Tuio-

Learning about Sustainable Cocoa Production: A Guide for Participatory Farmer Training

1. Integrated Crop and Pest Management

Compiled and edited
by

Sonii David

November 2008 version

Sustainable Tree Crops Program
International Institute of Tropical Agriculture

Copyright © 2008 IITA

The International Institute of Tropical Agriculture (IITA) holds the copyright to this publication. This document and all illustrations may be freely copied and distributed on a non-commercial basis, provided that IITA is clearly acknowledged. Proper citation is requested and prohibits modification of these materials.

Correct citation

S. David (ed.). 2008. Learning about sustainable cocoa production: a guide for participatory farmer training. 1. Integrated crop and pest management. Sustainable Tree Crops Program, International Institute of Tropical Agriculture, Accra, Ghana. September 2008 version

---

Sustainable Tree Crops Program
Regional Office
International Institute of Tropical Agriculture (IITA)
P.O. Box 135, Accra, Ghana
International mailing: c/o IITA Ltd.
Carolyn House, 26 Dingwall Road
Croydon, CR9 3EE, U.K
http://www.treecrops.org
http://www.iita.org
Email: stcp-wca@cgiar.org

Contributions by:

Cocoa Research Institute of Nigeria

About STCP

The Sustainable Tree Crops Program (STCP) constitutes a coordinated and innovative effort made by farmers and producer organizations, industry and trade, national governments, research institutes, the public sector, policymakers, donors and development agencies to facilitate the improvement of smallholder agricultural systems based on tree crops in West and Central Africa. The goal of STCP is to improve the economic and social wellbeing of smallholders and the environmental sustainability of tree crop farms in West and Central Africa. STCP is hosted and managed by the International Institute of Tropical Agriculture.

About IITA

The International Institute of Tropical Agriculture (IITA) was founded in 1967 as an international agricultural research institute with a mandate for improving food crop production in the humid tropics and to develop sustainable production systems. It became the first African link in the worldwide network of agricultural research centers known as the Consultative Group on International Agricultural Research (CGIAR), formed in 1971.

IITA's mission is to enhance the food security, income, and well-being of resource-poor people in sub-Saharan Africa by conducting research and related activities to increase agricultural production, improve food systems, and sustainably manage natural resources, in partnership with national and international stakeholders.

Contents

Contributors and acknowledgements VI

Preface X

Glossary of technical terms XII

Part I: Technical bulletins for trainers 1

Black pod disease, including tree canker 2

Cocoa Swollen Shoot Virus (CSSV) 5

Mirids (capsids) 6

Stem borer 8

Termites (white ants) 10

Rodents (squirrels and rats) 12

Mistletoe 13

Cocoa dieback 14

Rational pesticide use 16

Reducing pesticide residues in cocoa 20

Applying pesticides safely and effeciently on cocoa farms 21

Farm maintenance 24

Pruning 25

Farm sanitation 27

Understanding soil nutrients for improved management of cocoa farms 29

Applying fertilizer to cocoa trees 32

Harvesting, pod storage and breaking 35

Fermentation 36

Grading, storage, farmer quality checks 38

Child labour in cocoa production 39

Part II: Discovery learning exercises 41

Module 1: Starting FFS (SFFS) 42

SFFS exercise 1: Cocoa cropping calendar 43

SFFS exercise 2: Nine Dot Game 45

SFFS exercise 3: Ballot box 48

SFFS exercise 4: Getting to know each other 55

Module 2: Agro-Ecosystem Analysis (AESA) 67

AESA exercise 1: Agro-ecosystem analysis 69

AESA EXERCISE 2: MONITORING POD HARVESTS ON FFS PLOTS 82

MODULE 3: CROP HUSBANDRY (CH) 88

CH EXERCISE 1: IMPACT OF SHADING ON HUMIDITY IN A COCOA FARM 89

CH EXERCISE 2: PRUNING OLDER COCOA TREES 91

CH EXERCISE 3:THE ROLE OF SPACING, LIGHT AND SHADE IN DETERMINING THE ARCHITECTURE OF COCOA TREES 96

CH EXERCISE 4: ROLE PLAY ON THE IMPORTANCE OF SOIL FERTILITY FOR COCOA PRODUCTION 98

CH EXERCISE 5: THE EFFECTS OF FERTILIZERS ON COCOA PLANTS 102

CH EXERCISE 6: THE EFFECTS OF FERTILIZERS ON MATURE COCOA TREES 105

MODULE 4: MANAGING COCOA DISEASES AND PESTS (CDP) 108

CDP EXERCISE 1: IMPACT OF HUMIDITY AND THE ROLE OF DISEASED PODS IN SPREADING BLACK POD 109

CDP EXERCISE 2: COCOA DISEASE INFECTION STUDY 111

CDP EXERCISE 3: ROLE OF SOIL IN THE SPREAD OF BLACK POD DISEASE 113

CDP EXERCISE 4: BLACK POD DISEASE ZOO IN THE FIELD 115

CDP EXERCISE 5: INSECT ZOO I - SYMPTOM DEVELOPMENT 117

CDP EXERCISE 6: INSECT ZOO II—SYMPTOM DEVELOPMENT 120

CDP EXERCISE 7: INSECT ZOO - PREDATION EXERCISE 123

CDP EXERCISE 8: INSECT ZOO - LIFE CYCLE DEVELOPMENT 125

CDP EXERCISE 9: DETERMINING MIRID DAMAGE THRESHOLD FOR ESSENTIAL INSECTICIDE APPLICATION 127

CDP EXERCISE 10: IDENTIFYING COCOA SWOLLEN SHOOT VIRUS AND UNDERSTANDING HOW THE DISEASE SPREADS 130

CDP EXERCISE 11: THE BENEFITS OF DETECTING COCOA SWOLLEN SHOOT VIRUS EARLY 134

MODULE 5: RATIONAL PESTICIDE USE (RPU) 137

RPU EXERCISE 1: DECIDING TO APPLY PESTICIDES ON COCOA 138

RPU EXERCISE 2: UNDERSTANDING PESTICIDE REGULATIONS 141

RPU EXERCISE 3: CALIBRATION AND PERFORMANCE OF SPRAYERS 144

RPU EXERCISE 4: IMPROVED SPRAYING PRACTICES FOR MIRID CONTROL 147

RPU EXERCISE 5: PESTICIDE SPECIFICITY 149

RPU EXERCISE 6: SPRAY DYE EXERCISE 151

RPU EXERCISE 7: BOTANICAL PESTICIDE SCREENING 153

RPU EXERCISE 8: PESTICIDE RESISTANCE ROLE-PLAY 155

MODULE 6: COCOA QUALITY (CQ) 158

CQ EXERCISE 1: IMPACT OF POD MATURITY ON FERMENTATION AND COCOA QUALITY 159

CQ EXERCISE 2: DRYING COCOA ON A RAISED, COVERED PLATFORM 161

CQ EXERCISE 3: ALTERNATIVE FERMENTATION METHOD 163

CQ EXERCISE 4: DRYING COCOA BEANS USING AN IMPROVED SOLAR DRYER 165

MODULE 7: ECONOMIC ANALYSIS (EA) 168

EA EXERCISE 1: ESTIMATING THE PROFITABILITY OF ICPM PRACTICES 169

EA EXERCISE 2: FFS IMPACT EVALUATION 174

MODULE 8: SOCIAL TOPICS (ST) 179

ST EXERCISE 1: AN INTRODUCTION TO CHILD LABOUR ISSUES 180

ST EXERCISE 2: CHILDREN CARRYING HEAVY LOADS IN COCOA PRODUCTION 183

ST EXERCISE 3: THE USE OF PESTICIDES AND CHEMICALS BY CHILDREN ON COCOA FARMS 185

ST EXERCISE 4: THE USE OF SHARP FARM TOOLS BY CHILDREN IN COCOA CROPPING ACTIVITIES 187

ST EXERCISE 5: UNDERSTANDING MALARIA 189

ST EXERCISE 6: RAISING AWARENESS ABOUT HIV/AIDS 192

ST EXERCISE 7: HIV/AIDS RISK MAP 195

MODULE 9: BEHAVIOUR CHANGE, GROUP DYNAMIC AND ENERGIZER EXERCISES 197

BEHAVIOUR CHANGE EXERCISE 1: ATTITUDES AFFECTING HOW FARMERS CHANGE THEIR FARMING PRACTICES 198

BEHAVIOUR CHANGE EXERCISE 2: THE EFFECTS OF SELF ESTEEM ON DECISION-MAKING 200

GROUP DYNAMIC EXERCISE 1: WATER BRIGADE 202

GROUP DYNAMIC EXERCISE 2: DIFFERENCES IN PERCEPTIONS: THE STORY OF SERWA 204

GROUP DYNAMIC EXERCISE 3: WHISPERING A MESSAGE 206

GROUP DYNAMIC EXERCISE 4: ROPE SQUARE 207

GROUP DYNAMIC EXERCISE 5: RELEASING ROPE 209

GROUP DYNAMIC EXERCISE 6: THE FARMER'S GOAT 210

GROUP DYNAMIC EXERCISE 7: FINDING ONE'S GROUP (ANIMAL SOUNDS) 212

ENERGIZER 1: FOLLOW ME 214

ENERGIZER 2: WAO CLAP 215

ENERGIZER 3: I HAVE A HAMMER 216

ENERGIZER 4: IN THE LAKE, OUT OF THE LAKE 217

PART III: GUIDES FOR CONDUCTING FIELD ACTIVITIES 218

SANITARY HARVESTING 219

REMOVING CHUPONS 220
REMOVING MOSS AND EPIPHYTES 222
REMOVING MISTLETOES 222
KILLING UNWANTED SHADE TREES IN A COCOA FARM 223
WHERE AND HOW TO APPLY GROUND FERTILIZERS 224
MAKING COMPOST 225
POST-HARVEST OPERATIONS 227

Contributors and acknowledgements

Financial support for this publication comes from the United States Agency for International Development (USAID), the World Cocoa Foundation (WCF), individual chocolate companies and trade associations.

Many people contributed to the development of this manual. We acknowledge, in particular, STCP Master Trainers Jean Yves Couloud (Cote d'Ivoire), Mary Adu Kumi and Sylvanus Agorkorku (Ghana), Innocent Okuku (Nigeria), Dieu ne dort Njankoua Wandji and Simon Bassanaga (Cameroon), facilitators and field school participants in the four countries whose comments and contributions helped to refine the farmer field school curriculum. Janny Vos (CABI Bioscience), Roy Bateman (IPARC, Imperial College), Peter van Grinsven (Masterfoods, the Netherlands), Martin Gilmour (Masterfoods U.K), B. K. Matlick (World Cocoa Foundation) and Joel Joffre (Yara International) provided expert technical advice in developing the technical bulletins and field guides.

The farmer field school curriculum contained in this manual was implemented, tested, evaluated, and improved within the framework of the STCP Pilot Projects. The STCP country managers, Jonas Mva Mva (Cameroon), Chris Okafor (Nigeria), Isaac Gyamfi (Ghana) and Robert Yapo Assamoi (Cote d'Ivoire), contributed substantially to this process with technical advice, methodological insights and supervision. Stephan Weise, STCP Regional Manager, made invaluable contributions to the FFS curriculum development process and this manual in many ways, including helpful comments on layout and design.

The discovery learning exercises contained in this manual are drawn from several sources. The proceedings of the STCP Curriculum Development Workshop held in Mbalmayo, Cameroon in March 2003 provided a basic set of discovery learning protocols. Jim Gockowski (STCP/IITA) and Janny Vos (CABI Bioscience) organized the workshop and compiled the first set of protocols. Contributors to that workshop included resource persons from the following institutions: Centre National de Recherche Agronomique (CNRA), Cocoa Research Institute of Ghana (CRIG), Cocoa Research Institute of Nigeria (CRIN), Institut de Recherche Agricole pour le Development (IRAD), CABI Bioscience, International Labour Organization (ILO/WACAP), ACDI-VOCA, SOCODEVI, Winrock International and the International Institute of Tropical Agriculture (IITA).

Additional discovery learning exercises were contributed by the following individuals/institutions:

Name/Source	Contribution
Roy Bateman (IPARC, Imperial College), Simon Bassanaga (STCP/IITA) and Innocent Okuku (STCP/FUTA)	▪ Targeted spraying for mirid control ▪ Calibration and performance of sprayers
Simon Bassanaga (STCP/IITA)	▪ Impact of harvesting time on fermentation and cocoa quality
CABI Bioscience, Discovery learning about cocoa: an inspirational guide for training facilitators	▪ Pesticide resistance role-play ▪ Role of soil in the spread of black pod
Simon Bassanaga (STCP/IITA) and Dieu de dort Njankoua Wandji (STCP/IITA)	▪ Insect zoo II-symptom development
Jean Yves Couloud (STCP/ANADER) and Innocent Okuku (STCP/FUTA)	▪ Drying cocoa on a raised, covered platform
Innocent Okuku (STCP/FUTA)	▪ Mirid damage threshold level ▪ Deciding which cocoa tree to rehabilitate or eliminate
Janny Vos (CABI Bioscience)	▪ Black pod disease zoo in the field ▪ Alternative fermentation method
Blaise Nkamleu (STCP/IITA)	▪ Estimating the profitability of new ICPM practices
Mary Adu-Kumi (STCP/Kuapa Kokoo), Sonii David (STCP/IITA) and Jim Gockowski(STCP/IITA)	▪ Monitoring pod harvests on FFS plots
Pierre Tondje, IRAD	▪ The role of soil in the spread of black pod

Name/Source	Contribution
Cocoa Swollen Shoot Virus Unit, Cocobod Ghana and Sonii David (STCP/IITA)	▪ Identifying cocoa swollen shoot virus and understanding how the disease spreads ▪ The benefits of detecting cocoa swollen shoot virus early
Sonii David (STCP/IITA)	▪ Getting to know each other ▪ Role play on the importance of soil fertility for cocoa production ▪ Understanding pesticide regulations ▪ Deciding to apply pesticides on cocoa ▪ FFS impact assessment
Sonii David (STCP/IITA) and Joel Joffre (Yara International)	▪ The effects of fertilizers on cocoa plants ▪ The effects of fertilizers on mature cocoa trees
Jean Yves Couloud Family Health International, Ghana	▪ Drying cocoa beans using an improved solar dryer ▪ Understanding malaria ▪ Raising awareness about HIV/AIDS
Deciding to apply pesticides on cocoa (A)	▪ West Africa Pesticide Programs www.wapp.biochem.vt.edu/documents/pse

Graphics

We gratefully acknowledge contributions by:

- Pierre Tondje, IRAD, Cameroon
- ACDI-VOCA, Indonesia
- Alexis Assiri, CNRA, Cote d'Ivoire
- Joel Joffre, Yara International

Photo credits

- Cover photos by Sonii David, STCP/IITA
- Photo of fermented beans by Martin Gilmour, Masterfoods
- Photos of drying platforms by Jean Yves Couloud, STCP/ANADER
- Photo of fermentation box by Janny Vos, CABI Bioscience

Preface

While cocoa has been grown in West and Central Africa since the early 1900s, using participatory approaches to train cocoa farmers is relatively new in this region. Cocoa extension programs have used traditional top down approaches such as the training and visit approach based on the "technology transfer" model. Typically, the results have been disappointing, with relatively few farmers adopting the promoted practices. By the 1990s, most national cocoa extension systems had collapsed.

A basic premise of the Sustainable Tree Crops Program (STCP) is that, to produce cocoa sustainably, small-scale farmers need to develop knowledge of biological processes and understand interactions in the cocoa agro-ecosystem to be able to make sound management decisions. To meet the objective of training farmers to become "experts" in their own fields, STCP has pioneered farmer field schools (FFS) on cocoa in Cote d'Ivoire, Ghana, Nigeria and Cameroon since 2003. The objective of FFS training is to allow farmers to make their own discoveries about management practices that reduce their dependence on costly inputs such as pesticides and improve their understanding of crop and pest management. Farmer training focuses on integrated crop and pest management (ICPM) with specific emphasis on good crop husbandry, pest and disease management, rational pesticide use, farm renewal and cocoa quality. Farmers also learn about social topics such as responsible labour practices and HIV/AIDS and how to work in groups.

This publication was developed by STCP as a guide for trainers involved with participatory training of cocoa farmers. Trainers may be extension agents or farmers who have gone through a comprehensive training of trainers (ToT) program on participatory training of cocoa farmers. The discovery learning exercises contained in this manual, developed and field tested in STCP farmer field schools, should be treated as guides to be used flexibly and creatively by trainers.

The manual is divided into three sections. Section one contains bulletins that provide trainers with technical information on key topics related to sustainable cocoa production. Section two consists of discovery learning exercises for use in participatory farmer training. Section three provides guides for field activities in cocoa production. The content of this manual, particularly the discovery learning protocols in section two, should be adapted to the context and situations of farmer training by, for example, changing the names of case study characters, currencies etc.

Materials contained in this manual were developed by national and international cocoa researchers, national extension staff, and field staff from the global chocolate industry. The discovery learning exercises have been field tested, reviewed by farmers and technical experts and further revised. This is the second edition of the manual that remains very much a "work in progress". Feedback and comments on this publication are therefore warmly welcome and should be sent to:

Dr. Sonii David
Sustainable Tree Crops Program (STCP)
International Institute of Tropical Agriculture (IITA)
c/o IITA Ltd.
Carolyn House, 26 Dingwall Road
Croydon, CR9 3EE, U.K

Email: s.david@cgiar.org or stcp-wca@cgiar.org

As we integrate new material, this manual will be periodically updated.

Sonii David
Accra, Ghana
September 2008

Glossary of technical terms

Cambium	The layer of tissue between the wood and the innermost bark of a tree
Canker	A spot where the bark and cambium tissue is damaged or dead because of an infection caused by black pod fungus
Chupon	Vertical stem or shoot
Epiphyte	A type of plant (e.g. some mosses and ferns) that grows on another plant or object but is not rooted in soil. It does not directly harm the other plant.
Imago	The sexually mature stage of an insect's life cycle
Integrated crop and pest management	The best mix of pest management techniques which includes crop management methods, use of improved planting material/varieties, preserving and/or manipulating biological agents and the use of chemical pesticides
Jorquette	The point at which the vertical chupon stem changes to fan growth
Larva (pl. larvae)	Any young insect from the time that it hatches from the egg until it becomes a pupa, or chrysalis
Natural enemy	A living organism that kills, injures or causes disease in other living organisms
Nymph	The pupa of an insect
Pest	A living organism that we consider harmful because it attacks and damages crops
Pesticide	Any poison that kills a living organism. This includes insecticides (to kill insects), fungicides (to kill fungi) and herbicides (to kill weeds)
Predator	An animal that hunts and eats other animals. This is one type of natural enemy
Spore	Disease “seeds” of a fungus
Stag head	An abnormal tufted growth of small branches on a tree or shrub caused by fungi, insects or other physiological disturbance
Systemic fungicide	Fungicides that are absorbed by the cocoa tree