UCSC Farm & Garden Apprenticeship

University of California, Santa Cruz

Teaching Organic Farming & Gardening

RESOURCES *for* INSTRUCTORS

Edited by Martha Brown, Jan Perez, and Albie Miles

3RD EDITION *Revised & Expanded*

The CENTER *for* AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS

The Center for Agroecology & Sustainable Food Systems is a research, education, and public service program located at the University of California, Santa Cruz. The Center's mission is to advance sustainable food and agricultural systems that are environmentally sound, economically viable, socially responsible, nonexploitative, and that serve as a foundation for future generations.

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Foreword

You have before you a document that is as unique and revolutionary as it is useful. It is unique, because it draws upon nearly five decades of actual teaching practice in organic methods of growing plants. Over 1,500 apprentices at the Center for Agroecology & Sustainable Food Systems (CASFS, the Center) at the University of California, Santa Cruz have learned the methods described in this manual and applied them in settings as diverse as commercial organic farms, urban and school gardens, college and university farms, and overseas food projects. I can think of no other organic growing pedagogy that has been so thoroughly time- and field-tested.

This manual is revolutionary, because of how dominant the chemical- and resource-intensive paradigm for growing plants has become. As the world population grows and our climate changes, agricultural and food systems are ever more stressed and will be so for years to come. Diversified farming systems employing the techniques described in this manual absolutely can feed the world, as many studies continue to prove. If the future of food and agriculture is at all sustainable and just, it is far more likely to employ the methods in this manual than so-called conventional agricultural techniques.

But perhaps most important for you, our readers, this manual is useful because it works. The practices described here can be employed in a variety of climates, soils, and educational settings. The information on soil science provides a solid grounding for the practices described, and the units on social and environmental issues offer a broader context for those interested in sustainable agriculture.

Moreover, teaching organic farming and gardening has evolved dramatically over the last several decades. In contrast to the very early efforts at organic farming and gardening, a substantial body of agroecological research informs today's organic practices. Similarly, dramatic expansion in commercial applications of these techniques also confirms that they work, while simultaneously being modified for improvements. Today, those interested in teaching and learning about organic farming and gardening have a wealth of resources from which to draw, including this curriculum.

In the spirit of the University of California's dedication to public service, this manual is downloadable free of charge. Its many contributors are all grateful for the opportunity to share their experience, passion, and dedication as widely as possible.

Whether you are a long-time farmer educator, new farmer instructor, seasoned grower working a large farm, or a novice urban gardener, I thank you for your interest and trust. I fervently hope that this manual will help you teach others, learn on your own, and beautify your patch of the world.

– Daniel Press

Olga T. Griswold Professor of Environmental Studies

Executive Director, Center for Agroecology & Sustainable Food Systems

University of California, Santa Cruz

The Center for Agroecology & Sustainable Food Systems, and the Farm & Garden Apprenticeship

The Center for Agroecology and Sustainable Food Systems (CASFS, the Center) is a research, education, and public service unit of the Division of Social Sciences at the University of California, Santa Cruz, dedicated to increasing ecological sustainability and social justice in the food and agriculture system. Center research and education efforts seek to increase understanding of the social, economic, political, and ethical foundations of agricultural sustainability; to establish the ecological and agronomic basis for sustainable production systems; and to demonstrate and facilitate the use of information critical to the adoption of sustainable food and agriculture systems.

The Center's work covers a spectrum that includes academic education and practical training, theoretical and applied research, and public service for audiences ranging from international grower groups to local school children. The Center's 3-acre Alan Chadwick Garden and the 33-acre UCSC Farm are unique organic demonstration, education, and research sites on the UCSC campus.

The Farm & Garden Apprenticeship is a six-month training program held annually at the Center's farm and garden sites. Initiated by Alan Chadwick in 1967, this full-time course now brings participants of all ages from around the world to learn the basic skills of organic gardening and farming, while also studying the complex social and environmental issues surrounding sustainable agriculture and food systems. The program combines classroom instruction, small group demonstrations, and readings with hands-on learning in the fields, gardens, greenhouses, and orchards. The main instructors in the Apprenticeship course are the Farm Manager, the two Garden Managers, and the Community Supported Agriculture (CSA) Manager who work daily alongside the apprentices, present classes, and lead training sessions. UCSC faculty, researchers, and members of the agricultural community add a wide range of expertise to the course.

To date nearly 1,500 apprentices have completed the Apprenticeship training program. Graduates have established their own commercial farms and market gardens, run community gardens for inner city and prison populations, and developed school garden programs. Many graduates take part in international development and food security projects. Others have raised the standards of the organic food industry through work with certification programs and retailers. One of the most important outcomes of the Apprenticeship is the ripple effect our graduates have working locally, nationally, and internationally to practice, promote, and teach sustainable, organic farming and gardening.

> "There are very few programs that provide an academic component to the very real world of organic agriculture. This [Apprenticeship] program ranks among the very best in the nation thanks to the skill of the instructors, the diversity of the students, and the certified organic gardens and fields themselves."
>
> *—Bob Scowcroft, Founding Director*
> *Organic Farming Research Foundation*

Our on-campus farm and garden are open to the public year-round. Thousands of visitors come annually to see the hundreds of varieties of annual vegetable and flower crops, fruit trees, and perennial plantings, and to learn about sustainable growing methods, research projects, and education programs. Also based at the UCSC Farm, the non-profit group Life Lab hosts pre-K–12 science, nutrition, and environmental education programs, and the "Food, What?!" youth empowerment program. In conjunction with our support group, the Friends of the UCSC Farm & Garden, the Center offers a year-long series of organic gardening classes, workshops, and seasonal celebrations for the community.

For more information on the Center and its activities, contact us at:

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For questions about the Apprenticeship in Ecological Horticulture program, see the Center's website, *casfs.ucsc.edu* and *www.growafarmer.org,* or contact us at 831.459-3240, casfs@ucsc.edu.

Preface

Teaching Organic Farming & Gardening: Resources for Instructors was first produced in 2003 in response to the many requests from those interested in the curriculum offered each year by the Apprenticeship in Ecological Horticulture (see page vi) through the Center for Agroecology & Sustainable Food Systems (CASFS, the Center) at the University of California, Santa Cruz. A second edition with updated information and resources followed in 2005.

Since its publication and online posting, the training manual has seen widespread use in classrooms and farm fields from California to Vermont, as well as internationally. College and university educators, apprenticeship teachers, Master Gardener trainers, and other instructors have used the lectures, hands-on exercises, and supporting material to teach basic organic farming and gardening skills, along with the concepts of soil science and social issues as they relate to sustainable agriculture. Tens of thousands have purchased print copies or viewed and downloaded the curriculum for free from the CASFS website, the University of California's eScholarship Repository, and other online postings such as the USDA's Start2Farm website. Many have thanked us for making this material available, noting the comprehensive approach it offers.

Much has changed in the past decade. There's a growing recognition of the need to bring more people into farming as the farmer population ages and the pool of farms and food producers shrinks. There are more resources, training materials, and support for those interested in farming as a career, thanks in large part to projects funded by the USDA's Beginning Farmer and Rancher Development Program (BFRDP), and organizations such as the National Young Farmers Coalition, FarmLink, and the Greenhorns Project.

Myriad new opportunities to learn about agriculture both in and out of the classroom have emerged since 2003. More and more colleges and universities are adding hands-on farmer training to their offerings. The Sustainable Agriculture Education Association (SAEA) was founded to help promote innovative educational approaches to teaching sustainable agriculture. Apprenticeships, internships, farm incubators, and related efforts such as Collaborative Regional Alliances for Farmer Training (CRAFT) are springing up on farms across the country to serve those exploring a career in agriculture.

Farming's landscape, language, and demographics have changed as well. With "urban farming" now part of the vernacular, agriculture has spread beyond its rural roots: now New York City has its own farmer training project, San Francisco's municipal code encourages urban "micro farms," and Chicago has a vibrant commercial urban agriculture program. With concerns over climate change on the rise, the term "resilient" has joined "sustainable," "organic," and "diversified" in discussions of the type of agriculture we need to encourage. And many who are interested in agriculture and building healthy communities come from non-farming backgrounds with no hands-on experience.

The new edition of *Teaching Organic Farming & Gardening: Resources for Instructors,* was developed with this growing audience and evolving agricultural framework in mind. Through lectures, demonstrations, and exercises that can be tailored for use in the field, the garden, or the classroom, it offers comprehensive lessons from the "core" curriculum taught annually through the CASFS Apprenticeship, with an emphasis on developing basic organic farming and gardening skills for small- and medium-scale organic mixed vegetable operations. It also recognizes agriculture's social component and the increased interest in equity and justice in the food system, with new material on the social impacts of the current agricultural system and information on food justice activities.

Other new features include narrative supplements that expand on the updated lecture outlines, along with new appendices, illustrations, and resource listings. As with earlier editions, all of the written material is available free online, enhanced by Powerpoint and video to accompany many of the units (available at *casfs.ucsc.edu/about/publications)*. We plan to continue updating and revising the curriculum and look forward to your feedback in helping us improve this resource.

Acknowledgments

Teaching Organic Farming & Gardening: Resources for Instructors represents nearly fifty years of experience teaching organic farming and gardening skills, soil sciences, and social issues in agriculture at the Apprenticeship in Ecological Horticulture at UC Santa Cruz. The 2003 and 2005 editions of the training manual provided the opportunity to share this experience with a broader audience.

In developing this updated and expanded edition, editors Martha Brown and Jan Perez had the chance build on the vision and efforts of original editor and author Albie Miles, and to enhance the lectures, demonstrations, and hands-on exercises based on feedback and insights from many instructors, apprentices, and students.

At the heart of this effort have been the dedicated teachers, researchers, farmers, and Apprenticeship graduates who wrote, revised, and reviewed the various units (see Contributors & Reviewers, next page). These already busy people were asked to add even more work to their overflowing schedules, and we are grateful to them for the many hours they committed in bringing this project to fruition.

Thanks go also to many other contributors: Jane Bolling of Jane Bolling Design created the cover and updated the layout. Science illustrators Jose Miguel Mayo and Catherine Genetti Reinhard created the original line art for Parts 1 and 2. Photographers Abigail Huetter and Brandon Blackburn took many of the photos for the accompanying online Powerpoint presentations. Jessica Beckett Parr, Hillary Terashima, and Jim Clark created the online videos. Daniel Wu updated many of the resources.

We thank Daniel Press, Executive Director of the Center for Agroecology & Sustainable Food Systems, for his support throughout this project. And a very special thank you to Amy Bolton for the many hours of skillful work and insights required to lay out and proof more than 700 pages of materials.

The Center's grant writer Ann Lindsey brought in the funding for the training manual revision effort and helped shape and guide it along the way. This project would not have been possible without the generous funders who provided their support for the revised and expanded training manuals: Gaia Fund, the USDA Beginning Farmer and Rancher Development Program, Western Sustainable Agriculture Research and Education (WSARE), the Joseph and Vera Long Foundation, and the Eucalyptus Foundation. Funding for the project's initial development came from the True North Foundation, the Arkay Foundation, the Foundation for Sustainability and Innovation, the Organic Farming Research Foundation, Richard and Rhoda Goldman Fund, The Mary A. Crocker Trust, The Foxwhelp Group of the Tides Foundation, The Kellogg Foundation through the California Food and Fiber Futures Project, and John Kinder.

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Martha Brown, the Center's Principal Editor, writes, edits, and designs the Center's publications, along with managing the Center websites and other outreach efforts.

Sky De Muro-Miller *(Garden and Field Tillage and Cultivation; Transplanting and Direct Seeding; Making and Using Compost)*

Sky De Muro-Miller is a Garden Instructor at the UCSC Farm & Garden, where she helps manage the Chadwick Garden with Orin Martin. She also organizes and teaches workshops for the public and for beginning farmers on the Central Coast.

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Note that this list acknowledges Contributors and Reviewers to the first and second editions, as well as the current edition

How to Use This Resource

Teaching Organic Farming and Gardening: Resources for Instructors is a tool intended to increase and improve education in practical organic agriculture and horticulture skills and concepts. While the majority of the manual is devoted to practical training, the instructional materials also cover the science behind the practices, and provide a detailed introduction to social and environmental issues in agriculture. Although much of the material is designed for field or garden demonstrations and skill building, most of the units can also be tailored to a classroom setting. The manual is designed so that units or even individual lectures or demonstrations can be pulled out to be used on their own or in any sequence.

This manual is divided into three sections:

Part 1: Organic Farming and Gardening Skills and Practices

The eleven units in this section emphasize the "how-to" aspects of organic gardening and farming, including propagation, irrigation, tillage, transplanting, and compost production. This section also introduces students to critical skills and considerations in the management of soil fertility and agricultural pests (arthropods, diseases, and weeds) in organic systems. The information included in the manual is based on certified organic production practices that meet or exceed the USDA's National Organic Program (NOP) standards. Included throughout is an overview of principles and practices used in NOP-certified production.

Part 2: Applied Soil Science

This three-unit section covers basic information on soil physical properties, soil chemistry, and soil biology and ecology, providing a more detailed overview of the underlying scientific principles that inform many of the organic farming practices covered in Part 1.

Part 3: Social and Environmental Issues in Agriculture

This four-unit section first outlines the history and development of agriculture in the U.S. and then introduces students to social and environmental issues associated with conventional agriculture practices and the current organization of the food system. This section also introduces students to the various forms of resistance and alternative movement to the dominant systems.

Unit Components

Each unit in this manual contains multiple components, with some components being designed for the instructor, some for students, and some for both. Not all units contain all of the components outlined below, as some units are largely lecture-based (requiring no field demonstrations or hands-on exercises, for example) and others include extensive hands-on components that build on the lectures.

The units are designed with some or all of the following components:

Introduction—*A one- or two-page overview for use by instructor and students*

In the Introduction, the *Unit Overview* provides a summary of the unit, including a description of the information and skills to be conveyed. The *Modes of Instruction* list the suggested lectures, demonstrations, exercises, and assessment questions included in the unit (with an estimated time required for both preparation and implementation). The *Learning Objectives* list the fundamental skills and concepts in each unit that students are expected to learn. The learning objectives serve as the foundation for overall unit content and provide the basis for the evaluation of student comprehension.

Lecture Outlines—*Detailed outlines to guide presentations and/or discussions*

The lectures include pre-assessment questions that may be used to gauge student knowledge at the beginning of the unit. The outlines include the essential qualitative and quantitative information and are intended to provide a broad but comprehensive overview of a subject, identifying many of the key concepts within a given discipline. Instructors are encouraged to adapt the overall content of the lecture to specific audiences or settings. Some units have one lecture outline and some have several. Copies (or online versions) of the lecture notes can be given to the student before the lecture. All technical terminology is either defined in the text or included in the glossary of terms at the end of each unit.

Demonstration Outlines

These instructor outlines provide an overview of the preparations and suggested content for field demonstrations of specific agricultural and horticultural practices. They include time requirements for preparation, materials lists, site preparation instructions, the demonstration sequence, and demonstration lecture outline.

Step-By-Step Sheets—*For student use following Demonstration Outline*

These detailed "how-to" instructions walk students through tasks such as building a compost pile and preparing a planting bed. The sheets include the preparation, sequence, and techniques used in executing a task (parallels the instructor's Demonstration Outline).

The step-by-step sheets contain sufficient information for students to use them as a reference tool when working independently. They are intended to be provided with the Hands-on Exercises, below.

Hands-On Exercises

These activities or exercises serve to reinforce student comprehension of the subject matter or skill through active participation and practice immediately following a technique-based demonstration.

Assessments Questions (and Answer Key)

Five to ten short essay questions based on the lecture content and demonstration(s) are used to gauge student comprehension of the subject matter presented. Questions are intended to be a balance of theoretical and applied knowledge and require some synthesis of information. Assessments are based on learning objectives.

Discussion Questions

Some units have questions after the lecture. These questions can be used for class discussions to further explore and integrate the information from the lecture.

Suggested Readings

Certain units list specific preparatory readings for the student (see the Unit Overview or the beginning of the References and Resources section).

Resources and Resources Section

This section includes an annotated listing of books, periodicals, websites, films, videos, organizations, and equipment or material suppliers on the subject matter addressed in each unit. References from the lectures are also included here.

Supplements

Narrative supplements provide more detailed information on topics presented in the lectures.

Appendix Section

The appendices provide tables, graphs, charts and/or graphics used as visual aids in lectures, demonstrations, or as student reference materials associated with the Hands-on Exercises.

Glossary

Several units include an alphabetical listing of technical terms used in either the lecture or demonstration.

Online Resources: Videos and Powerpoints

Each of the units in this manual is also available online as a .pdf. Videos and Powerpoints to illustrate a number of the lectures and exercises are also available online. We will continue to add resources to the online materials at: *casfs.ucsc.edu/about/publications*. Look for the *Teaching Organic Farming & Gardening* link.