INTERCROPPING
in semi-arid areas

Report of a symposium held at the Faculty of Agriculture, Forestry and Veterinary Science, University of Dar es Salaam, Morogoro, Tanzania, 10-12 May 1976

Editors:
J. H. Monyo, A. D. R. Ker, and Marilyn Campbell

IDRC-076e
Monyo, J. H.
Ker, A. D. R.
Campbell, M.
IDRC

/IDRC pub CRDI/. Report of a symposium on /intercropping/ in semi/arid zone/s in the /tropical zone/, with an examination of /agricultural research/ activities — examines the effects of intercropping on /crop/ /plant production/; includes /research result/s, /list of participants/, /bibliography/c notes.


Microfiche Edition $1
Intercropping in Semi-Arid Areas

Report of a symposium held at the Faculty of Agriculture, Forestry and Veterinary Science, University of Dar es Salaam, Morogoro, Tanzania, 10–12 May 1976

Editors: J. H. Monyo, A. D. R. Ker, and Marilyn Campbell

The views expressed in this publication are those of the individual author(s) and do not necessarily represent the views of IDRC.
Farmer's field near Ibadan, Nigeria, showing intercrop of cowpea under maize
## Contents

**Foreword**  A. D. R. Ker ......................................................... 5

**Addresses to the Participants**

Welcoming address  A. M. Hokororo .............................................. 8
Opening address  Hon Mr J. S. Malecela ........................................... 9

**Summaries of Papers Presented**

An appraisal of some intercropping methods in terms of
grain yield, response to applied phosphorus, and monetary
return from maize and cowpeas  Y. A. Sudi, H. O. Mongi,
A. P. Uriyo, and B. R. Singh .................................................. 12

Rhizosphere populations in intercropped maize and soybean
T. H. M. Kibani, C. L. Keswani, and M. S. Chowdhury ................... 13

Intercropping for increased and more stable agricultural
production in the semi-arid tropics  B. A. Krantz,
S. M. Virmani, Sardar Singh, and M. R. Rao ................................ 15

Cropping systems research: the scope and strategy for
research in crop combinations based on experience of
previous and current studies  B. N. Okigbo ................................... 16

Mixed cropping research at the Institute for Agricultural
Research, Samaru, Nigeria  E. F. I. Baker and Y. Yusuf .................. 17

Crop production practices in intercropping systems
R. C. Finlay ............................................................................. 18

Effects of crop combinations and planting configurations on
the growth and yield of soybeans, millet, and sorghum in
intercropping  R. K. Jana and V. M. Sekao .................................. 19

Intercropping with sorghum at Alemaya, Ethiopia
Brhane Gebrekidan .................................................................... 21

Studies on mixtures of maize and beans with particular
emphasis on the time of planting beans  D. S. O. Osiru and
R. W. Willey ............................................................................. 23

Intercropping of cassava with vegetables  G. F. Wilson
and M. O. Adeniran ...................................................................... 24

Some aspects of the productivity and resource use of
mixtures of sunflower and fodder radish  R. W. Willey and
D. A. Lakhani ............................................................................ 25

Preliminary results of intercropping trials in Zaire with
maize and certain legumes  Thomas G. Hart and Mangha Kewe ....... 27

(con’t.)
Contents (concluded)

Effects of maize height difference on the growth and yield of intercropped soybeans  D. R. Thompson, J. H. Monyo, and R. C. Finlay .................................................. 29

Intercropping as a means of producing off-season tomatoes during the hot summer months in the Sudan  A. T. Abdel Hafeez ................. 30

Development of cowpea ideotypes for farming systems in Western Nigeria  Olatunde A. Ojomo ................................................................. 30

Cereal–legume breeding for intercropping  R. C. Finlay ..................................... 31

Cowpea as an intercrop under cereals  H. C. Wien and D. Nangju .................. 32

Selection criteria in intercrop breeding  R. C. Finlay ..................................... 33

Experiments with maize–bean and maize–potato mixed crops in an area with two short rainy seasons in the highlands of Kenya  N. M. Fisher ................................................................. 37

Pest control in mixed cropping systems  H. Y. Kayumbo .................................. 39

Measuring plant density effects on insect pests in intercropped maize–cowpeas  B. M. Gerard .................. 41

Effects of spraying on yield of cowpeas grown in monoculture and under maize, sorghum, or millet  H. Y. Kayumbo, R. C. Finlay, and S. A. Doto .................................................. 44

Possible relationship between intercropping and plant disease problems in Uganda  J. Mukibi .................. 45

Attempted control of virus incidence in cowpeas by the use of barrier crops  S. A. Shoyinka ................................................................. 46

Induced resistance to bean rust and its possible epidemiological significance in mixed cropping  D. J. Allen .................. 46

A limited objective approach to the design of agronomic experiments with mixed crops  N. M. Fisher .................. 47

Systematic spacing designs as an aid to the study of intercropping  P. A. Huxley and Z. Maingu ................................................................. 50

Future directions of intercropping and farming systems research in Africa  A. D. R. Ker ................................................................. 51

Developing mixed cropping systems relevant to the farmers' environment  D. W. Norman ................................................................. 52

Assessment of innovations in intercropping systems  C. D. S. Bartlett, E. A. Manday, and G. I. Mlay ................................................................. 58

Summary and Conclusions  
D. W. Norman ................................................................. 59

H. Doggett ................................................................. 62

References ................................................................. 63

List of Participants ................................................................. 67
Rhizosphere Populations in Intercropped Maize and Soybean

T. H. M. Kibani, C. L. Keswani, and M. S. Chowdhury

Faculty of Agriculture, Forestry and Veterinary Science, University of Dar es Salaam, Morogoro, Tanzania

A rhizosphere is a region of contact between plant roots and soil from which plants obtain their nutrients and in which each plant exerts its particular effect on the soil by stimulating or inhibiting the growth of microorganisms. Similarly, it is also possible that microorganisms in the rhizosphere may have effects on the growth and yield of the plants. Rhizospheres of different plants harbour different microflora, and the quantitative and qualitative nature of the microflora depends on the age of the plant, the depth of the root system, and the physiological and nutritional status of the plant (1).

Gantotti and Rangaswami (2) have suggested that the rhizosphere microflora in association with the roots of growing plants plays a vital role in improving soil structure. Gerretsen (3) described the enhancement of nutrient uptake by plant roots under the influence of microflora and observed that under sterile conditions without bacteria the uptake of phosphate proceeds at a lower rate than in the presence of bacteria. The rhizosphere of maize contains bacteria capable of releasing phosphorus from its compounds (3, 4).

Several studies have been done on the influence of microflora on the growth and yield of crop plants (5, 6, 7), but these studies involve monoculture conditions. Shantaram and Rangaswami (8) studied rhizosphere microflora of mixed crops using sorghum (Sorghum vulgare Pers.) and sunhemp (Crotalaria juncea Linn.) under greenhouse conditions.

This study dealt with rhizosphere and nonrhizosphere fungal and bacterial populations of soybean (Glycine max (L.) Merr.) and maize (Zea mays L.) under intercropped and monoculture conditions. Since both crops were grown simultaneously in intercropping, it is hypothesized that root exudates from either of the crops may have effects on the rhizosphere microflora and consequently on the availability of nutrients to plants. Therefore, an attempt was made to assess the microbial population in the rhizosphere and nonrhizosphere soils of maize and soybean under intercrop and monoculture conditions and its relation to crop yield under field conditions.

Results showed that the rhizosphere microbial population was greater than the nonrhizosphere microbial population. Maize intercropped with soybean showed an increase of 1.10 and 9.19% fungal and bacterial populations in its rhizosphere, respectively. Unlike maize, soybean showed a decrease of 11.74% of fungal population and an increase of 3.52% in bacterial population in its rhizosphere. Intercropping increased the bacterial R:S ratios of maize and soybean whereas fungal R:S ratio showed a decrease in both cases when compared to monoculture conditions. Yields of maize increased by 33.97% in intercropping compared to monoculture, whereas...
yields of soybean decreased by 51.14% compared to monoculture. *Rhizopus microsporus* was predominant in the rhizosphere soil of maize under both farming systems, and *R. microsporus* and *Aspergillus niger* were predominant in the rhizosphere of soybean under intercrop and monoculture, respectively. *A. niger*, *Penicillium variable*, and *A. terreus* were predominant in the nonrhizosphere soil of maize and soybean under both cropping systems.

Although there were some qualitative and quantitative differences in fungal populations in intercropped and monoculture conditions, there seems to be no relationship between these parameters and yield in either maize or soybean.