

# INTERCROPPING

Proceedings of the  
Second Symposium on  
Intercropping in Semi-Arid Areas,  
held at Morogoro, Tanzania,  
4-7 August 1980

Editors: C.L. Keswani  
and B.J. Ndunguru

**ARCHIV**  
**49306**

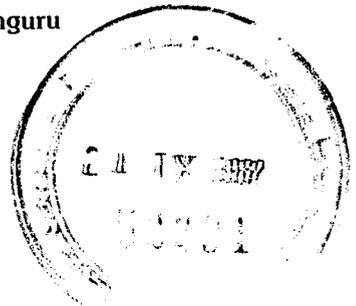
49306

IDRC-186e

# INTERCROPPING

Proceedings of the Second Symposium on  
Intercropping in Semi-Arid Areas,  
held at Morogoro, Tanzania, 4-7 August 1980

Editors: C.L. Keswani and B.J. Ndunguru



University of Dar es Salaam  
Tanzania National Scientific Research Council  
International Development Research Centre

AN 2001  
626.584123  
15

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

©1982 International Development Research Centre  
Postal Address: Box 8500, Ottawa, Canada K1G 3H9  
Head Office: 60 Queen Street, Ottawa

Keswani, C.L.  
Ndunguru, B.J.

University of Dar es Salaam, Dar es Salaam TZ  
Tanzania National Scientific Research Council, Dar es Salaam TZ  
International Development Research Centre, Ottawa CA

IDRC-186e

Intercropping : proceedings of the Second Symposium on Intercropping  
in Semi-Arid Areas, held at Morogoro, Tanzania, 4-7 August, 1980. Ottawa,  
Ont., IDRC, 1982. 168 p. : ill.

/Intercropping/, /semi-arid zone/ — /agricultural research/, /Africa/, /culti-  
vation practices/, /plant breeding/, /plant protection/, /crop yield/, /research  
results/, /research methods/.

UDC: 631.584(213)

ISBN: 0-88936-318-8

Microfiche edition available

## Contents

Foreword *R. Bruce Scott* 7

Addresses to the Participants

Welcoming address *N.A. Kuhanga* 10

Opening address *Hon John S. Malecela* 12

Agronomy

Summary and conclusions *B.J. Ndunguru* 16

Comparative development and yield and other agronomic characteristics of maize and groundnut in monoculture and in association *O.T. Edje* 17

Evaluation of soil-testing methods for available potassium in some soils of Morogoro *B.R. Singh, A.P. Uriyo, M. Kilonde, and John J. Msaky* 27

Intercropping maize or millet with soybean, with particular reference to planting schedule *E.N. Nnko and A.L. Doto* 33

Some observations on the effects of plant arrangements for intercropping *K.W. May and R. Misangu* 37

Agroforestry: preliminary results of intercropping *Acacia, Eucalyptus, and Leucaena* with maize and beans *J.A. Maghembe and J.F. Redhead* 43

Intercropping under marginal rainfall conditions in Kenya *Hassan M. Nadar* 50

Influence of plant combinations and planting configurations on three cereals (maize, sorghum, millet) intercropped with two legumes (soybean, green-gram) *D.B. Nyambo, T. Matimati, A.L. Komba, and R.K. Jana* 56

Density of dry beans (*Phaseolus vulgaris*) interplanted with maize (*Zea mays*) — summary *W. de Groot* 63

Evaluation of phosphorus placement methods and nitrogen carriers under conditions of maize-bean intercropping — summary *Andrew P. Uriyo, Budh R. Singh, and John J. Msaky* 65

Effect of planting schedule and intercropping systems on the production of green-gram (*Phaseolus aureus* Roxb.) and bulrush millet (*Pennisetum americanum* (L.) Leeke) — summary *K.W. May* 66

Influence of intercropping methods on foliar NPK contents and yields of maize and cowpeas — summary *H.O. Mongi, M.S. Chowdhury, and C.S. Nyeupe* 67

Modifying the competitive relationship in maize-bean mixtures in Kenya — summary *O.E. Hasselbach and A.M.M. Ndegwa* 68

Physiological aspects of maize and beans in monoculture and in association — summary *O.T. Edje and D.R. Laing* 69

The relative importance of above- and below-ground resource use in determining yield advantages in pearl millet/groundnut intercropping — summary *M.S. Reddy and R.W. Willey* 70

Effects of moisture availability on intercropping and yield advantages — summary *M. Natarajan and R.W. Willey* 71

Performance of a maize-legume intercrop system in Sri Lanka — summary *H.P.M. Gunasena* 72

Effect of minimum tillage, mulches, and fertilizers on intercropped cowpeas with maize — summary *A.A. Mashina and R.K. Jana* 73

Increased resource exploitation through intercropping with cassava — summary *G.F. Wilson and T.L. Lawson* 74

Groundnut-maize interplanting in southern Mozambique — summary *A.D. Malithano and J. van Leeuwen* 75

#### Plant Breeding

Summary and conclusions *A.L. Doto* 78

Genotype evaluations and implications for adapting plant material for intercropping *K.W. May and R. Misangu* 79

Soybean-cereal intercropping and its implications in soybean breeding *M.M. Makena and A.L. Doto* 84

Genotype identification for intercropping systems — summary *D.S.O. Osiru* 91

#### Plant Protection

Summary and conclusions *C.L. Keswani* 94

A study of crop/weed competition in intercropping *N.R. Mugabe, M.E. Sinje, and K.P. Sibuga* 96

Intercropping of maize and cowpea: effect of plant populations on insect pests and seed yield *A.K. Karel, D.A. Lakhani, and B.J. Ndunguru* 102

Effect of intercropping on the severity of powdery mildew on greengram *C.L. Keswani and R.A.D. Mreta* 110

Bean production in monoculture and in association with maize: the effect of diseases and pest incidence — summary *H.A. Van Rheenen, O.E. Hasselbach, and S.G. Muigai* 115

Effect of intercropping on some diseases of beans and groundnuts — summary *J.K. Mukiibi* **116**

Effect of insecticide spray on insect pests and yield of sorghum and simsim in pure stand and in intercropping — summary *D. Kato, A.K. Karel, and B.J. Ndunguru* **117**

## Farming Systems

Summary and conclusions *B.J. Ndunguru* **120**

The use of farming systems research for understanding small farmers and improving relevancy in adaptive experimentation *M.P. Collinson* **121**

Asian experience in cropping systems research *Gordon R. Banta* **126**

An experimental approach for improving present cropping systems in tropical Africa *Peter Vander Zaag and Pierre Tegera* **131**

Farming systems economics: fitting research to farmers' conditions *J.W. Gathe* **136**

On-farm experiments: some experiences *C.N. Muriithi* **141**

Interaction between agronomic research and agricultural economic analysis to develop successful dryland cropping systems in Kenya *H.M. Nadar and Gordon E. Rodewald* **146**

Farming systems and farming systems research in Morogoro — summary *P. Anandajayasekeram* **155**

Farming systems research in Uganda: past performance and future prospects — summary *I. Fendru* **157**

Mixed cropping in Tabora region — summary *J.E. Mansfield* **158**

Farming systems research questions — summary *C.D.S. Bartlett and E.A.M. Okarie* **160**

## Concluding Remarks and Participants

Concluding Remarks *R. Bruce Scott* **162**

Participants **164**

similarities, and differences.

In view of these facts, a farming systems research program is being proposed. The basic aims of the program will be: (1) to develop more relevant and effective research methods and understanding of indigenous farming systems; (2) to evolve and develop improved or new technical components for alternative farming systems; and (3) to aid small farmers, who have, so far, been ignored by new technological developments in agriculture.

The farming systems research will be based in the Faculty of Agriculture and Forestry, Makerere University. The university farm at Kabanyolo, about 16 km away, will serve as the locus of the project. Cooperative farmers will be selected from within a radius of 80 km from Kabanyolo for logistical reasons. The project area will be extended to other parts of the country as and when resources permit.

The first step in the proposed FSR will be to establish the nature and magnitude of the various problems confronting small farmers. Most of the research will be conducted in farmers' fields because "on-farm" research enables farmers to be involved in formulating and testing farming system technologies under natural conditions and at many locations simultaneously. As well, it enables researchers to make recommendations that are directly relevant to local conditions, thereby allowing farmers to be grouped into recommendation domains based on the identification of similar circumstances.

The farming systems research will be multidisciplinary in approach and will consist of agronomic, soil management, pest and disease management, integrated crop and animal management, and socioeconomic studies. The ultimate goal of the research is to generate technological components that the farmer would be willing and able to adapt.

## Discussion

*Mukiibi* (comment): There was a suggestion from one of the participants that the agricultural systems in Uganda are robust enough not to require much improvement. I think this is incorrect. At the moment, there is famine in Uganda, which indicates that there is a delicate balance between production and consumption. Actual production is at least four times less than potential production, so there is a great deal of room for improving the farming systems in Uganda.

*Brain* (question): Is not the real problem in Uganda an absence of marketing and buying systems rather than farming systems per se, which were very effective in the past?

*Fendru* (answer): The farmer is faced with a whole array of problems. Our aim is to find out what farmers are doing now. There is a shift from cash crops to food crops due to the risk of not selling, which can be counteracted by their consumption.

## Mixed Cropping in Tabora Region — Summary

J. E. Mansfield

*TRIDEP, Tabora, Tanzania*

Tabora region is located in west-central Tanzania. It occupies an area of approximately 73 500 m<sup>2</sup> and is of relatively low relief, ranging from 1050 m above sea level in the northeast and northwest to 1500 m in the southeast. The climate is warm, with mean maximum temperature of around 30°C. Rainfall is markedly seasonal, occurring between November and May, the mean rainfall ranging from 1000 mm in the west to 700 mm in the northeast.

The climate is unsuitable for perennial crops; therefore, this paper dealt mainly with upland annual rain-fed crops grown within the region.

The important upland cash crops are tobacco and cotton. In addition, other commonly grown crops in the area include: rice, maize, sorghum, and millet. Legumes such as groundnuts, French beans, cowpeas, bambara nuts, green-grams, and pigeon peas are found in mixed cropping. Cassava and sweet potatoes are grown as root crops. Sunflower also finds a place in mixed crop fields. Maize is the preferred cereal staple throughout most of the region, even in the areas of low rainfall.

The important environmental factors of the region may be said to be the dominance of coarse- or medium-textured soils of low fertility. Rainfall is

variable from year to year and is suitable only for growing rain-fed annual arable crops. Two-thirds of the region is in a relatively high rainfall area (800-1000 mm), with the remainder of the region receiving less than 800 mm of rainfall. This mean rainfall difference gives rise to a drier type of vegetation and higher risk of long dry spells. Within the two rainfall areas, one finds the relatively small amount of highly fertile, dark brown to black, cracking clays on which most of the cotton is grown.

Spacing of the maize component of mixtures appeared to increase with increasing complexity of the mixtures and there appeared to be an awareness to vary spacing according to the crop components and the complexity of the mixtures. Root-crop mixtures usually occupy the smallest plots (<0.1 ha) and are concentrated near the homestead. The complexity of the mixture tended to decrease with distance from the homestead and few farmers appear to cultivate at distances greater than 2.5 km from the homestead.

Mixture combinations vary from year to year. It is a highly flexible system that has developed over the years and it is highly resistant to changing to monocropping as far as family food crop production is concerned.

Early maturing varieties of maize are favoured in the low rainfall areas, except where soils are fertile and have a high water-holding capacity. Yields from accurately measured plots, based on farmer recall, showed a trend toward higher yields being associated with small areas (<0.1 ha). This was considered to be partly due to "greater exaggeration" and also because of receiving increased attention as a result of the plot being located close to the home and improved land fertility provided by small stock, refuse, and kraal manure. Yields show a high coefficient of variation and mean yield figures, therefore, are of limited value as a guide to the actual levels that can be expected.

Simple plot trials involving maize/groundnut and maize/sorghum mixtures showed that maize grown alone or in a mixture gave significantly higher yields in high rainfall districts than in lower rainfall areas, whether fertilized or not. Groundnuts in a mixture gave significantly higher yields

with fertilizer in low rainfall districts. There was no significant yield difference between maize grown alone or in a mixture in the high rainfall district. The maize component seemed to benefit most from the application of fertilizers. Coarse-textured soils gave higher mean yields of maize in the higher rainfall areas regardless of whether fertilizer was applied or not. Yields from medium- to fine-textured soils, without fertilizer, did not vary significantly with rainfall but the response to fertilizer was significantly higher in the high rainfall district. It is suggested that this may be partly due to the higher water-holding capacity of these soils counteracting the adverse effect of lower rainfall.

## Discussion

*Scott* (question): Based on the information that has been gathered and analyzed by Dr Mansfield for the Tabora area, it would be useful if he could comment on his recommendation for research, which could lead to increased and more stable production for farmers.

*Mansfield* (answer): Regarding whether or not interrow mixtures are the same as alternate-row combinations has been partly answered in papers already presented. Alternate-row combinations lend themselves to mechanizing mixed cropping for use in commercial production, should this prove the most economic form of production. This should be investigated. Due to the multiple choice element in plant populations it would seem questionable how much research effort should be put on this aspect of cultivation.

*Monyo* (question): Could you comment on the concept of a two-season pattern in a trimodal rainfall regime.

*Mansfield* (answer): I don't know the significance of this pattern, which is based on rain pattern and distribution as compared with monthly distribution. I may show a transition from a distinct bimodal pattern in the north to a nonmodal pattern in the south. It does indicate that, in practice, there are two rainfall troughs rather than one in January, the locally accepted "dry months."