“A flower, for example, investigated by means of natural science, will tell us certain facts about the physical and chemical laws operating within the plant, but life itself always eludes such scientific observation.”

Rudolf Steiner (1861–1925)
Founder of biodynamic agriculture
Thanks

Thank you for supporting me, always:
Liliana Mena Ramirez (mi vida!) and my two beautiful sons,
Jason and Kees Schelfhout.

Thanks also to Bram Appels, Benjamin Biggs, Miquel Boix Tomàs,
Jan Bokhorst, Jorge Cervantes, Ryan Davidson,
Michel Degens, Destiny, Jesse Dodd, John Eijdenberg,
Pius Floris, Philippe Fourquet, Eric Freischläger,
Tigrane Hadengue, Gareth Hopcroft, Karima Horvath,
Claudia Külling, Pic Lelièvre, Nicole Maalsté,
Enzo Manavella, Egbert van Meggelen, Paul Milner,
Alessandro Peretti, Chris Pobreski, Jason S. Ralph-Smith,
Esau Rodriguez, Christine Roelofs, Michka Seeliger-Chatelain,
David Symanzig, Theo Tekstra, Steven Terlouw, William Texier,
Tim Watts, Xavi Turull, Olav van Velsen, Olivier Verbrugghe,
Ernée and Bart Vollenberg, Ingrid Weissenhorn,
Mike Winner and Bernhard Zom.

Karel Schelfhout

Thank you to Jaap Tromp.

Michiel Panhuysen
Table of Contents

PREFACE 15

INTRODUCTION 23
Why did we write this book? 23
Preamble – Michiel introduces Karel 24
Goodbye dissension; hello green dimension 26

CHAPTER 1
THE ORGANIC MINDSET 33
1.1 A mindset 35
1.2 Yield 40
1.3 Cost 42
1.4 Do-it-yourself 42
1.5 Working with living organisms 47
1.6 Over-inflated containers 48
1.7 Rinsing and flushing 49
1.8 Read labels 50
1.9 Measuring pH and EC 52
1.10 Taking action if there’s a problem 54

CHAPTER 2
SOIL AND THE SOIL BIOTA 59
2.1 The soil food web 60
2.2 Carbon 69
2.3 Nitrogen: an important plant nutrient 74
2.4 Mineralization 80
2.5 Roots and mycorrhizae 85
2.6 Bacteria 90
2.7 Fungi 98
2.8 Water and air 106
2.9 Earthworms 107

CHAPTER 3
SOIL STRUCTURE 117
3.1 Soil 117
3.2 Soil texture 119
3.3 From organic materials to humus 123
3.4 Mycorrhizae 128
3.5 Using core aeration to loosen the soil 136
3.6 Earthworms and their labours 137

CHAPTER 4
ORGANIC NUTRIENTS 151
4.1 Feeding the soil 151
4.2 Nutrients and deficiencies 154
4.3 Organic fertilizers 177

CHAPTER 5
COMPOST 207
5.1 Making compost 210
5.2 Vermicompost 226
5.3 Bokashi composting 239
5.4 Buying your compost 241
5.5 How to use compost 244
5.6 Compost tea 247
5.7 Mulching 251

CHAPTER 6
ORGANIC METHODS FOR GROWING OUTDOORS 265
6.1 Soil tests 267
6.2 Garden plots or garden pots? 270
6.3 Organic methods for feeding the soil 277
6.4 Permaculture 292
6.5 Biodynamic agriculture 302
6.6 Growing organic with the help of ready-made products 305
6.7 Sowing seeds 306

CHAPTER 7
ORGANIC METHODS FOR GROWING INDOORS 313
7.1 Potting soil 314
7.2 How to feed your plants indoors 320
7.3 Case Study # 4 325
7.4 Indoor growing techniques: liquid versus solid 329
7.5 Growing organic plant food 337
7.6 The container or pot 347
7.7 The growing space 351
7.8 Equipment 353
7.9 A quick look: seeds or cuttings? 366

CHAPTER 8
WATER 375
8.1 Chlorine, mineral salts and filters 376
8.2 The vortex: obscure science or precious knowledge? 386
8.3 Indoor watering 393
8.4 Watering and irrigation outdoors 408

CHAPTER 9
PLANT DISEASES AND OTHER CHALLENGES 417
9.1 Prevention 417
9.2 Diseases in the field 420

CHAPTER 10
RECENT INNOVATIONS 447
10.1 Biostimulants 447
10.2 The use of carbon dioxide (CO2) 449
10.3 Foliar feeding 452
10.4 Organic hydroponics (a.k.a. bioponics) 454
10.5 Aquaponics 458
10.6 Biochar (agricultural charcoal) 462
10.7 Microionization 464
10.8 Palm tree ash and volcanic foam 464
10.9 Vertical gardens 466

CONCLUSION 471

APPENDIX 1
ORGANIC REGULATIONS, EUROPEAN UNION 477
European regulations 477
Labels 480

APPENDIX 2
SOIL AND WATER ANALYSIS 487

GLOSSARY 497

BIBLIOGRAPHY 517

INDEX 525
Preface

In nature, nothing is lost; everything is transformed. Plants feed animals, animals enrich the soil, and the soil generates plant growth. They all depend on one another; the cycle is complete.

Traditional farms – the farms that gave shape to our countrysides – were microcosms based on this principle of circularity. In barns and in stables, the horses that pulled our wagons and ploughs, the cows that offered their milk, the pigs that became our bacon and ham, and the chickens in their coops were all provided with straw bedding that, enriched with manure, would later be used as fertilizer. The manure heap often had pride of place in the centre of the courtyard because everyone knew that it held the promise of harvests to come: the promise of bread that would feed the land, and the promise of cheese, beans and lentils; of cabbage and carrots.

As Victor Hugo so wisely wrote, ‘If our gold is manure, our manure, on the other hand, is gold.’

Spread over the fields, manure was the fertilizer that would make it possible for the soil to produce wheat (for bread), oats (to delight the horses) and hay (the tall grasses that, when dried, would feed the farm animals all winter). The cycle was complete.

But as early as the 1950s, modern farming techniques began to tear this agrarian production unit apart. From then on, farmers either raised livestock or cultivated the fields. Animals or plants, but rarely both. The cycle was broken, and with it the manure that enriched the soil and ensured future harvests was lost. In the absence of this natural fertilizer, farmers resorted to chemical fertilizers in the form of soluble powders that, diluted by rainwater, leached into the bowels of the earth, where they merged with our water tables (to the point that the water that flows from our taps today is often too rich in nitrates and other chemicals for
public authorities to consider it drinkable). And, paradox of paradoxes, animal waste from factory farms became a major source of pollution. Gradually, during the same period, the way we fed ourselves changed too. Industrial agriculture gave us conveyor-belt chickens and pigs galore. In a few decades, the proverbial Sunday roast chicken and pieces of ham on a thick slice of bread gave way to solid portions of meat at every meal. The by-product of our unbridled meat consumption was the production of an ocean of excrement – liquid manure or slurry – that no one knew how to handle. And that, more often than not, also managed to seep into the water tables. Finally, single crop farming – those great stretches of land where only one kind of plant is grown – favoured agricultural epidemics, making the use of (chemical) pesticides virtually inevitable. In the beginning, though, the illusion was perfect. Modern agriculture based on man-made chemicals was a triumph that yielded record harvests. It took a few decades for the truth to reveal itself: our soil was becoming depleted. Worse yet, it was turning toxic. Happily, as early as the 1960s, a few visionaries spoke up loud and clear to assert that chemicals exhaust the soil, pesticides poison the biosphere, and for agriculture to be sustainable, it has to respect the cycles of nature. It has to be “green”. The organic farming and gardening movement was born. In Europe, the French group Nature et Progrès defined the first technical specifications for organic agriculture in the mid-1970s; the French government recognized and approved their guidelines ten years later. In the absence of the manure which, in the past, gave back to the earth what harvests had taken from her, this new breed of farmers made use of a miraculous substance called . . . compost. What, actually, is compost? It’s the tried and true alternative to yesterday’s manure heap. We now know that if plant waste is gathered and layered in a certain way, it decomposes and yields organic matter that forms a perfect fertilizer. This is what the hippies, who were pioneers of the back-to-the-earth movement, made and used. Just a few decades later, the value of compost is so well known that many councils hand out free or low-cost bins for the home compost maker. Composting has now become standard practice. For many years, the fine art of making and using compost was the focus of organic gardening techniques. Also important were crop rotation, green manure and a knowledge of ‘companion planting’, since certain species are complementary: they grow best and protect each other when they are neighbours (the very opposite of single crop farming, that bane of our honeybees). Little by little, the Gaia hypothesis, first formulated in the 1970s, became a paradigm: our planet Earth is a living entity, a self-regulating organism. Increasingly, we began to question the chemical solutions that once seemed to hold so much promise. Life itself was at the heart of our reflections – life, that invisible phenomenon that continued to elude us, since traditional scientific instruments were unable to distinguish between a living seed that could sprout and unfurl into a plant, and a ‘dead’ one that no longer had the potential to grow and thrive. This shift was aligned with a new vision of the world. Ever since Louis Pasteur’s day, we perceived ‘our’ organism to be a sort of citadel that needed to be defended against the bacterial invader. Today we know that our bodies contain ten times more bacteria than cells. Incredibly, 99 per cent of the genes we are made of are not, actually, ours. We are, first and foremost, the result of a massive symbiotic relationship involving at least five hundred species of bacteria. And the same goes for Mother Earth. The ‘body’ of our planet is a self-orchestrated bacterial swarm. Earth positively teems with invisible life – the very life that sustains the plants that provide our sustenance. The main job of organic farmers and green gardeners is to stimulate this vitality. The mirage of chemically intensive agriculture has faded away, and we are seeing a veritable boom of crops cultivated without synthetic fertilizers or pesticides: there are twice as many organic acres cultivated today as there were seven years ago. Recent years have also been marked by the increased awareness that everything is interconnected. We are one. Nature is not distinct from us: we are not distinct from nature. We are all in the same boat (or rather, spaceship), as the nuclear disaster of Fukushima reminded us when its radioactive leakage rapidly crossed the Pacific, reaching Vancouver and San Francisco before continuing to spread across the entire planet. These new perspectives aren’t restricted to agriculture; home gardeners also want to cultivate plants without toxic residue and grow food they can eat with pride. They want their produce to contribute to their health.
as well as that of the planet. For it is now perfectly clear that healthy soil produces robust plants, and robust plants contribute to the good health of those who consume them. By making compost and spreading it in the garden or filling pots with it, we participate in the well-being of one and all.

Nowadays, the organic movement abounds with new ideas and innovative techniques that go far beyond the classic compost heap to enhance the gardener’s panoply of practices. Revolutionary new strategies are in the making, and the great merit of this book is that it leads us right to them.

So that our beautiful planet can prosper. And so that we can too.

Michka Seeliger-Chatelain

---

1. Michka Seeliger-Chatelain was a pioneer in the early days of the organic movement in France. As early as the 1980s, she championed green techniques in the columns of a variety of gardening periodicals.
Introduction

Why did we write this book?

Farmers who are aware of the earth’s power and potential know just how important it is to keep it healthy. The life of the soil is essential for plant nutrition. Mushrooms, fungi, bacteria, protozoans, nematodes, worms and many other organisms present in the earth break down organic matter and transform it into humus, plant nutrients, vitamins and antibiotics. The life forms of the soil are capable of supplying plants with the best possible nutrition without damaging the environment. Soil is an abundant reserve of life, and of potential solutions for the diseases that threaten plants, animals and humans.

A healthy environment is of primordial importance for human health as well. Both indoors and out, gardening and farming techniques that employ organic materials produce healthy, healthful plants and fruit. In contrast, the use of chemical fertilizers and synthetic pesticides leads to the deterioration of soil vitality and of the humus layer, and inhibits biodiversity.

The Organic Grow Book is designed to be a reference book, even though it would be impossible to describe all the techniques and facets of organic gardening in just one volume. The techniques and examples presented here are especially useful for home gardeners. We hope that they will provide you with a basis for creating your own green techniques whether you’ll be gardening indoors or out.

A book may be able to show the way, but valid solutions to the challenges you’ll encounter can best be found through observation and training. The finer points of gardening are learnt through practice. Don’t hesitate to experiment: you’ll learn from your mistakes.
Preamble – Michiel introduces Karel

Karel was born to a family of farmers in the western part of the Netherlands called Zeeland. In his village, just about every household had a kitchen garden. He grew up eating vegetables harvested from the family garden.

When he was eighteen, Karel left for The Hague. Once in the big city, he found himself yearning to grow things. He was particularly interested in cultivating a particular species of fast-growing dioecious^2 annual, which he always grew indoors. Along with a friend, he applied techniques garnered from commercial greenhouse horticulture, such as rock-wool substrates, synthetic fertilizers and artificial lighting. As Karel’s indoor growing career took off, he developed it by selecting and producing seeds at a professional scale. He was so famous in the early 1980s that his expertise is still renowned to this day in certain growers’ circles.

At the time, Karel’s success was based on the use of chemical fertilizers. But around 2007 he read several articles alerting him to the disastrous consequences of synthetic pesticides and chemical fertilizers. The production of chemical fertilizers requires a significant amount of energy.

Worse still, these chemicals cause harm to the organisms that naturally live in soil, such as bacteria, fungi, monads and nematodes. These microorganisms play a key role in breaking down animal and plant matter and transforming it into substances that plants can use. Artificial fertilizers weaken the root system and increase plant vulnerability, thus creating a vicious circle, because to battle plant diseases ever more toxic chemicals are used. In agricultural areas that have been subjected to years of sustained use of chemical fertilizers and synthetic pesticides, soil vitality is extremely reduced. Karel began to realize that dependence on chemicals was a dead end. A complete about-face led him to become an organic gardener.

---

^2 In dioecious species, male and female reproductive organs grow on separate plants.

A hill of rock wool waste. Rock wool (or stone wool) decomposes even more slowly than plastic; this waste will be there for a little slice of eternity. In some countries rock wool is partly recycled, but worldwide spent rock wool is causing environmental problems.
Farewell dissension, hello green dimension

From one harvest to the next, Karel took the plunge and committed himself to organic gardening. Bye-bye rock wool! He grew his plants in real soil, and replaced chemical plant food with natural nutrients provided by the transformative processes effected by the bacteria and fungi present in the earth.

The first time I met Karel – straight after his about-face – I questioned him about the essence of growing green. Not a big talker, Karel could only explain that he was more comfortable when he gardened outside, in the earth, and nourished the vitality of the soil (organically) than when he used chemical fertilizers and rock wool. His answer puzzled me, so I sought to find out more about the possible motivations behind relying on organic nutrients to grow plants.

I discovered that a good number of those who grow organic have, at some point, decided to spurn artificial fertilizers in favour of plant- and animal-based nutrients. But among these ‘dissidents’ or ‘converts’ (as I call them) many still think and act like farmers who use chemical fertilizers. Yes, they have replaced synthetic chemicals with organic fertilizers, but they continue to view just about every other aspect of the growing process as they did before. The more I learnt about these ‘converts,’ the more I discovered how important it is for organic gardeners to cultivate a ‘green mindset’.

Because they nourish the soil and not the plant, the approach of green gardeners is fundamentally different from that of growers who use chemical fertilizers. Soil that is well cared for and rich in microorganisms is better able than any other to provide plants with nutrients and other necessary substances.

For outdoor gardeners, transitioning to organic means they will be using compost. Indoor gardeners who transition will opt for organic plant nutrients. This is because grow lights demand so much from plants that compost alone can’t nourish them properly.
Organic farmers and gardeners don’t use chemical fertilizers or synthetic pesticides. They nourish the soil by using compost and supplements derived from plants and animals.

**‘Organic gardening’**

The world of organic gardening is very diverse. Organic farmers and gardeners alike reject the chemical fertilizers and synthetic pesticides that are so detrimental to soil vitality and produce such fragile plants. They nourish their soil with compost and other organic matter derived from plants or animals so that the soil can nourish the plant. They also respect the environment and pay close attention to the flavour of their crops.

Compost is the perfect foundation for plants grown outdoors. Plants grown inside generally require more nutrients than their outdoor cousins.

Karel is a gardener whose expertise is the result of years of experience. When he adopted organic methods, a whole new world opened its doors to him. But even the finest of gardeners can’t know everything; Karel learns something new every day. It is our pleasure to invite the reader to take part in his coming-of-age journey and in the paths of a few other organic gardeners, and to share their discoveries.
Chapter 1
The organic mindset

Readers, many among you will be converts: gardeners who have left behind chemical fertilizers and synthetic pesticides in favour of organic farming and gardening. Since the mid-twentieth century, the use of chemical fertilizers has been common practice. Today, the vast majority of farmers and gardeners use artificial nutrients and synthetic pesticides. It’s as if these methods were now rooted in the DNA of a good many professionals and amateur gardeners alike.

Meanwhile, organic farmers and gardeners often feel a need to justify the fact that they don’t use chemical fertilizers. Agriculturally speaking, growing green is still considered a divergent practice. Generally, farmers and gardeners need to reach a turning point before they transition to organic. Beyond this point, they will gain new knowledge and, especially, new perspectives. But it is also a point of uncertainty. Will crops grown using organic methods provide yields comparable to those grown using more familiar chemical products?

As converts, organic gardeners have to develop a new feel for gardening. A variety of techniques fall under the ‘organic’ umbrella. Gardeners can choose among them or develop other methods that suit them best.

All these approaches are based on green principles: cultivation using organic matter, eschewing toxic substances, and, whenever possible, opting for the most ecologically sustainable solution. Home gardeners are free to make concessions and bend the rules if they want to. There is no law forbidding the use of chemical fertilizers and no court can force them to use a certain kind of organic nutrient. Professionals, on the other hand, must respect certain guidelines if they mean to sell their produce under an organic label; laws vary from country to country. For professionals as well, many roads lead to Rome.