

total number of weeds could be reduced by the companion plants. The number of species was also influenced. Grasses as companion plants suppressed weed growth to a greater extent than clover. Reducing the growth of the companion crop at the 2-leaf stage of maize development led to the best results in terms of weed control with the least detriment to the maize. Within the crop sequence the consequences of insufficient weed control were evident even after 2 years, for example, in the case of early-seeding weeds when the suppression of the companion crop was too late.

XI WATER MANAGEMENT

210

88 - 11/1

Water management

Review, book, dryland, water conservation, soil conservation, erosion, wells, water lifting, surface water storage, organization for action

CHLEQ, J.-L. and DUPRIEZ, H.

Vanishing land and water.

Macmillan Publishers/Terres et Vie, 1988, 117 pp., ISBN 0-333-44597-X; distributor: CTA, P.O.B. 380, 6700 AJ Wageningen, Netherlands

Rains are infrequent in the semiarid regions such as the Sahel and Sudan savanna zones, which stretch across Africa from the west coast to the horn of Africa in the east and which include the Kalahari and Namib areas of southern Africa. The rains last 3-4 months of the year and are often erratic and torrential. Man is powerless to alter the rate of precipitation. Of the other hand, he is not powerless when it comes to holding back, storing and using sparingly the rainwater that falls on his fields. Using methods to trap water and stop the loss of soil around the village, he can ensure water penetration for the benefits of crops, store water for periods of drought, and make sure that fertile clay stays in the settlement.

This book sets out to show how artisan crafts dealing with water supply problems can play an important role in village life in dry lands. Water crafts are direct and indirect sources of revenue. They are a direct source of income for water craft artisans and an indirect source of income for cultivators and pastoralists who benefit from the water resources on their land, thanks to the advice and skills of local artisans.

This book was inspired by village schemes in Sahelian Burkina Faso. They extended over a long period and involved close collaboration between villagers, artisans and technicians. These people worked together to find solutions to the problems of water runoff, and the use and exploitation of water resources. The techniques described are limited. Many other techniques exist and have been described in other publications. But what is striking about the experience of the GARY (Groupement des Artisans Ruraux du Yatenga = Group of Yatenga Rural Artisans) is that the level of practical skills acquired by villagers is quite high.

This book advocates cooperation between all the people concerned. The technical aspects, sometimes described in great detail, are only meaningful if they are accepted as something to be thought about by water technicians and their village partners. In other words, this book is not designed just for technicians. Its whole aim is to spark off useful discussions between the parties concerned. If this exchange is initiated, technical solutions will be found - maybe the solutions put forward here, or maybe others inspired by these solutions.

The Land and Life Series is aimed at practitioners and students of agriculture and rural development and associated vocational and technical skills. The books in the series treat topics according to appropriate, small-scale and affordable technology taking into account traditional ways but adding relevant modern improvements. For training, they can be used in secondary schools and vocational training centres and colleges up to the diploma and degree level, but they are chiefly meant to be used in the field, in practice. They are ideal for self-help, adult education and rural extension projects. They are written in a clear and highly illustrated style and thus can be used equally by those for whom English is a second language and by non-specialists. All the titles in the series are designed and produced as low-cost editions. Although based on African practice, the books are relevant to similar climatic regions in other continents.

The Land and Life Series is co-published with Terres et Vie, from whom French language editions are also available. Translation from French to English was financed by CTA.

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88 - 11/2

Water management

Arid zones, water management, study appropriate technology, food production

KRANTZ, B.A.

Water conservation, management, and utilization in semiarid zones: advances in food-producing systems for arid and semiarid lands.

Part A.

Ed. J.T. Manassah, E.J. Briskey, 1981, pp. 339-378.

This paper discusses efforts to alleviate shortfalls in food production and a deterioration of the resource base in many areas, through interdisciplinary and cooperative Farming Systems Research. It has been found that: dry sowing on deep Vertisols is successful if the early monsoon rains are dependable; introduction of tool carriers results in greater timeliness and improved efficiency of draft-animal use; the broadbed- and furrow system reduces erosion, improves crop drainage, and facilitates supplemental irrigation and cultural operations; double cropping in deep Vertisols shows promise for greatly increased food production, and intercropping increases total yields substantially. Watershed-based resource development and management contribute significantly to greater productivity and resource conservation. Improved farming systems, tested for 6 years in operational-scale research watersheds, consistently result in more than fourfold increase in rainfall productivities over traditional systems. Cooperative on-farm research to involve farmers in appropriate technology development and to search for effective forms of group action is discussed. The paper was presented at the Symposium on "Advances in Food Producing Systems for Arid and Semiarid Lands", held in Kuwait in April 1980.

Abstract from WAERSA

212

88 - 11/3

Water management

West Africa, water management, water drainage, dam building, hydraulic engineering, agronomy, sociology, economics, rural development

BERTON, S.

La maîtrise des crues dans les bas-fonds: petits et micro-barrages en Afrique de l'ouest (Control of flood in the shallows: small dams and micro-dams in West Africa).

GRET - Le point sur. Dossier No. 12, 1988, 495 pp.; available from: GRET, 213 rue la Fayette, F-75010, Paris, France

In tropical areas, shallows correspond to the bottom of small valleys and represent the main line for water drainage. Thus, these shallows are the essential focus for agricultural intensification which requires appropriate and antierosive layouts.

These small and tiny dams, which are multiplying everywhere, allow a better utilization of water and soils in the shallows, thus securing and increasing agricultural production. However, some of these dams are built too hastily and do not efficiently meet the needs of the population.

This publication gives many different details on hydraulic and agronomic as well as sociological and economic studies which have to be considered when laying out such dams together with the villagers. It sums up the technical data for each type of work. It is an indispensable guide for those who would like to see shallows become a real factor of rural development.

Abstract from Agriculture actualité (GEYSER)

213

88 - 11/4

Water management

Developing countries, water management, irrigated agriculture, planning, investment, drainage water

ALLAM, M.N. and MARKS, D.H.

Irrigated agricultural expansion planning in developing countries: investment scheduling incorporating drainage water use.

Water Resource Research, 20 (7), 1984, pp. 757-766

Agricultural expansion planning in developing countries where there is extensive government involvement in the planning process can be defined as a two-level hierarchy. At the first level, the role of the agricultural expansion investment in achieving the strategic goals of the sector is to be determined. At the second level, analysis of the agricultural expansion is to be conducted in such a way that the strategic decision from the first level can be implemented. The focus of this paper is on analyzing investment scheduling, the major issue of the second level. A mathematical optimization model is built to aid in analyzing the scheduling problems of land development, crop selection, drainage water re-use and capacity expansion of irrigation and drainage networks. A

minimum cost criterion is used, where costs of land development, farming, irrigation and drainage infrastructures, maintenance and operations, and pump stations are considered. The model has a nonlinear objective function to explain economies of scale and linear and nonlinear constraints. A fixed charge approximation is used for the nonconvex functions, and a mixed programming algorithm, with an enumeration procedure, is used for solving the model. The solution procedure guarantees global optimality for the approximated problem. A hypothetical expansion of 70 000 acres (28 350 ha), based on data from the Nile Delta in Egypt, is used as a case study to illustrate the procedure under different conditions of irrigation water quality.

Authors' summary

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88 - 11/5

Water management

Developing countries, book review, water management, resources, water distribution, utilization, technical cooperation, projects, water supply, hydraulic engineering

GTZ

Infrastructure, facts and figures 1987: hydraulic engineering and water resource development projects
Schriftenreihe der GTZ, No. 200, 1987, 263 pp., ISBN 3-88085-336-3; distributor: TZ-Verlagsgesellschaft, P.O.B. 36, D-6101 Roßdorf 1, FRG

A sufficient supply of safe water for human and animal consumption, agriculture, trade and industry combined with hygienic waste water and solid waste disposal, play a key role in improving socioeconomic living conditions in both rural and urban areas. Drinking water being one of man's vital needs, water supply is a field rich in traditional techniques developed by the populations themselves over the ages. Water supply projects are therefore increasingly geared to initiating and reinforcing active self-help efforts by the local people, while simultaneously being in line with the administrative and supply structures specific to each country, whose agreement and support must also be ensured. For this approach to project work, the target group must be fully informed and aware of their situation, and involved in planning, construction and supervision of water supply facilities at as early a stage as possible. Only appropriate technological solutions can be considered which will be understood and accepted by the local population. The self-help approach can be optimally realized, for example, in the case of flood protection, erosion, control and other hydraulic engineering activities. Water distribution and utilization are often a matter for the state, government agencies or public sector utilities. Institution-building is therefore of major importance in technical cooperation projects concerned with hydraulic engineering and water resource development. A major criterion governing the design and implementation of projects in the water sector is their environmental impact. No factor

is so central to natural and sociocultural environment as water - the immediate examples are how deforestation, erosion and over-exploitation of groundwater affect water balance, or how water pollution restricts the use of surface water. It is imperative that water - often a scarce and always a sensitive commodity, but so essential for life - be put to ecologically sound, well-planned and thrifty use.

This publication presents the GTZ service package in the hydraulic engineering and water resources development sector. It describes projects in the fields of hydrology, hydrometeorology, hydrogeology, water resource development, watercourse regulation, water pollution control, water resources protection, and port construction, planning and operations. The book contains the following chapters:

- Project Overview
 - Index according to country, project number and GTZ section
- Part I
 - Water resource development
 - Ports projects
 - Profile of ongoing projects
- Part II
 - Water supply and sanitation projects
 - Profile of ongoing projects
- Part III
 - Hydraulic engineering projects
 - Profile of ongoing projects

This book is intended to provide basic information for all those committed to the promotion of the water sector in the interests of developing countries.

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88 - 11/6

Water management

Review, arid and semiarid zones, rainfed agriculture, water management, development

DAVIS, T.J.

Development of rainfed agriculture under arid and semiarid conditions.

Proc. of the 6th Agriculture Sector Symposium; World Bank, Washington, 1986, 412 pp., ISBN 0-8213-0817-3; available from: World Bank Headquarters, 1818 H Street, N.W. Washington, D.C. 20433, USA

These proceedings are the sixth in a series of records of Agricultural Sector Symposia presented at the World Bank since 1980. The theme of the present publication was chosen as being a critical subject area for about 70% of the world's farmers and a subject on which less has been accomplished in terms of achieving productivity gains in world agriculture. This fact, coupled with the recent droughts in Africa, make the subject even more timely. An assessment of the Bank's experience in rainfed agriculture was given. Other papers covered principle divisions of the theme including environment, technology, institutions, and policy issues in rainfed agriculture. In addition three sessions focused on work

in semimechanized systems, small-scale water conservation, and sorghum and millet breeding.

XII SOIL FERTILITY

216

88 - 12/1

Soil fertility

Review, proceedings, developing countries, tropics, soils, soil fertility, ecosystems

GARVER, C.L.

Management of acid tropical soils for sustainable agriculture. IBSRAM Proceedings No. 2, 1987, 299 pp., ISBN 974-7614-39-1

Acid tropical soils - Oxisols and Ultisols - support an increasingly large proportion of the developing world's population, but technologies for their sustained production are at early stages of development. Recognizing the urgency of this situation, IBSRAM organized the inaugural workshop on management of acid tropical soils for sustained production. The importance of this meeting is quite evident from the following facts:

- Acid tropical soils account for about 1 billion ha of land around the world.
- Of this area, acid humid tropical ecosystems comprise about 700 million ha, while acid savannas occur on about 300 million ha. Both ecosystems are located primarily in the developing world.

Brazil and Peru, the host countries of the inaugural workshop of the Acid Tropical Soils Management Network, contain highly representative areas of both the humid tropics (Yurimaguas) and the acid savannas (Brasilia). Traditional farming systems on the acid soils of the tropics are mainly based on the slash-and-burn method of shifting cultivation. After a few years of cropping, this land is reverted to bush fallow and, over many years, returns to forest. Population pressure, however, has forced many farmers to intensify cropping on these areas, which exposes many of the soils to chemical and physical degradation.

The most common constraints to agriculture on Oxisols and Utisols are high soil acidity, associated secondary and micronutrient disorders, and low available phosphorus. In addition, nitrogen and sulfur deficiencies and a high susceptibility to compaction and erosion may occur to varying degrees.

The conquest of the agricultural frontier has to be made at a very low cost on a per-hectare basis. To achieve this goal, research, knowledge generation and management will play a fundamental role in removing constraints to agricultural production in the humid tropics, especially in areas such as:

- soil fertility evaluation,
- availability of germplasm tolerant to soil stresses,
- management of soil acidity,
- nitrogen fertilizer efficiency,
- phosphorus fertilizer management,
- biological nitrogen fixation,
- land-clearing methods, and
- improved farming systems, including:
 - . sustained production in Oxisols and Utisols,