obtain the documents locally.

Simple Assessment Techniques for Soil and Water, MF 05-213, booklet, 37 pages, Coordination in Development, Environment and Development Program, New York, out of print.

This fine booklet presents procedures for six simple soil and water tests using mostly locally available materials such as tin cans and glass jars. The tests include: soil pH, soil texture, percolation, dissolved minerals (in water), sodium in water, and coliform bacteria. Each test is followed by interpretations of the results. "What is surprising is how much useful information can be gained with so little equipment. These tests deal with significant features of soil and water, and with reasonable care the results can be meaningful and reliable." Recommended for people doing farming, irrigation, and water supply work. Also good for science teaching.

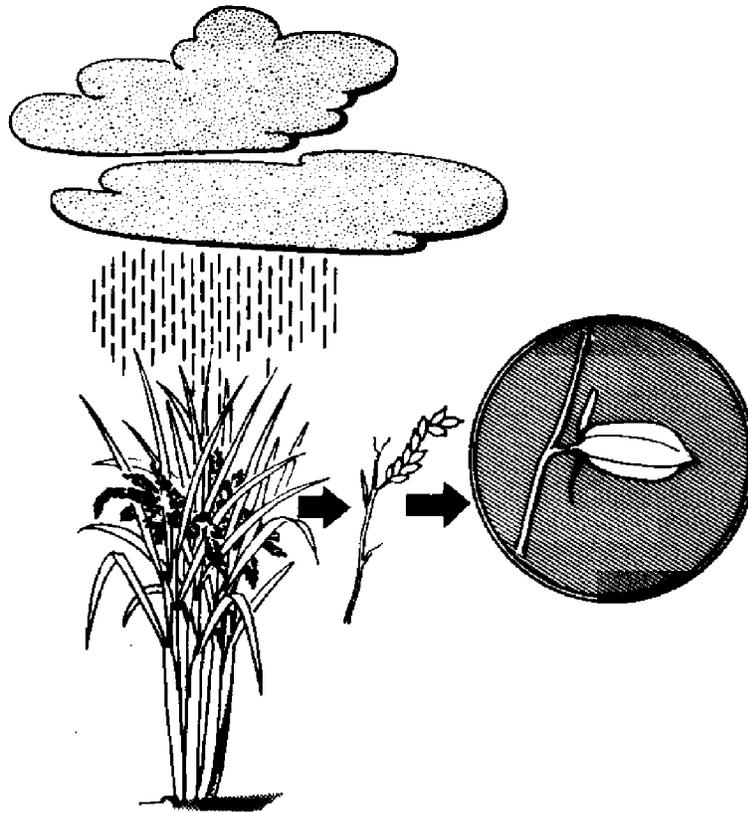
Test the Soil First, Popular Mechanics Plan No. X630, MF 05-221, 4 pages, by John B. Mullen, 1957, \$3.00 from Popular Mechanics.

This article provides a good basic explanation of soil testing, including the preparation of chemical solutions to do tests and the evaluation of test results.

No mention is made of local plants which can often be used to measure pH. The author recommends adding chemical fertilizers even when tests for phosphorus, potassium and nitrogen indicate very high levels are already present—a wasteful recommendation. There is also no mention of natural fertilizers or composting.

Basic Soil Improvement for Everyone, MF 05-136, booklet, 31 pages, by James M. Corven, 1983, \$3.50 from VITA.

This excellent guide explains the basics of soil management. Advantages and disadvantages are given for various forms of tillage, including u-bar tillage, double digging, chisel plow, and low-till cropping. The importance and methods of composting are presented with special reference to sugarcane trash, forest leaves, paddy husk, and water hyacinth. Mulch, fertilizer and nitrogen-fixing legumes are also discussed. This is a good introductory piece, but it will be useful to consult more specific texts in this section.



Composting in Tropical Agriculture, Review Paper Series No. 2, MF 05165, booklet, 36 pages, by H.W. Dalzell, K.R. Gray, and A.J. Biddlestone, International Institute of Biological Husbandry, 1979, out of print.

This book looks at the principles, techniques, and economics of composting as they apply to the specific problems faced by farmers in tropical developing countries.

Composting for the Tropics, MF 05-164, booklet, 27 pages, edited by V.L. Leroux, 1963, Henry Doubleday Research Association, out of print in 1985.

Dating from British colonial days in Eastern and Southern Africa, this booklet describes three successful composting methods developed in present-day Kenya, Malawi and Zimbabwe. The simple but effective methods of three former market gardeners and farmers are presented by the Henry Doubleday Research Association in the hope of sharing practical experience with farmers in other tropical countries.

Perhaps the greatest challenge to tropical agriculture is to maintain soil

fertility and productivity at the same time. Often the value of both natural and chemical fertilizers is lost due to rapid processes of decay and leaching. Using sawdust-based composts, these farmers were able to take advantage of the long decay period of sawdust to slow the breakdown and loss of plant nutrients. Thus, these nutrients remained available for food crops.

The information is valuable but may be of limited use in developing countries because sawdust may not be a material readily available to the rural farm population. Also, available sawdust and wood shavings are often used for fuel.

No illustrations are included, but the written descriptions of the processes are easy to understand if the reader has a basic knowledge of agriculture.

Composting: Sanitary Disposal and Reclamation of Organic Wastes, WHO Monograph No. 31, MF 05-166, book, 200 pages, by H. Gotaas, 1956 (reprinted 1971), order no. 1140031, \$28.00 (30% discount on orders from developing countries) from WHO; also available from WHO regional distributors; also available in French.

This is a solid, important reference book for anyone seriously interested in composting as part of fertilizer policy. Most of the book deals with fundamentals of composting: decomposition, raw materials, sanitary importance, etc. There are 26 pages on composting methods for villages and small towns. The book also includes a chapter on methods and planning for cities. The facts, figures, and illustrations are comprehensive. Coverage of continuous-operation, low-impact techniques suitable for developing countries, such as the Bangalore/Indore method (see illustration) for handling assorted wastes, is outstanding.

One feature of this recommended manual is a 23-page chapter on methane gas recovery in farms and villages. It contains important information on gas pressure and the biological composition of waste input into digesters, as well as a good general introduction. However, the design itself is an unproven one, and from our experience it's not very workable in practice.

Backyard Composting, MF 05-134, booklet, 17 pages, by Helga Olkowski, 1975, \$1.00 inside U.S., \$1.95 outside U.S., from Berkeley Ecology Center, 2530 San Pablo Avenue, Berkeley, California 94702, USA.

This is a brief summary of the Berkeley Fast Composting Method, where organic wastes can yield a nitrogen-rich humus in just 14-21 days. The technique covered in this booklet takes attention and human energy, but its high quality and quick results warrant the effort.

"This compost will provide a plant fertilizer as well as act as a soil amendment and mulch; fly and rodent problems will be kept to minimums; high temperatures will be reached that will kill most plant pathogens and even take apart pesticides."

The drawings depict the tools needed for this method: a system of bins (at least 3), simply constructed of wood, bamboo, or other available materials, to facilitate storing and turning the organic matter; a pitchfork; and a tool to chop, shred, or otherwise reduce the size of organic wastes for easier decomposition. The raw materials are leafy vegetable material, animal manure, kitchen scraps (or market refuse), and a high-carbon substance such as sawdust, rice straw, corn husks, etc. Often animals kept in cages prove to be the most effective "compost shredders," and a chopping tool made of a long-handled blade hinged to a block of wood can be very useful. Pitchforks can be manufactured by local blacksmiths.

We recommend this method and booklet to anyone interested in efficient village or city-based compost production.

China: Recycling of Organic Wastes in Agriculture, FAO Soils Bulletin No. 40, MF 05-163, book, 107 pages, 1979, \$11.50 from UNIPUB.

This valuable resource book surveys the use and re-use in present-day China of substances such as night soil (human waste), city garbage, and water weeds—which are often ignored or disposed of in both developed and developing countries alike. Good quality photographs, charts, working drawings, and systems diagrams are used to explain the various methods and installations found in China by an FAO/UNDP study team.

Techniques of special interest include:

—The seeding and inoculation of rice paddies with *Azolla Pinnata*, a small aquatic plant which harbors nitrogen-fixing blue-green algae. These biological fertilizers are cultivated and stored by simple methods.

—The production of fertilizer directly in the fields in silt-grass manure pits. River silt, rice straw, animal dung, aquatic plants, and small quantities of chemical fertilizers (such as superphosphate) are built up in layers in round or rectangular pits and covered by a sealing layer of soil.

—The composting of night soil and city garbage in concrete tanks and mud-plastered piles. High temperatures, conscientious maintenance, and scientific controls assure that disease-causing organisms are kept under control.

—Extensive use of "green manures," crops which are not harvested for animal or human consumption. These are plowed under to add organic matter, improve soil structure, prevent nutrient leaching, and, in the case of leguminous crops, add nitrogen to the soil.

—The widespread use of biogas technology to convert human and animal wastes into fuel and fertilizer. (This topic is covered more fully by other books reviewed in the biogas chapter of the **A.T. Sourcebook**.)

The information presented in this book is easily understandable. It should be remembered that the cost and production figures cited are as reported by the Chinese themselves. It is doubtful that the virtually complete recycling of organic matter as practiced in China can be adopted in many other countries. Incentives may be lacking, and there are often cultural inhibitions against waste handling. Nevertheless, this book identifies effective and proven options which could be attempted throughout the world.

Highly recommended.

How to Make Fertilizer, Technical Bulletin No. 8, MF 05-187, 8 pages, by Harlan Attfield, illustrated by Marina Maspero, \$5.25 (overseas orders add \$3.00 for surface mail, \$5.00 for airmail), from VITA; also available in Spanish and French.

Drawings and simple text on composting crop residues and manure, adapted from a Bangladesh booklet. Uses bamboo bins.

Small Plastic Greenhouses, Publication No. 2387, MF 05-216, leaflet, 12 pages by Robert Parsons, 1974, Division of Agricultural Sciences, University of California, Berkeley, California, out of print.

This set of five plans for plastic-covered light frame greenhouses provides a

practical approach to greenhouse construction. Unlike glass-covered greenhouses, which require expensive glass and heavy wood beams for support, these structures are simply built, low-cost, and lightweight. The plastic film covering, where obtainable, is easily installed and unbreakable. There would be a need to periodically change the worn-out plastic. It is unclear whether the plastic film could withstand heavy tropical monsoon winds and rains.

Managing Pests and Pesticides in Small Scale Agriculture, MF 05271, book, 204 pages, by F.H.J. van Schoubroeck et al, Center for Development Work, 1990 Dfl. 22.50 from TOOL.

This is an introductory book to provide a general understanding of the principles of integrated pest management, a group of techniques for minimizing pesticide use while controlling pest damage to crops. Emphasis is given to identifying friendly insects and to using physical techniques to minimize the growth of harmful insect populations. Biological control, good storage practices, and safe use of pesticides are discussed.

There are some useful though brief suggestions about how to conduct IPM training for farmers. "After such training, farmers view the use of pesticides more as a financial investment than as a means to guarantee their harvest. They can also identify the most important pests and are able to decide whether spraying is necessary or not. Farmers who have undergone training in IPM achieve higher yields and use less pesticides each season than untrained farmers. This evidence comes from the results of a survey conducted five years after the IPM training took place."

Case studies are from Peru and Sri Lanka. Appendices contain lists of the most common pesticides, their tradenames, properties, and environmental effects.

Integrated Pest Management, A Catalogue of Training and Extension Materials, MF 05-276, book, 305 pages, by F.A.N. van Alebeek, 1989, available free of charge to institutes and organizations in Third World countries, \$8.00 plus postage to developed countries, from Department of Entomology, Wageningen Agricultural University, P.O. Box 8031, 6700 EH Wageningen, The Netherlands.

Integrated Pest Management (IPM) can bring about a substantial improvement in the food production of small-scale farmers. This system is based on conserving and enhancing naturally occurring limiting factors to contain plant pests and diseases below thresholds that cause economic damage. Biological control, cultural control including traditional and new agricultural practices, mechanical control use of host plant resistance, and selective chemical crop protection are all components of IPM.

Implementation of IPM has been slowed by the lack of widely available information. This catalog is an attempt to inventory and review this material, covering 350 handbooks, 120 slide sets, and 60 posters, films and videos covering various aspects of pest management in the tropics.

Each entry includes crop, geographical region, target audience, and ordering information. Innovative indexes match crops with geographical regions, pests and diseases, and methods of crop protection. There are 150 IPM research and information centers listed.

Integrated Pest Management, MF 05-239, book, 120 pages, by Dale Bottrell, 1979, Council on Environmental Quality, Consortium for International Crop Protection, out of print.

"Chemical pesticides are—and will continue to be—of considerable importance in food and fiber production, forest management, and public health and urban pest control programs. However, in addition to continuing concern about their environmental and health effects, other disadvantages of heavy dependence on chemical pesticides have become increasingly apparent. The price of synthetic organic pesticides has risen significantly Groups of pests have developed strains that are genetically resistant to the pesticides The resistant groups include some of the world's most serious insect pests affecting agriculture and public health."

"Integrated Pest Management (IPM) seeks maximum use of naturally occurring pest controls including weather, disease agents, predators, and parasites. In addition, IPM utilizes various biological, physical, and chemical control and habitat modification techniques. Artificial controls are imposed only as required to keep a pest from surpassing intolerable population levels predetermined from accurate assessments of the pest damage potential and the ecological, sociological and economic costs of the control measures."

"The presence of a pest species does not necessarily justify action for its control, and in fact tolerable infestations may be desirable, providing food for beneficial insects, for example."

Whereas important advances have been made since this study was done, it provides a good introduction to the subject with examples of control techniques and strategies.

Large-scale programs of the U.S. Cooperative Extension Service show "the feasibility of IPM on major agricultural crops such as cotton, corn, tobacco, apples, grain sorghum, soybeans, peanuts, and citrus—with little or no reduction in yields and higher net profits than with conventional programs."

Illustrated Guide to Integrated Pest Management in Rice in Tropical Asia, MF 05-269, book, 411 pages, by W.H. Reissig et. al., International Rice Research Institute, 1986, \$33.30 plus \$11.00 airmail or \$3.00 surface mail, from IRRI, P.O. Pox 933, Manila, Philippines.

Integrated pest management (IPM) is based on several fundamental economic and ecological principles. First, from an economic point of view, scarce time and resources should not be devoted to the application of pesticides when pest populations are not likely to significantly damage crops. Yet farmers around the world have generally used pesticides according to the calendar, with no reference to the real threat by pests. This means that much pesticide use constitutes a waste of resources. Secondly, from an environmental point of view, indiscriminate pesticide use has led to the eradication of the natural predators of the pests, the development of pesticide resistant varieties of pests, and the spread of hazardous chemicals which threaten the health of both human beings and farm animals. Thus, IPM recognizes that pesticides should be used as little as possible, and only when measurements of insect populations indicate that pesticide intervention is both economically justified and the only viable method to control these pests.

The **Illustrated Guide** is a remarkable compilation of the best IPM techniques for rice. Two hundred pages are devoted to the major insect pests of rice, covering their life cycles, describing monitoring techniques, and recommending non-

pesticide methods of control. The several thousand illustrations help in the identification of pests and indicate where they are likely to be found on the rice plant. Rice diseases, weed pests and rats are also covered. Attention is also given to biological control of rice pests and to safety techniques in the use of pesticides. The illustrations communicate an extraordinary amount of information in a very accessible fashion.

Readers unfamiliar with IPM techniques will find this an important tool for rapid learning.

Friends of the Rice Farmer: Helpful Insects, Spiders, and Pathogens, MF 05-275, booklet, 136 pages, by B. M. Shepard et. al., 1987, \$4.30 plus \$3.00 for airmail, \$1.00 for surface mail, from IRRI Publications, P.O. Box 933, Manila, Philippines.

"Before intelligent decisions about pesticide applications can be made, it is necessary to be able to identify which insect species are pests and which are beneficial The beneficial species often control insect pests, especially in places where use of broad-spectrum pesticides is avoided. Without these beneficial species the insect pests would multiply so quickly that they would completely consume the rice crop"

This farmer's pocketbook "illustrates representative examples of some of the more common species of predators, parasites, and diseases of insect pests of rice. It can be used with the IRRI booklet **Field Problems of Tropical Rice**, which provides information only on pest species"

"Scientific language has been minimized so that the descriptions can be more easily understood. The pictures will provide an easy way of identifying beneficial species and thereby help prevent unnecessary chemical treatments." The booklet was designed to be easily translated and published in languages other than English.

There are good line drawings and excellent color photographs of each beneficial insect and spider.

Code of Practice for Safe Use of Pesticides, MF 05-235, booklet, 28 pages, CSIRO, 1976, out of print.

Pesticides are now widely used in developing countries, and farmers and farm workers are often being exposed to great health hazards as a result. While substantially reducing or stopping the use of pesticides may be possible in the long term, protection and handling precautions deserve immediate emphasis. This booklet summarizes the basic steps to minimize the health risks during field application.

"Although any given amount of pesticide is more rapidly and more completely absorbed if inhaled or ingested ... the most likely route of pesticides into the body is through the skin Most of the pesticides in common use can be absorbed through the skin; this fact is particularly significant when handling the concentrated material More pesticide applications take place in warmer weather, thus giving potentially greater hazard through skin exposure, but in addition, pesticides are absorbed through the skin more rapidly and more completely at higher temperatures Overalls buttoned at the wrist and neck and a cloth hat should be worn."

The health risks from pesticide use could be greatly reduced by following the no-cost and low-cost recommendations made here. However, the high cost of respirators and the cost and inconvenience of full protective clothing in hot

climates mean that substantial risks will remain for pesticide users in developing countries.

An Agromedical Approach to Pesticide Management, MF 05-231, book, 320 pages, edited by John Davies et. al., from the Consortium for International Crop Protection, 4321 Hartwick Road, Suite 404, College Park, Maryland 20740, USA.

Safety practices and first-aid for pesticide poisoning victims are treated here. The discussion of how pesticide poisoning commonly occurs is based on experiences in developing countries.

"Past experience has shown that whenever there is increased use of agricultural chemicals, human pesticide poisoning soon becomes a major public health problem."

Soil Conservation: Project Design and Implementation Using Labour Intensive Techniques, MF 05-285, book, 206 pages, by Bernard Leblond and Laurent Guerin, 1983, 20 Swiss Francs from ILO.

This book provides extensive coverage of the range of soil conservation techniques that are practiced and affordable in developing countries. Topics include forest protection and reforestation, contour farming, tiering and terracing, bank and gully protection, and drainage of waterlogged soil.

Project planning and implementation is a major topic of the second part of the book. The appendix contains illustrations of standard soil conservation structures.

Approved Practices in Soil Conservation, MF 05-130, book, 497 pages, by Albert B. Foster, 1955, reprinted 1982, \$19.95 from Interstate Printers and Publishers, Inc., 19-27 North Jackson Street, Danville, Illinois 61832, USA.

Written for use in North America, this book sometimes assumes the use of mechanized equipment and chemical inputs not readily available for the local Third World farmer. However, it contains much information which the small farmer and resource management planner would find useful. Emphasis is on conservation of land cultivated for field crops. Management of woodlands and pastures is also discussed.

Introduction to Soil and Water Conservation Practices, MF 05-241, booklet, 33 pages, 1985, revised 1990 edition \$4.00 plus shipping from World Neighbors, 5116 North Portland Avenue, Oklahoma City, Oklahoma 73112, USA; Indonesian edition from Studio Driya Media, Jalan Hariangbanga No. 2 Pav, Bandung, Indonesia 40116.

This comic-book style booklet illustrates simple methods for reducing soil erosion and water runoff on sloping farm land. These methods include erecting barriers or dikes along contour lines and constructing drainage ditches with check dams. All materials used are locally available, usually at no cost.

Barriers may be constructed of wood or bamboo, rocks, or soil. Sometimes certain fast-growing trees, grasses, or pineapple plants are used to strengthen the barriers. They may also provide firewood, fodder, and green manure to increase the fertility of the soil.

Clear illustrations and explanations of basic concepts make this a valuable

booklet for fieldworkers and farmers. This is the first book in a series on the topic. For more information on the use of leucaena for soil conservation, see **Leucaena Based Farming**. A number of other booklets on dryland agriculture will be available in the future.

Recommended.

Leucaena Based Farming, MF 05-243, booklet, 29 pages, 1985, revised 1990 edition \$4.00 plus shipping from World Neighbors, 5116 North Portland Avenue, Oklahoma City, Oklahoma 73112, USA; Indonesian edition from Studio Driya Media, Jalan Hariangbanga No. 2 Pav, Bandung, Indonesia 40116.

Some farmers in the dry hilly eastern islands of Indonesia have begun to control erosion by planting leucaena trees along the contour lines of their sloping fields. The leucaena trees grow very quickly. When planted closely together in a row along the contour line, they create a live barrier and network of roots which hold soil in place. They also provide firewood, and the leaves can be worked back into the soil to provide a "green manure" rich in nutrients or used as a feed supplement for livestock. Other grasses and trees suitable for soil erosion control are also mentioned.

While local farmers have been very happy with the results of this approach, the authors have pointed out to us that it may be wise to avoid exclusive dependence upon leucaena in applying these soil conservation methods. This seems particularly true now, as a leucaena pest has been moving across the Pacific Ocean from Latin America, damaging leucaena trees.

This is the second in the comic-book style series which begins with **Introduction to Soil and Water Conservation Practices**.

Recommended.

Vetiver Grass: A Method of Vegetative Soil and Moisture Conservation, MF 05-283, booklet, 69 pages, edited by Fran Bidero, 1987, World Bank/New Delhi, out of print.

This well-illustrated handbook describes a system of soil and water conservation based on the use of plants as a cheaper and more effective system than earth bunds. It is written for farmers and fieldworkers based on experience in India using vetiver grass (khus, khuskhus), which is the best-known plant for this purpose.

"The short-term costs of *constructed* soil conservation measures would outrun the short-term benefits by three or four times, and these practices not only cost money, they also *cut* production. Farmers do not look kindly on these practices."

"On the other hand, vegetative soil and moisture conservation measures are not only extremely cheap (less than 1/10-1/100 the cost of constructed banks and waterways) but the farmers can do the work themselves, and, if they have the planting material, at no cost. Once vegetative hedges are established (usually takes two to three seasons) they are permanent. When they are followed as contour guidelines for cultivation and planting, the resulting 'in-situ' moisture conservation increases yields by at least 50% over traditional methods."

Integrated Farm Management, Practical Guide to Dryland Farming No. 3, MF 05-286, booklet, 36 pages, 1989, \$4.00 plus shipping from World Neighbors, 5116 North Portland Avenue, Oklahoma City, Oklahoma 73112, USA; Indonesian edition from Studio Driya Media, Jalan Hariangbanga No. 2 Pav, Bandung, Indonesia 40116.

This illustrated booklet explains the many benefits of integrated farming based on soil and water conservation practices that have been successfully applied in eastern Indonesia. Intended for use by extension agents working with farmers, the drawings could be easily modified for use with farmers in other parts of the world.

Guidelines for Watershed Management, FAO Conservation Guide 1, MF 05282, book, 293 pages, 1977, \$40.00 from UNIPUB.

A collection of articles and case studies relevant to conditions in developing countries, including measuring and monitoring of erosion, basic watershed management principles, erosion control methods, terracing, landslide problems, and remote sensing for watershed management.

Gully Control and Reclamation, VITA Technical Bulletin 51037-BK, MF 05-260, booklet, 26 pages, by Robert Flannery, 1981, \$5.25 (overseas orders add \$3.00 for surface mail, \$5.00 for airmail) from VITA.

This manual describes how erosion causes gullies, what can be done to stop gullies from deepening, and how to reclaim eroded soil. Written for South Africa, but useful elsewhere as well.

Recommended.

Manual for Calculation of Check Dams, MF 05-244, by Bernhard Hiller, 1979, 85 pages, photocopies available from SDC or SKAT.

This manual was written for engineers "to calculate and to design check dams for torrent control to prevent erosion under Nepalese conditions. Locally available construction material, the lack of contractors' skill and know-how and the total absence of machinery require a special type of structure: the gravity check dam. This manual shows step by step how to proceed in the construction of such a check dam." Dry masonry and gabion (wire-surrounded) check dams only. Includes detailed information on how to calculate the likely amount of runoff water under extreme conditions.

Conservation Farming for Small Farmers in the Humid Tropics: Techniques and Tools, MF 05-167, booklet, 19 pages, by Ray Wijewardene, 1984, \$1.00 from International Institute of Tropical Agriculture/Sri Lanka Program, 133 Dharmapala Mawatha, Colombo 7, Sri Lanka; also available from TOOL and ITDG.

A discussion of techniques of no-till agriculture applied to major tropical row crops (maize, rice, grain-legume, etc.) which includes recommendations for planting, weed control and herbicide safety. While providing an introduction to the technology and practices developed by IITA Sri Lanka Program, a strong case is made for the benefits of no-till agriculture (water retention, reduced soil erosion, lowered production costs).

Surface Irrigation, FAO Agricultural Development Paper No. 95, MF 05-219 book, 160 pages, by L.J. Booher, FAO, 1974, out of print, available for \$6.00 from UNIPUB.

Relevant to both small and large farming units, this is a good introductory reference book on surface irrigation. No special technical background is necessary, although general knowledge of agriculture and basic mathematics is required. This volume is more in-depth than **Small Scale Irrigation**, but it does not cover micro-irrigation with catchments or runoff irrigation techniques.

The sections on soils, land preparation, ditches, and pipeline distribution systems offer good background material for the later chapters on basin, border, wild flooding, furrow, corrugation and drop irrigation. There are helpful guidelines for choosing an irrigation system based on crop, slope, soil, and available water. Charts and tables show how to plan irrigation systems to suit varying conditions (for example, recommended length and spacing of furrows based on soil type and land slope). Photographs and drawings show both mechanized and low-technology tools and equipment for land preparation and water control.

Small-Scale Irrigation, MF 05-217, book, 152 pages, by Peter Stern, 1979, £6.95 from ITDG; also available from VITA and TOOL.

A valuable introduction to the technical requirements of irrigation on farms from 0.1 hectare vegetable plots to 100 hectare units. "The strongest argument in favor of small-scale irrigation is that ... the human problems are reduced to a manageable scale."

Often people underestimate the quantity of water needed for irrigation. "If all the water consumed in a month by a rural community of 100 people with 250 cattle and 500 sheep and goats were used for irrigation, this would provide two irrigations a month to an area of about a quarter of a hectare."

The author begins with a discussion of moisture conservation techniques, and maximum use of runoff water. He introduces seven principal surface irrigation methods: basin, border, furrow, corrugation, wild flooding, spate and trickle irrigation. Also mentioned are sprinkler systems (too expensive for most uses in developing countries). To calculate water quantities needed, he discusses crop water requirements and soil infiltration rates. The slopes required for different systems and soils are noted. Other topics include design of drainage systems, channels and pipelines, hand and animal-powered water lifting systems, and measurement of rainfall and water flow in streams. This book gives a basic background, but the reader is expected to get more detailed information either from local agricultural officers or by trial and error.

In areas with very little annual rainfall, micro-irrigation systems can be used. The author gives an example of a farm with annual rainfall of 500 mm, insufficient to produce vegetables. A farmer "could set aside 1000 square meters of his land for catchment irrigation. Of this 1000 square meters, 700 square meters would be prepared as a catchment apron, from which runoff would be fed into a catchment tank, and 300 square meters would be used as a vegetable garden, irrigated by watering can from the tank. In a dry year, with 300 mm of rain, the catchment tank would receive 210 cubic meters of water ... (and allowing for losses) the garden would then receive 300 mm of direct rainfall plus 330 mm from the tank."

Recommended.

Operation and Maintenance of Small Irrigation Schemes, MF 05-272, book, 45 pages, by Peter H. Stern, 1988, £5.50 from ITDG.

Complementing **Small Scale Irrigation** by the same author, this book highlights the important organizational, management and technical considerations in operation and maintenance. "Usually the significant causes of poor performance lie in the problems of management and operation Some of the most acute problems of organization and management occur in countries or regions where irrigation has not been practiced before and is being introduced for the first time, calling for major changes in the activities of rural people." Major topics include water conveyance, distribution, farm application of water, and drainage.

In an overview of the main small-scale irrigation alternatives, the author identifies the most common technical and organizational problems. Most of these are easily solved once they are understood, although many require well-organized local water users' groups.

The Design and Optimization of Irrigation Distribution Networks, MF 05-274, book, 247 pages, by Y. Labye et. al., FAO, 1988, \$25.00 from UNIPUB.

This very technical reference book will be most easily understood by readers with some engineering training. However, there are a number of valuable insights accessible to the more general reader regarding basic elements of design.

One interesting example is the 120 degree rule—a rule which helps in determining the least amount of pipe or channel that can be used to reach a fixed set of water hydrants. (This rule can also be used in the design of other systems using pipe or electrical wire, such as village drinking water systems.)

"The optimal position of the node M can readily be determined by construction with the help of a piece of tracing paper on which are drawn three converging lines subtending angles of 120 degrees. By displacing the tracing paper over the drawing on which the hydrants A, B, C have been disposed, the position of the three convergent lines is adjusted without difficulty and the position of the node determined.

"It should be noted that a new node can only exist if the angle ABC is less than 120 degrees. When the angle is greater than 120 degrees, the initial layout ABC cannot be improved by introducing a node and it represents the shortest path. Conversely, it can be seen that the smaller is the angle ABC, the greater will be the benefit obtained by optimizing."

Irrigation Principles and Practices, Peace Corps Program and Training Journal Reprint Series No. 5, MF 05-192, book, 112 pages, 1978, available free of charge to Peace Corps volunteers and development organizations from Peace Corps; also available from ERIC (order number ED-242880) and NTIS (accession number PB85-249209).

Clearly written and easily understood, this manual covers water measurement, irrigation water control, drainage, and planning related to irrigation. The appendix includes diagrams for easily-built low-cost tools, and tables for calculating water flow through a weir.

More Water for Arid Lands (Promising Technologies and Research Opportunities), MF 05-199, book, 137 pages, report of a National Academy of Sciences panel, 1974, accession no. PB-239 472/4, paper copies \$23.00 domestic, \$46.00 foreign; microfiche \$8.00 domestic, \$16.00 foreign; Mom NTIS; also from ITDG and TOOL.

"Little-known but promising technologies for the use and conservation of scarce water supplies in arid areas are the subject of this report. Not a technical handbook, it aims to draw the attention of agricultural and community officials and researchers to opportunities for development projects with probable high social value.

"The technologies discussed should, at present, be seen as supplements to, not substitutes for, standard large-scale water supply and management methods. But many have immediate local value for small-scale water development and conservation, especially in remote areas with intermittent rainfall. With further research and adaptation, some of the technologies may prove to be economically competitive with standard methods of increasing the water supply or reducing the demand."

This report attempts to address the need for "fresh innovative approaches to water technologies, particularly those designed to meet the needs of arid regions in the less developed world, where there has often been improper application of practices developed in regions with higher rainfall or more abundant water supplies. Also, we need to reconsider practices developed in arid regions by ancient agriculturalists."

The report is divided into two parts: water supply and water conservation. It includes the following subjects: rainwater harvesting, runoff agriculture, irrigation with saline water, wells, reducing evaporation from water sources, trickle irrigation, use of greenhouses, and other innovative irrigation and water collection methods. For each subject, methods, advantages, limitations, stage of development, and needed research and development are briefly covered.

Although some of the techniques mentioned are high-technology, most of them are simple, low-cost methods gathered from all over the world. Photos and diagrams abound. This booklet has more immediately useful techniques and technology than most of the other NAS reports.

Fields and Pastures in Deserts: A Low Cost Method for Agriculture in Semi-Arid Lands, MF 05-174, large book, 37 pages, 1976, Wadi Mashash, Germany, out of print.

This is a report from an experimental farm, Wadi Mashash, in the Negev desert. The average annual rainfall is about 110 mm, most of which falls within a few hours during the occasional heavy rains. The farm uses simple techniques to trap rainwater; these were developed thousands of years ago, and recently rediscovered through archaeological evidence. The loess soil of the area (often found in other arid regions as well) leads to a high percentage of runoff whenever there is rainfall. Trees are planted in basins, each located at the lowest point of a 250-square meter micro-catchment area. When there is rain, all of the water runoff from this larger area goes to the tree basins and soaks in—providing all the water the tree needs, even during long periods without rain. Forage crops for sheep are also grown. This technique has been successfully tried in other places. Forty-five drawings and photos are included. This is a fascinating, low-cost method for making productive use of arid land without the use of costly and energy-intensive irrigation canal systems or other expensive technologies.

How to Grow More Vegetables (Than You Ever Thought Possible on Less Land Than You Can Imagine), MF 05-186, large paperback, 150 pages, by John Jeavons, 1982, \$15.00 (add \$3.00 for airmail worldwide) from Ecology Action, 5798 Ridgewood Road, Willits, California 95490, USA; French and Spanish translations of the second edition (December 1990) also available from Ecology Action at the above address.

Ecology Action is devoted to education and research on bio-dynamic/French intensive horticulture. Their gardening classes for the public began on small plots of donated land in 1972. "The series of classes led to the development of information sheets on topics such as vegetable spacings and composting techniques. Many people asked for a book which contains all the information we have gathered This book is the result."

Ten years of research have shown that, as compared to U.S. commercial agriculture, intensive gardening can produce yields that average 4-6 times as much, require 1/2 (or less) of the quantity of water, and consume only about 1% of the energy. The garden consists of a series of raised planting beds with heavy additions of organic fertilizers such as manure and compost, prepared by a technique known as "double-digging." "The crops are grown so close to each other that when the plants are mature, their leaves barely touch. The close spacing provides a mini-climate and a living mulch which reduces weed growth and helps hold moisture in the soil."

This edition includes sections on garden planning and fertilization as well as chapters on history and philosophy, preparation of the double-dug raised beds, compost, seed propagation, and companion planting/backyard ecosystems.

An attractive, easy-to-read book with many good illustrations and a great deal of tabular information on seeds, yields, spacings, time to maturity, fertilizing, and insect pests and their plant controls. While successful gardening relies on experience, this book is probably the most useful single reference for getting started in temperate climates. In tropical and subtropical developing countries, the **Samaka Guide** (see review) remains the most directly useful manual on intensive gardening. Simple English and clear drawings make **How to Grow More Vegetables** a useful secondary reference book in the tropics, but the important plant species combinations and soil conditions will be different.

Highly recommended.

The Backyard Homestead Mini-Farm and Garden Log Book, book, 196 pages, by J. Jeavons, J.M. Griffin and R. Leler, 1983, \$8.95 plus \$2.30 surface or \$10 airmail (prepaid) from Ten Speed Press, P.O. Box 7123, Berkeley, California 94707, USA.

"It is a good idea for all gardeners to keep records of what happens throughout the year in their gardens—what fertilizers have been added, when seeds were planted, what yields were, problems that have come up, and so on. For the mini-farmer, keeping good records is almost essential. To be economically successful you cannot rely on memory or guesswork. You need to know what worked and what did not so you can plan ahead, and avoid misfortune."

This is a companion volume to the well-known and widely distributed **How to Grow More Vegetables**, which is considered by many to be the bible of the Biodynamic French Intensive Method of intensive horticulture. While it is embraced by many home gardeners and food activists as a means of alleviating world hunger and generating income, this method also has its critics. Some friendly

critics see it as one of a number of alternative approaches to conventional chemical-based food production, rather than *the* alternative. Less sympathetic reviewers consider this method's applicability limited to more temperate micro-climates and its vast economic and agronomic claims as yet unproven on a broader scale.

The authors have sought to provide more technical details and some very useful intensive gardening management techniques and tools. While some of this book's charts and contents are also contained in the earlier reference, it succeeds in filling in some major gaps for prospective "mini-farmers," agricultural extensionists, and development workers. The crops, climates, measurement units, and agricultural assumptions covered in the book are most relevant to temperate regions or uplands in the tropics, and the measurements are in English rather than metric units. Nevertheless, the garden planning maps and guidelines, data logs, and calendars should prove to be very useful references well worth adapting to local crops and circumstances around the world.

The Samaka Guide to Homesite Farming, MF 05-211, book, 173 pages, by Colin Hoskins, 1973, Samaka Service Center, Philippines, out of print in 1981.

The Samaka Guide is an excellent introduction to homesite farming, encompassing the vital skills of homesteading from seed-sprouting to goat-skinning. The **Guide** is closest to the needs and socio-economic level of the bulk of the people in developing countries; the emphasis on village self-reliance, cooperation and respect for traditional methods make it widely applicable outside its Philippine setting.

A summary of the **Guide's** contents: well drilling, composting, special directions for growing various indigenous vegetables and fruits, building plans for livestock pens, operation of a family fishpond, and care of assorted animals such as rabbits, chickens and water buffaloes. Also briefly covered are home industries, sanitation, tenant rights and barrio fiestas (neighborhood parties). This wealth of information is presented systematically, for an integrated model homestead of 600 to 1000 square meters (Y6 acre). The book is well-illustrated and detailed for widespread use.

The Samaka Guide is immediately applicable at the village level (the English used is simple and non-technical). An Indonesian/Malay edition is available from Percetakan Arnoldus, Penerbitan Nusah-Indah, Ende, Flores, Nusah Tenggara Timur, Indonesia for Rp. 250 (1976 price).

Gardening for Better Nutrition, MF 05-179, booklet, 64 pages, by Arnold Pacey 1978, £4.95 from ITDG; also available from VITA and TOOL.

"The subject of this particular manual is the basic technology of horticulture and vegetable growing as it applies mainly to family gardens."

This is a thought-provoking overview of the practice of nutrition-oriented agriculture for tropical and developing countries. It summarizes the lessons learned in various projects ranging from Bangladesh to Brazil and provides a detailed reference bibliography with emphasis on specific regions.

"Although it may include economic activity (such as selling produce at local markets), nutrition-oriented agriculture differs from commercial agriculture in a number of ways:

a. In growing crops because of their nutritional value rather than because of their market value.

- b. In concentrating on gardens of a size which most families can cultivate.
- c. In appealing primarily to those who produce the family's food—in many communities, the women.
- d. In linking agricultural extension work to health education, social education, and community development."

All aspects of gardening vital to the successful implementation of local programs are touched upon, including crop selection, vegetable agronomy, and problems and techniques. The photos and drawings are excellent, the text clear. Highly recommended as a basic resource book, to be complemented by local technical manuals such as Papua New Guinea's **Liklik Buk**, **The Samaka Guide** from the Philippines, and **Gardening for All Seasons** from Bangladesh (see reviews).

Gardening with the Seasons, Technical Bulletin No. 46, MF 05-180, 72 pages, by Harlan Attfield, 1979, revised 1985 edition \$7.25 (overseas orders add \$3.00 for surface mail, \$5.00 for airmail) from VITA; also available in Spanish.

Similar in intent to **The Samaka Guide** and **Cultivo do Hortalizas en la Huerta Familiar** (see reviews), this practical booklet describes gardening techniques and vegetable varieties for Bangladesh. **Gardening with the Seasons** is briefer than the others, though it also is well-illustrated and based on extensive field experience. The author has worked on grass-roots rural development projects for 8 years in West Africa, South America and Bangladesh. The Bangladesh gardening project has been a key component of that country's Integrated Rural Development Program.

This booklet contains general guidelines for soil preparation using raised beds, seed germination, transplanting, and companion plants. Brief specific information—when to plant, the best soil conditions, spacing, and care—is provided for 36 vegetables grown in Bangladesh.

"Generally people plant the vegetable they like to eat. But good gardeners should also consider food value because some vegetables are richer in value than others. Vegetables should be selected that are easy to grow under local soil conditions, add richness to the soil, and are resistant to insects and disease. Fresh vegetables are an excellent source of minerals and vitamins. They contain many of the minerals, such as calcium and iron, which the body utilizes to make bone, teeth and blood. They also provide important vitamins, mainly Vitamin A, the B vitamins, and Vitamin C."

Highly recommended.

Intensive Gardening for Profit and Self-Sufficiency, MF 05-191, 159 pages, written and illustrated by Deborah and James Vickery, 1977, Peace Corps, out of print.

This gardening manual was prepared for use in Jamaican projects but is useful in any area. It starts with simple botany, soils analysis, components of fertility and methods for soil management and improvement. Instruction concentrates on intensive gardening systems, and describes simple tools, composting, irrigation, rotation and companion planting. Useful charts and illustrations.

The UNICEF Home Gardens Handbook: For People Promoting Mixed Gardening in the Humid Tropics, MF 05-226, book, 55 pages, by Paul Sommers, 1982, UNICEF, out of print.

"Mixed gardens are the result of centuries of trial and error and have evolved

into a self-sustaining system that can provide rural households with most of their basic dietary needs and perform many other useful functions." Based upon the author's experience in the Philippines, this fine manual was written to help fieldworkers and planners to establish home garden programs in lowland humid tropical areas. The gardens described are much larger than the yards of some households in developing countries, but the mixed garden approach can be easily modified for smaller holdings. Includes a table of plants and household sprays which repel insects.

Highly recommended.

The Basic Book of Organic Gardening, MF 05-135, book, 377 pages, edited by Robert Rodale, 1971, Rodale Press, out of print.

A basic introductory text, this book compresses the essentials of organic gardening into a readable, practical format. Its compact size and detailed information make it a valuable asset to the field. Although it does not have any illustrations, this book redeems itself with a common-sense approach to plant protection and other standard techniques in the organic arsenal. Organic fertilizer equivalents of the figures cited in the **AID Handbook of Tropical and Subtropical Horticulture** (see review) can be easily calculated: simply substitute ground fish heads or seaweed for urea and superphosphate, for example. Although some of the information applies to temperate climates only, the philosophy and methods are easily adaptable to all conditions.

This book "tells you what soil is, how to create good soil, the fundamental rules about mulching and composting, why you need birds and insects, how to grow marvelous tasting and nutritious fruits and vegetables: it is packed with information about organic materials and foods—and where to get them."

Rodale Press is the foremost publishing and research organization dealing with organic gardening in the world today. Their information, however, is most immediately applicable to temperate climates and that of the eastern region of the United States in particular. Another outstanding and comprehensive Rodale book which deserves mention here is **The Encyclopedia of Organic Gardening** (1968, 1145 pages, \$39.95 from Rodale). This book is an advanced treatment for more experienced gardeners, covering soils, compost, mulch, and plant varieties (again, mainly from North America). Those people wanting further information can write Rodale Press for a list of their publications .

The Self-Sufficient Gardener, MF 05-212, book, 256 pages, by John Seymour, 1979, Faber and Faber (London), U.S. edition \$16.95 Mom Doubleday Consumer Services, P.O. Box 5071, Des Plaines, Illinois 60017-5071, USA.

This large, beautifully illustrated book was intended as a companion to the author's **The Complete Book of Self-Sufficiency**, which it surpasses. As a practical manual of planting, growing, storing, and preserving home-grown produce in temperate or sub-tropical regions, it ranks as one of the clearest and most concise available. Especially useful are diagrams showing how to convert a conventional row-crop garden into an intensive deep digging bed garden. This book covers practically everything under the sun except pest management and in a most entertaining and informative way.

In developing countries, an indigenous gardening resource manual like **The Samaka Guide** (see review) will be much more useful than this book. However we

do recommend it as a supplementary reference in developing countries, and a primary resource in industrialized countries.

Tropical Vegetables, MF 05-257, book, 112 pages, by G.J.A. Terra, Royal Tropical Institute, The Netherlands, 1966, SKAT, out of print.

This volume contains primarily "information on original vegetables of equatorial and subtropical regions. These are more adapted to local soil and climate: leached soils, humidity, temperature, day length, etc., and therefore they can be grown more easily and more cheaply. Moreover, propagation is fairly easy. They offer vast resources for further selection, which has been insufficient until now. Many of them are only found in the wild or half-wild state. They are only locally grown or even locally known as vegetables, and sources of information are few and far between."

Each plant is identified by Latin name and some English, French, and Spanish common names. Very brief descriptions indicate which part of the plant is eaten, and under what climatic conditions it can be grown.

Vegetable Production Under Arid and Semi-Arid Conditions in Tropical Africa, FAO Plant and Protection Paper 89, MF 05-263, book, 434 pages, FAO, 1988, \$45.00 (order no. F7188) from UNIPUB.

"The information in this manual applies primarily to the dry, lowland climates of tropical Africa." If you have a vegetable production problem under these conditions, this weighty reference book (especially the chapters on pest control and problems of irrigated vegetable crops—134 pages) might have a suggestion you can use. The authors do seem a bit quick to recommend chemical pest control. Altogether this is rather an ambitious book which also covers ecological conditions, breeding of vegetable crops, seed production, and preparation of crops for market (sorting, grading, suitable containers). Suggestions are provided for calculating production costs. This is a place to look for that occasional bit of technical detail that you can't find in the gardening books. Few illustrations.

Hydroponics: The Bengal Systems, MF 05-189, cloth-bound book, 185 pages, by J. Sholto Douglas, fifth edition 1975, \$7.95 from Oxford University Press, 2001 Evans Road, Cary, North Carolina 27513, USA.

This highly regarded book, in its 5th printing since its original issue in 1951, is the most complete and comprehensive to be found, incorporating innovations, designs and methods in the field of hydroponics, the science of soil-less cultivation of plants. The author is the originator of the Bengal System of hydroponics, which is suited to developing countries and can be used successfully in areas where normal soil cultivation is impossible, such as in Sahel savannahs or crowded urban areas.

The author is careful to give the reader a solid foundation in the theory of hydroponics. The system uses watertight containers filled with materials such as sand and gravel. This is continuously recharged with a nutrient solution with proper aeration and drainage. Douglas provides many ideas for low-cost systems, including detailed data and types of organic non-chemical fertilizers (the Sharder process) and such construction materials as erosion-resistant mud plaster and alkali puddled clay.

The systems described are low in capital costs and are labor-intensive,

employing existing resources and materials. They are characterized by a high immediate rate of return. Well-illustrated, supported with vital statistics, construction details and maintenance information, **The Bengal System** is a definitive book.

Animal Husbandry in the Tropics, MF 05-232, book, 755 pages, by G. Williamson and W.J.A. Payne, 1980, Longman Group Ltd., Longman House, Burnt Mill, Harlow, Essex CM20 2JE, England, out of print.

Here is a reference text which includes a brief discussion of some unusual tropical animals such as camels, llamoids (llamas and alpaca), and wild game, as well as the more conventional cattle (200 pages), sheep, goats, pigs, poultry, and buffalo.

Characteristics of common tropical breeds of the economically more important animals are discussed and illustrated with photographs. A section on animal products includes processing of milk and milk products, meat and carcass by-products, and wool production.

The presentation tends to be more academic than many of the practical books reviewed here; background information on climate, health, nutrition, reproduction, species distribution, physiology, and behavior receive relatively more emphasis, while practical management techniques for the low-capital farmer receive less.

Still, there is some discussion of management techniques for the village setting, and we would recommend this book as a solid reference to supplement a more practice-oriented text.

A Livestock Manual for the Tropics, book, 406 pages, 1983, \$23.00 plus \$4.00 postage, from The Jamaica Livestock Association, Newport East, P.O. Box 36, Kingston, Jamaica, West Indies.

This is a solid reference on cattle, goats, sheep, horses, pigs, poultry, rabbits, and bees. Based on experience in Jamaica, the book is intended for use in other tropical areas as well. Sections on pasture and fodder management, and animal diseases, are included, but information on buffalo, ducks and geese is not.

There are two major limitations of this book. The first is that much of the material is oriented towards large-scale commercial producers, with techniques such as artificial insemination, embryo transplant, and the use of milking machines, which are not appropriate for backyard or small commercial operations. The second limitation is the rather hefty price.

Still, there is much good material here, and we would recommend this book for those needing a general livestock text, particularly those in commercial production. The backyard producer will do better to start with one of the books written specifically for small-scale, low-capital operation.

Keeping Livestock Healthy, MF 05-242, book, 322 pages, by N. Bruce Haynes, revised 1985, \$15.00 plus postage from Storey Communications, Inc., Schoolhouse Road, Pownal, Vermont 05261.

This is a very good book for those who want to gain a more thorough understanding of animal health and disease. The first 135 pages cover disease prevention, including nutrition, housing, reproduction, animal restraint, and techniques for examination. The next 170 pages cover various categories of disease

(bacterial, viral, parasitic metabolic, deficient, etc.). Clear explanations of basic concepts, such as disease resistance and immunization, and of disease types set this book apart from other books (or chapters of books) on the topic

For the small operation in the tropics, however, this book also has several substantial drawbacks. These are primarily due to its U.S. orientation. While the book covers cattle, horses, goats, sheep and pigs, the greatest attention is paid to cattle, while pigs, goats and sheep, which are economically more important to the small tropical farmer, get less attention.

A second limitation is that several important diseases foreign to the U.S., such as foot and mouth disease, gain only brief mention. Similarly, special considerations for raising livestock in the tropics are not discussed. Because access to a veterinarian is assumed, **Keeping Livestock Healthy** provides less specific information of medications and dosages than is found in **Goat Health Handbook**, **Sheep Health Handbook**, and **Raising Healthy Pigs Under Primitive Conditions**.

A Planning Guide for Small Scale Livestock Projects, MF 05-246, book, 80 pages, by Gordon Hatcher, 1984, \$4.50 from Heifer Project International, P.O. Box 808, Little Rock, Arkansas 72203, USA, also available in Spanish.

Here is an essential primer for those with limited experience who are considering launching a livestock project. This is not a text on how to raise livestock. Rather it is a book which outlines the important considerations for project planners. It is packed with useful advice and warnings based upon years of experience with community livestock projects in the tropics.

The book discusses cattle, buffalo, sheep, goats, swine, poultry, rabbits, bees and fish, but the general planning approaches can be applied to other species as well. The advantages of local vs. imported animals are discussed with advice for those who must import animals. Approaches to project monitoring and farmer education are also presented. A good bibliography and list of publishers is included.

Highly recommended.

Raising Healthy Cattle Under Primitive Conditions, MF 05-268, book, 110 pages, by James Carlson, D.V.M., \$5.00 donation if you can afford it, otherwise free, from Christian Veterinary Mission, World Concern, 19303 Fremont Avenue, Seattle, Washington 98133, USA.

Written for missionaries, small farmers and agricultural workers, this manual provides basic information on beef cattle, including facilities and handling, nutrition management, poisonings, and mineral and vitamin deficiencies. Fully half the book is devoted to disease symptoms, treatment and prevention.

The author notes that steadily increasing demand for meat in developing countries is expected to greatly increase the numbers of cattle and, even more rapidly, the amount of meat produced by those cattle. These increases will demand significant improvements in the management of these animals. This book will certainly help in that effort.

Raising Healthy Goats under Primitive Conditions, MF 05-267, booklet, 135 pages, by Robert A. Vanderhoof, \$5.00 donation if you can afford it, otherwise free, from Christian Veterinary Mission, World Concern, 19303 Fremont Avenue, Seattle, Washington 98133, USA.

This volume is packed with information on disease and problems, emergencies, and good management under difficult conditions. If you have a problem with your goats, this is a reference you will want. The author does not assume that you are a veterinarian or a person already having years of goat-raising experience. Nor does he assume that you live in a rural part of the United States, where malnutrition is never an issue and diseases are predictable and easily controllable. A practical manual with lots of illustrations, written for people who will get their hands dirty caring for goats.

Raising Goats for Milk and Meat, MF 05-249, book, 110 pages, by Rosalee Sinn, revised 1985, \$10.00 from Heifer Project International, P.O. Box 808, Little Rock, Arkansas 72203, USA; also available in Spanish.

Goats are an important source of meat and milk in many developing countries. They are well-adapted to a wide variety of climates and can live mainly on a diet of grass and waste plant residue. Due to their small size, goats can be raised on small land holdings, and an entire goat can be eaten by a family before the unrefrigerated carcass spoils in the tropics.

This clearly presented, comprehensive training manual on the basics of goat raising includes sections on housing, feeding, breeding, kidding (bearing young), milking, slaughtering for meat, record-keeping, and health care. This training course was developed in West Africa, but has been adapted for more general use. The author notes that trainers may wish to supplement it with information on local techniques, when appropriate.

The orientation of the manual is towards small holdings with little capital. It includes instructions for building a disbudding box and recipes for a variety of cheeses. A filmstrip to accompany this course is also available from the Heifer Project.

Goat Health Handbook, MF 05-237, spiral bound book, 123 pages, by T.R. Thedford, 1983, \$6.00 plus \$0.95 shipping (overseas airmail \$3.40) from Winrock International, Route 3, Morrilton, Arkansas 72110, USA; also from ITDG.

The **Goat Health Handbook** will help people raising goats to diagnose and treat their sick animals. A large amount of information is presented in a small amount of space. While the book is generally easy to use, some explanations are so brief that they may be confusing. Often, missing information is presented elsewhere in the book, so a thorough familiarity with the book will reduce this problem.

Because of the complexity of the topic, the author recommends consulting a veterinarian whenever possible. "Remember that diagnosis and treatment are extremely complex tasks The information in this guide will not allow you to make a specific diagnosis in most cases. However, it can help you to identify symptoms and narrow the range of diseases for treatment.

"The handbook is divided into five major sections:

1. The **Diagnostic Guides** will help you to easily identify a small number of diseases that are the most probable cause of the symptoms that you have observed.

2. The detailed **Disease Descriptions** will allow you to reduce the number of potential diseases even further, provide appropriate treatment, and take preventive measures to avoid further spread of the disease.
3. The section on **Therapy** describes many of the antibiotics and other drugs that are used in the treatment of goat diseases. It provides information on dosage and administration. In addition, this section includes some formulas that are useful in treating sick goats.
4. **Techniques** of treatment are described and illustrated. This section covers techniques of treatment such as the sterilization of instruments and oral administration of medicine, and techniques of normal health care such as castration and foot trimming.
5. The section on **Birth and the Newborn** describes the procedures for both normal and difficult delivery, with illustrations. It also covers pre and post-delivery care." An important book for those raising goats, particularly in remote areas.

Sheep Health Handbook, MF 05-253, spiral-bound book, 132 pages, by Thomas R. Thedford, 1983, \$6.00 plus \$1.25 shipping (overseas airmail postage is \$3.40) from Winrock International, Route 3, Morrilton, Arkansas 72110, USA; also from ITDG.

This is essentially the same manual as **Goat Health Handbook** (see review above), except that it is written for sheep rather than goats.

The Homesteader's Handbook for Raising Small Livestock, MF 05261, book, 256 pages, by J. Belanger, 1974, RODALE, out of print.

This is a handbook on raising small livestock on a small scale. Easy to understand, non-technical language. Many drawings and photos, often of build-it-yourself cages, pens, water devices, etc. Covers goats, rabbits, chickens, sheep, geese, hogs, turkeys, guinea fowl, ducks, and pigeons. Written for North Americans moving from the cities back to small farms. No information on vaccinations or shots. Does include a list of further references.

There is a good section on rabbits. Rabbit meat tastes like chicken. France and Italy together produce 200 million pounds of rabbits each year. Rabbits reproduce quickly and have high labor and small space requirements. The fur can be used (tanning instructions are given). Hutches (rabbit cages, usually raised off the ground) can be easily built out of bamboo. This chapter also tells how to make a well-balanced rabbit feed.

Raising Healthy Pigs Under Primitive Conditions, MF 05-250, book, 83 pages, by Dr. D.E. Goodman, optional donation of \$5.00 per book, from Christian Veterinary Mission, c/o World Concern, Box 33000, Seattle, Washington 98133, USA.

This well-written book is most valuable for its extensive chapter on nutrition. The nutritional value and preparation of a wide variety of possible foods are discussed. Health care, reproduction, and baby pig management are also well-covered. The health care section includes short descriptions of the most important diseases, and steps for their prevention and cure.

Non-intensive, low-capital management systems are assumed. Various low-cost feeders, waterers, and houses are illustrated. Information on available breeds of pigs is not given, since it is assumed that most primitive operations will be using locally available varieties.

Christian Veterinary Mission will provide additional information to pig farmers who are having problems. An outline in the back of the book shows what information is needed.

Small-Scale Pig Raising, MF 05-254, book, 263 pages, by Dirk van Loon, 1978, \$12.95 from Storey Communications, Inc., Schoolhouse Road, Pownal, Vermont 05261, USA.

This is a complete, well-written, and humorous guide for the backyard pig raiser in the U.S. The book is written for people without prior experience raising pigs, and the author provides a good deal more background information than is usual in a manual of this sort.

This book does not discuss special considerations for raising pigs in the tropics, or with very limited resources. The health section lists common problems, but doesn't provide very much information on treatment as access to a veterinarian is assumed.

Housing, nutrition, and management are well-covered, as are slaughtering and butchering. Good illustrations and numerous useful tips make this a good book for the small pig operation, despite its U.S orientation, particularly if used in conjunction with **Raising Healthy Pigs Under Primitive Conditions** or **Pigs and Poultry in the South Pacific**.

Pigs and Poultry in the South Pacific, MF 05-203, book, 93 pages, by Ian Watt and Frank Michell, 1975, Sorrett Publishing Pty. Ltd., Malvern, Victoria, Australia, out of print.

"This book sets out in simple language the information required by extension workers and others responsible for helping the farmer. It deals with all levels, from simple improvisation in a village to semi-intensive and intensive type production."

Two-thirds of the book is on raising pigs. This section covers management systems, pig nutrition, housing, breeds, and diseases. The poultry section covers raising and feeding young chickens, management and feeding of laying hens, timing of replacement of stock, deep litter bedding, ducks, and diseases. Both sections discuss the costs/benefits of home-grown versus commercial feeds. The nutritional needs of the animals are described and some sample home-grown foods are mentioned that will meet these needs.

"By delaying maturity, the bird will produce larger eggs when it starts to lay. If a bird is made to lay eggs at too young an age, most of the eggs it will produce during its life will be small eggs Lowering the protein content of the feed from 21% to 15% for the actual growing period of the bird is probably the easiest way of delaying maturity. So for the first six weeks, a layer chicken is fed a 20-21% protein medicated feed, but at the end of six weeks it is changed over to a grower feed which is also medicated (against Coccidiosis), until the bird is about 24 weeks of age when it begins to lay."

The clear, illustrated presentation should make this book valuable to anyone considering pig or poultry raising in the tropics.

Practical Poultry Raising, Peace Corps Appropriate Technology for Development Series Manual M-11, MF 05-205, book, 225 pages, by Kenneth M. French, 1981, available free of charge to Peace Corps volunteers and development workers from Peace Corps; also available from ERIC (order no. ED241771) and NTIS (accession no. PB85 243301/AS).

Written for the extension worker, this manual focuses on chicken, the most common type of poultry. No fowl knowledge is assumed. Options presented range from "free range" (chickens run free and essentially take care of themselves) to cage systems which may require relatively high capital investment. Marketing considerations are briefly discussed, as are other types of poultry.

Raising Healthy Poultry Under Primitive Conditions, MF 05-266, booklet, 93 pages, by W.M. Reid, G.M. Pesti, and M.A. Hammarlund, \$5.00 donation if you can afford it, otherwise free, from Christian Veterinary Mission, World Concern, 19303 Fremont Avenue, Seattle, Washington 98133, USA.

This is a handy reference for the management of small-scale poultry farms. Feed and health considerations are major topics. The insecticides and medicines suggested may be unavailable and unaffordable in many developing countries. Nevertheless, there is a lot of good practical advice that can be used anywhere.

"a) Never introduce older birds into a young flock.

b) Prevent visitors (including neighbors), wild flying birds, rodents and especially other poultrymen from entering poultry houses.

c) Avoid visiting neighbor's flocks and returning to your own without a complete change of footwear and clothing.

d) Establish an 'All in, all out' rule to keep birds of one age together."

Several methods of extending the storage life of eggs are described. "Oil in the form of a thin film will prolong quality for three weeks or longer if stored under 10°C. Eggs should be dipped in a light mineral or cooking oil such as coconut oil. The oil temperature should be about 11 °C higher than room temperature. If reused, the oil should be filtered and sterilized by heating to 116°C."

Raising Poultry the Modern Way, MF 05-251, book, 220 pages, by Leonard S. Mercia, 1983, \$9.95 from Storey Communications, Inc., Schoolhouse Road, Pownal, Vermont 05261, USA.

Written primarily for small commercial operations in the U.S., this book covers chickens, turkeys, ducks and geese, with more than half of the book devoted to raising chickens for meat and eggs. No consideration is given to conditions outside of the U.S., but the book is otherwise complete, particularly for chickens (for geese and ducks, see **The Book of Geese**, and **Raising the Home Duck Flock**). Includes a section on health, and illustrations of various equipment which can be built, as well as of killing, plucking and butchering chickens.

Raising the Home Duck Flock, MF 05-252, book, 192 pages, by Dave Holderread 1975, \$9.95 from Storey Communications, Inc., Schoolhouse Road, Pownal, Vermont 05261, USA.

Ducks are efficient producers of meat and eggs. They are highly resistant to disease and wet weather (both are problems for chickens), and they can tolerate a

wide range of temperatures. Ducks are also better at finding their own food, such as snails, insects and weeds, than chickens, and they have a longer productive life for laying eggs than chickens do.

Raising the Home Duck Flock covers all aspects of raising ducks, from selecting stock through incubation, rearing of ducklings, managing adult ducks, and butchering, as well as health care of ducks. The author's experience is mostly in the U.S., and parts of the book reflect this. For example, discussion of the availability of specific breeds in other parts of the world, and special considerations for raising ducks under tropical conditions, are not given much attention. However, the book is very readable and otherwise complete.

The Book of Geese, MF 05-234, book, 209 pages, by Dave Holderread, 1981, \$9.45 postpaid from The Hen House, P.O. Box 492, Corvallis, Oregon 97339, USA.

"In areas where green grass is available during a good portion of the year, geese can be raised on less grain or concentrated feed than any other domestic fowl, with the possible exception of guinea fowl. Along with being great foragers, geese require little or no housing in most climates, and if protected from predators and given reasonably good care, they have an extremely low mortality rate Along with ducks, they seem to be the most resistant of all poultry to disease, parasites and cold or wet weather."

While geese do not lay as many eggs as chickens or ducks, they grow very quickly and are efficient producers of meat.

This book is similar in organization and completeness to **Raising the Home Duck Flock**, by the same author. The emphasis of the book is upon raising geese in the U.S., and treatment of special considerations for other climates and conditions is limited. Otherwise, all aspects of small-scale goose flock management are covered in this well-written, well-illustrated text.

Raising Rabbits, MF 05-208, book, 82 pages, by Harlan Attfield, 1977, \$9.50 from VITA; also available in French.

"A rabbit raiser can start with two females and one male and produce fifty, or more, rabbits in one year." This rapid reproduction rate and the rapid growth rate of these animals have made rabbit-raising schemes popular in small development projects. Here is a manual that offers good basic advice for most aspects of rabbit raising.

The author stresses the use of locally available plants and grains for food. Because rabbits reproduce and grow quickly, they also consume a lot of food—it takes about 4 pounds of grain to produce 1 pound of rabbit meat (which tastes much like chicken). Record-keeping to aid in breeding, symptoms and treatment of common diseases, skinning and tanning are all discussed. There is no mention of special problems affecting rabbit raising in the tropics. Cages of bamboo, wood, and wire are shown. In all, a well-illustrated, easy to understand manual.

Rabbit Production, MF 05-247, book, 328 pages, by Cheeke, Patton, and Templeton, fifth edition 1982, 1987 edition \$26.60 plus \$3.00 postage and handling from Interstate Publishers, Inc., P.O. Box 50, Danville, Illinois 61834-0050, USA.

This book contains a wealth of good information on most aspects of raising

rabbits. Extensive chapters on breed selection, handling and management of rabbits, rabbit nutrition, feeds and feeding, toxins found in feeds, and rabbit diseases make this an excellent reference. For those interested in selective breeding to improve herd quality, there is a section on rabbit breeding and genetics.

Rabbit Production is written primarily for a U.S. audience, and lacks substantial discussion of special considerations for the tropics or of low-cost techniques.

This is a valuable book for the rabbit raiser, but beginners will find **Raising Rabbits** to be an easier book to start with.

Raising Healthy Rabbits Under Primitive Conditions, MF 05-265, booklet, 93 pages, by Sheldon Biven, Kathleen Murray, and Glenn Olsen, \$5.00 donation if you can afford it, otherwise free, from Christian Veterinary Mission, World Concern, 19303 Fremont Avenue, Seattle, Washington 98133, USA.

Rabbits "do not compete for grains used for human consumption, since they can reproduce and grow on low-grain, high-forage diets; unlike chickens, they can be successfully raised on a diet consisting largely of forage plants, grasses, and shrubs ... rabbits can use these sources of protein more efficiently than most other animals and they have a high feed conversion ratio. Weaning rabbits can gain one kilogram of body weight for each 2.5-4.0 kilograms of plants they eat. For beef cattle on a similar diet, 12-15 kilograms of feed are required per kilogram of body weight."

The text covers cages, feeders, watering devices, diseases, and a variety of foods that are alternatives to commercial feeds.

This has a greater quantity of more easily understood technical information than **Try the Rabbit**. "During unusually warm weather, the two most important requirements for rabbits are shade and good air circulation. In addition, rabbits should have a good supply of fresh water. Newborn litters and pregnant does are most susceptible to heat stress. Signs of heat stress include extreme restlessness in early stages and, in young animals, rapid respiration, excessive moisture around the mouth, and small hemorrhages on nostrils. Place a rabbit suffering from heat stress in a quiet, cool, well-ventilated location. Wet the rabbit or give it a cloth soaked in water to lie on."

Try the Rabbit, MF 05-264, book, 52 pages, by S.O. Adjare, 1984, Technology Consultancy Centre, £4.95 from ITDG.

A rabbit-raiser with 25 years of experience in Ghana provides basic advice in this little book. Much of this advice is relevant for rabbit-raising anywhere. There are a few photos and drawings.

"How to catch a strayed rabbit: Upon spying the escaped rabbit, try to maneuver yourself to stand in front of the rabbit. Then crouch down and widely spread the fingers of both hands near the rabbit's face. The rabbit will stop and lower its ears in readiness for arrest. Do not chase it from behind as this will be an unsuccessful pursuit."

The Rabbit as a Producer of Meat and Skins in Developing Countries, MF 05-248, book, 36 pages, by J.E. Owen, D.J. Morgan and J. Barlow, 1977, TDRI, out of print.

This is a brief discussion of rabbit raising in the tropics, not a how-to manual. "Rabbit production on a relatively small scale, involving minimal inputs, could

make a substantial contribution to the supply of animal protein for human consumption in tropical developing countries"

The authors discuss the effects of heat and humidity on rabbits, housing, diseases, feeding, breeds and breeding, slaughter and processing, rabbit skins, and problems with escaped rabbits.

"Heat is one of the most important environmental factors which may affect rabbits in tropical developing countries. At ambient temperatures above approximately 30 degrees Centigrade, rabbits suffer increasing discomfort and physiological stress (These effects) can be greatly reduced by the construction of suitably designed housing ... using locally available materials."

A nice introduction to rabbit raising, with a lot of facts and illustrations.

The Water Buffalo, Animal Production and Health Series #4, MF 05-227, book, 283 pages, FAO, 1979, \$19.00 from UNIPUB.

This book seems to cover everything one might want to know about water buffaloes, including the types, reproduction, nutrition, diseases, parasites, management, training, and milk and meat production.

Tropical Pastures and Fodder Crops, book, 135 pages, by L.R. Humphreys, 1978, Longman Group Ltd., Dfl. 21.95 from TOOL.

Pasture improvement offers the possibility, in some cases, of raising the output and profitability of livestock operations. This text begins with a brief discussion of factors controlling the development of natural grassland, and the philosophy of pasture improvement. It then presents a variety of new and improved pasture plants, discusses pasture establishment, soil fertility and fertilizer, and pasture management practices.

This book was written to be used as a college or university-level text. Readers without any botanical background will have to translate from scientific plant species names to the locally used names.

Tropical Feeds: Feeds Information Summaries and Nutritive Values, MF 05-222, book, 529 pages, 1975, by Bo Gohl, FAO Feeds Information Centre, out of print.

"Published information on the nutritive value of feeds in general is scanty, and when it comes to tropical feeds, it is almost non-existent. Correct data on the nutritive value of local feed-stuffs are essential for the expansion of the livestock industry in the developing countries." This enormous reference book covers 650 tropical feeds, most of them tropical plants. "The summaries include short descriptions of the feeds and the more important points in their use." Many references for additional information on specific feeds are provided.

General considerations for use are given at the beginning of each feed group (e.g., grasses, legumes, root crops, oil cakes). In the miscellaneous categories, feeds such as grain distillers' byproducts (left over when alcohol fuels are produced from grain) are discussed. At the end of the book, charts offer such information as crude protein content, metabolizable energy per kilogram, and mineral and vitamin content of the feeds. The index allows the reader to look up plants under either their botanical or English names.

ADDITIONAL REFERENCES ON AGRICULTURE

Liklik Buk has information on a large number of tropical plants; see GENERAL

People's Workbook covers crops and animals for South Africa; see GENERAL

Aspects of Irrigation with Windmills and **Syllabus for Irrigation with Windmills** are in ENERGY: WIND.

Food or Fuel: New Competition for the World's Cropland examines the potential effects of large-scale alcohol fuel production on the world food supply; see ENERGY: GENERAL.