frequent watering. Swales were touched on and the group asked if we could do a workshop on swale-building at a future workshop.

Raymond brought all the participants cabbages from the trials and everyone got to take home and sample cabbages grown organically and with chemicals. We asked the group to report back to us their findings, taste-wise and consistency of the cabbages.

Good bye – until next time when we meet to build swales.

Demonstration garden at student doctor residence at George Hospital – Kos en Fynbos

Date: Wednesday 13th May 2016

Venue: Uber Student Doctor's Residence – George

Eight student-doctors and nine Kos en Fynbos members got together to create a food garden for the students to grow their own fresh produce where they are currently residing. We choose a sunny spot on the lawn within reach of the hose-pipe. The students had collected cardboard which we laid down in two horse-shoe shapes. On top of this we laid down a thick layer of compost and manure. Then we covered this with newspapers which were dampened. Over this a layer of dried grass mulch was added. Into this on the one side we planted seedlings; beetroot, celery, parsley, cabbage and Swiss-chard. On the other side beetroot seeds were sown and a few nasturtiums planted. Along the fence we planted Cape gooseberries and nasturtiums too.

The students are eager to eat a more healthy diet of organic vegetables and herbs, while they work and study. They are on a limited budget which means eating cheaper, less healthy food. They will be here for the next 6 months so they will see the crops mature, and be able to pick and enjoy the parsley and celery.

We spoke about how often they will need to water; they shouldn't need to weed as the newspaper and mulch should inhibit the weed seeds from germinating and becoming a pest.

As for pest control methods inter-planting with the herbs and the planting of the nasturtiums nearby should help deter pests.

Just a thin layer of wet newspapers – ensures that any weed seeds in the soil do not grow through the mulch. When the newspapers decompose they become plant food.

The tyres and wheel casing were also planted in. In the one tyre potatoes were planted and in the other sweet potato.

The compost and manure layer before the newspaper and mulch was added

Post-graduate Students to be Supervised by Prof Raymond Auerbach as at 19 January 2015

Surname	First name	Student Number	Year reg	Degree	Supervisor	Co-supervisor	Source of Bursary	
Graduated								
Nteyi	Vuyo		2011	M Tech	R Auerbach	Dr Mike Ferreira WCDA	Passed	
Faulconbridge	Steven		2013	M Tech	R Auerbach	Mike Cameron, Conservation	Passed	
Ackhurst	Albert	211251038	2013	M Tech	R Auerbach	Prof Josua Louw, Forestry	Passed	
Troosters	Wim	213332396	2013	M Tech	R Auerbach	Dr Gareth Haysom UCT	Passed	Distinction
Mashele	N'wa-Jama	213482207	2013	M Sc	R Auerbach	Prof Maarten de Wit	NRF-AEON	Agronomy - organic trials
In process								
van Niekerk	Braam	214372995	2014	M Tech	R Auerbach	Prof Sandra Lamprecht	AgriSETA	Agronomy - biological control
Nalunga	Jane	214390454	2014	D Tech	R Auerbach	Prof Charles Ssekyewa	NRF	Organic training Uganda
Chitalu	Munshimbwe	215325540	2015	D Tech	R Auerbach	Dr Gunnar rundgren	NRF	Organic governance - Zambia
Munthali	Robert	214391531	2015	D Tech	R Auerbach	Dr Mebelo Mataa	NRF	Organic agronomy - Zambia
Eckert	Catherine	211067423	2015	M Tech	R Auerbach	Prof Simon Lorentz	NRF	Water use efficiency - organic trials
Malaba	Livhuwani	210044977	2015	M Tech	R Auerbach	Dr Keith Arnolds	NRF	School gardens - Thembalethu
Swanepoel	Marike		2016	M Sc	R Auerbach	Prof Johnny van den Berg	NRF	Agronomy - organic trials

International Centre for Research in
Organic Food Systems (ICROFS)

Professor Raymond Auerbach
School of Natural Resources
Nelson Mandela Metropolitan University
Private Bag X6531
George 6530

Date: 20 January 2014
Ref.: LIAN
J.no:
Direct Tel: +45 87 15 77 04

Dear Professor Auerbach,

We are pleased to learn that there might be an opportunity for us to interact with you in person in 2013 while you may be travelling in Europe.

We would like to invite you to visit ICROFS at Research Centre Foulum, Denmark, tentatively on 16-17 June 2013, to discuss project ideas and development of proposals for research in agro-ecological farming systems and to learn from your experience on long-term comparative research trials in South Africa.

You will on that occasion also be able to meet researchers from University of Aarhus, particularly from the Department of Agro-ecology, who are located at Research Centre Foulum as well.

We would also highly appreciate if you would give a presentation at a seminar, on organic/agro-ecological/sustainable agriculture research in Africa that we would like to organise during your visit. You presentation could, for example, be on the topic 'Transforming Africa – AGRA & Organics'.

We hope you will accept our invitation and look forward to receiving you in Foulum, Denmark.

Sincerely,

Lise Andreasen
International Coordinator

International Centre for Research in
Organic Food Systems (ICROFS)
P.O. Box 50, Blichers Allé 20
DK- 8830 Tjele, Denmark

Tel: +45 87 15 77 71
E-Mail: icrofs@icrofs.org
www.icrofs.org

Forschungsinstitut für biologischen Landbau
Institut de recherche de l'agriculture biologique
Research Institute of Organic Agriculture
Istituto di ricerche dell'agricoltura biologica
Instituto de investigaciones para la agricultura orgánica

Visit Raymond Auerbach and N'wa-Jama Mashele 23-25 June 2014

Day/date: 23-25 June 2014 **Language:** english

Program:

Time slot	Content	with
Mo, 23 June		
09:40 – 10:00	Pick up at Frick station	Anne Merz
10:00 – 10:30	Welcome coffee	Beate Huber, Helga Willer Andreas Gattinger, Andreas Fliessbach
10:40 – 12:00	Discussion (Soil department)	Andreas Fliessbach
12:00 – 13:00	Lunch at FiBL	
13:15 – 14:15	World of organic, statistics	Helga Willer
14:15 – 16:45	Long term trials	Gurbir Bhullar, Noah Adamtey
	Dinner with	Beate Huber
Tue, 24 June		
08:30 – 12:00	DOC trial in Therwil	Andreas Gattinger
12:00 – 13:00	Lunch at FiBL	
13:15 – 14:15	Guided tour	Thomas Alföldi
14:30 – 15:30	SMART	Lukas Baumgart
16:00 – 17:30	Africa: Manual, collaboration	Gian Nicolay
	Dinner with	Urs Niggli
Wed 25 June		
8:30	Meet with	Urs Nigglis
14:18	Departure Frick station	

Das FiBL hat Standorte in der Schweiz, Deutschland und Österreich
FiBL offices located in Switzerland, Germany and Austria
FiBL est basé en Suisse, Allemagne et Autriche

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COAST CARL VON OSSIETZKY UNIVERSITÄT OLDENBURG
Zentrum für Umwelt- und Nachhaltigkeitsforschung

TRANSFORMING AFRICAN AGRICULTURE – TOWARDS SMALLHOLDER BASED SUSTAINABLE AGRICULTURE AND FOOD SECURITY IN SOUTHERN AFRICA

Prof. Dr. Raymond Auerbach, Nelson Mandela Metropolitan University, South Africa

Wann: Donnerstag, der 19. Juni, 12-14 Uhr

Wo: Campus Wechloy W 02 – 1-148

Prof. Raymond Auerbach is a researcher at the Nelson Mandela Metropolitan University (NMMU) School of Natural Resource Management. He holds a doctorate in Agricultural and Environmental Sciences. He is an experienced leader of trans-disciplinary research into sustainable development, who farmed organically for twenty years (Rainman Landcare Foundation), trained organic farmers for twenty years, and now leads an Agro-ecology programme at the George Campus of NMMU, which is part of the new Centre of Excellence in Food Security, funded across six universities by South Africa's National Research Foundation; he has post-graduate students in Uganda, Tanzania, Zambia and South Africa working through the National Organic Agricultural Movements.

Clim-A-Net
The North-South-Network on Climate Proofing of Vulnerable Regions

DAAD

Fachhochschule Münster • Postfach 30 20 • 48016 Münster

NMMU – Nelson Mandela Metropolitan University
Prof. Dr. Raymond Auerbach
Soil Science & Plant Production
Agricultural Management
School of Natural Resource Management
Pvt Bag X6531, George 6530
Südafrika // South Africa

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Fachbereich
Oecotrophologie · Facility Management

Prof. Dr. Carola Strassner

Aktenzeichen:

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kuttenkeuler@fh-muenster.de
www.fh-muenster.de

Münster, 12. November 2013

Letter of Invitation

Dear Dr. Auerbach

On behalf of the Chair of Sustainable Food Systems in the Faculty of Home Economics, Nutrition Science and Facility Management I am pleased to extend this invitation to you to visit the University of Applied Sciences Muenster in Germany for the week 9th-13th June 2013, during our Summer Semester.

We would like to invite you to enrich our English Module series for our Bachelor students, which are also open to our incoming students from partner institutions. Furthermore, we would like to integrate aspects of your field into our Sustainability Master course; additionally there are opportunities to bring your aspects into already existing courses. Finally, your visit would provide an excellent opportunity to take our research collaboration further, and to discuss nutritional aspects of your comparative research trials.

Please contact our International Office (Ms. Roman at i.roman@fh-muenster.de) for assistance with any short-term accommodation requirements or immigration paperwork. Shared office space, computer facilities, phone and a facsimile connection will be available to you within our Faculty. Please do not hesitate to contact myself or Ms. Gabriele Welsch (Contact Office, Tel: 0049-251-8365412, oecotrophologie@fh-muenster.de) who will ensure you are set up with the facilities and assistance you need. Ms. Welsch is our liaison officer for student and staff exchanges with our Faculty.

I look forward to collaborating with you and wish you a productive and successful time together with us at the University of Applied Sciences Muenster.

Yours sincerely

Prof. Dr. Carola Strassner, MBA
Sustainable Food Systems / Nutrition Ecology

Guidelines for nominating Champions For Ecological Organic Agriculture

Background

Africa continues to face the biggest challenge of feeding its populations. With a rapidly growing population, worsening effects of climate change, effects of globalisation, rising food prices, new and old contracted conflicts, the urgency and pressure felt by our national governments has led to various declarations aimed at supporting Agriculture. Addressing these challenges needs a multi-sectoral, holistic approach and the Ecological Organic Agriculture (EOA) is one such initiative that brings into agriculture dimensions that embrace sustainability, biodiversity, and ecosystem services, while producing food for the populations.

EOA is an initiative to promote ecologically sound strategies and practices among diverse stakeholders in production, processing, marketing and policy making to safeguard the environment, improve livelihoods, alleviate poverty and guarantee food security.

Champions of EOA initiatives are stakeholders who are deemed to have contributed positively to the above. These include people in the following:

- GOVERNMENT/REGIONAL/CONTINENTAL: Support in enacting laws, developing policies, establishing institutions and structures and creating the enabling environment for EOA to strive.

- CSO/NGOs: Persons who have devoted significant amount of time and resources in advocating and creating awareness of EOA initiatives and fighting against initiatives that destroy the ecology.

- RESEARCH / INSTITUTIONS: Persons who have devoted their resources to research and development of tools, techniques and strategies to solving and addressing challenges of EOA initiatives.

- PLAYERS/ACTORS: Persons who have contributed to increase production, expansion of markets and the creating of jobs. They have also demonstrated through Corporate Social Responsibilities (CSR) to the development of EOA initiatives.

PROFESSOR RAYMOND AUERBACH of Nelson Mandela Metro University (NMMU).

I know of few other organic pioneers in Africa that has worked so tirelessly and actively in organic agriculture in this continent.

He has worked in science, in extension, in practical hands-on farming, and also in supporting the development of the movement globally for 40 years.

He was a pioneer member of not only IFOAM, but he has been a contributor to various publications on the African organic landscape and has been a member of numerous think-tank initiatives and projects.

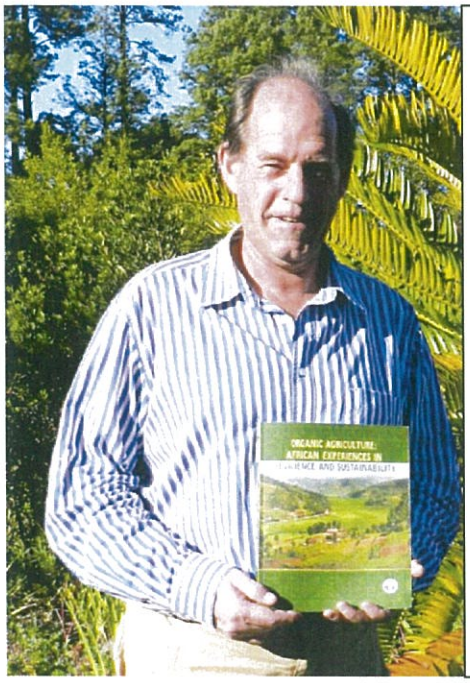
He has also recently worked on establishing the first of many long-term trials in EOA on the continent, and is mentoring postgraduate studies of a number of African students at the NMMU.

I am happy to furnish more information on Raymond, and suggest that he be considered as an EAO Champion for Africa.

Organic Agriculture: African Experiences in Resilience and Sustainability: New Book published by FAO to be launched Monday 1st July at 6 pm at Spier Conference Centre.

Transforming African Agriculture: Organics and AGRA (Alliance for a Green Revolution in Africa) is the title of the first chapter by Prof Raymond Auerbach of the Nelson Mandela Metropolitan University at George in the new book, "*Organic Agriculture: African Experiences in Resilience and Sustainability*" which was edited by himself, Gunnar Rundgren and Nadia El-Hage Scialabba.

The book is a cutting-edge research report, beautifully illustrated covering four primary focus areas – Mainstreaming Organic Agriculture into the African Development Agenda; Community-based Livestock Systems; Ecofunctional Intensification and Smallholders Knowledge. The first chapter compares various approaches to agricultural development (see Figure below), and is linked to Prof Auerbach's work in the field or organic agriculture spanning more than four decades. The book selects the best papers from a dozen countries presented at the Second African Organic Conference in Zambia a year ago, and is published by the United Nations Food and Agriculture Organization (FAO); it sells at R300.



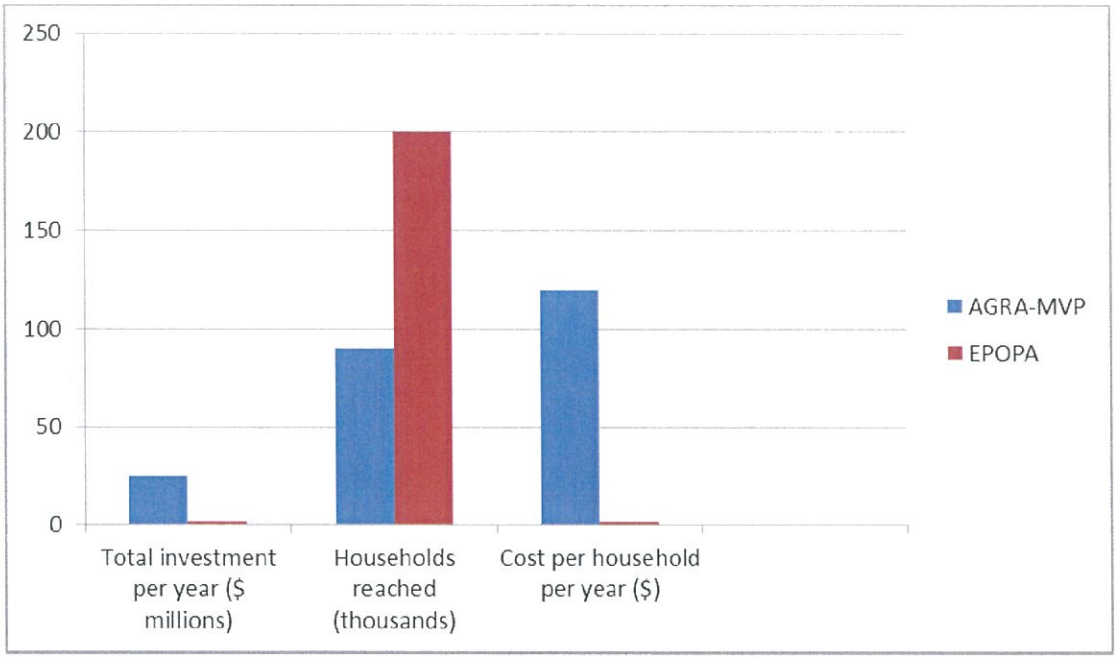
Professor Raymond Auerbach, Soil Science & Plant Production, Agricultural Management at George (Nelson Mandela Metropolitan University) with the FAO-endorsed book on organic agriculture which has now been published.

(Photo: Alet van Tonder, NMMU Marketing)

It may also be down-loaded free of charge from: www.fao.org/docrep/018/i3294e/i3294e.pdf

Click on the book and download the full pdf (7.6 MB).

Case studies highlighted by Prof Auerbach include the Millennium Villages Project which was initially implemented in 14 village clusters, mainly in West and East Africa; as well as his own research mostly conducted in KwaZulu-Natal, which provided the background for his earlier master's and doctoral studies. Organic market linkages as vehicles for sustainable development, as well as rainwater harvesting and crop rotation to reduce the risk of crop failure are also highlighted. The chapter concludes with the insight that "a combination of science with social and environmental activism is needed if African agriculture is to move into an era of prosperity, based on increased resilience and sustainability".



Comparison of Alliance for a Green Revolution in Agriculture Millennium Villages Project (AGRA-MVP) with the Export Programme for Organic Products from Africa (EPOPA)

This comparison shows how cost-effective organic agricultural development is!

The often-repeated question "Can organic agriculture feed the world?" can be definitively answered "Yes, it can, and without the impossible cost to Africa of importing chemical fertiliser, poisons and genetically engineered seed".

The twelve case studies show how organic farming is working in very different settings, from Maasai livestock co-operatives where meat processing is fuelled by biogas, to ethno-veterinary practices in Nigeria; from organic production of pink rice on large-scale enterprises in Madagascar to small scale mixed farming in Zambia; from information technology serving the needs of farmers and traders in Uganda, Kenya and Burkino Faso to organic cotton in Nigeria and large scale Namibian rangelands managed by communities and by commercial farmers.

Organic farming is working in Africa, and it is helping farmers to earn a decent livelihood while adapting to climate change, and even mitigating change through doubling the levels of carbon sequestration, reducing non-solar energy use and improving water-use efficiency.

MaAfrika needs sustainable organic farming:

African solutions for African problems with local African resources!

Invitation to the Regeneration International Conference & Workshop in Costa Rica June 7-9

Dear Prof. Auerbach,

The Regeneration International working group (Vandana Shiva, Hans Herren, Andre Leu, Steve Rye, and Ronnie Cummins) would like to cordially invite you to actively participate in the inaugural ***Regeneration International Conference and Workshop***, in Costa Rica, June 7-9, at Finca Luna Nueva Lodge.

Finca Luna Nueva (www.fincalunanuevalodge.com) is a biodynamic research farm, rainforest eco-lodge and conference center, located two hours from the San Jose International Airport and near the Arenal Volcano. Our host Tom Newmark, owner of Finca Luna Nueva and co-founder of the Carbon Underground, will provide accommodations, ground transport, organic food and beverages.

The conference will provide an unprecedented opportunity to network and strategize with the world's leading farmers, scientists, media professionals and activists. Our goal is to craft messages and develop a global communications network in order to:

(1) Counter the growing global push for so-called "Sustainable Intensification" based on GMOs and the increased use of toxic pesticides and fertilizers. This can only be achieved by increasing awareness of the environmental, health, economic and social problems caused by industrial food and farming, GMOs, and seed monopolization.

(2) To promote the multifunctional benefits of regenerative forms of organic agriculture such as agro-ecology, holistic grazing, cover cropping, permaculture, and agroforestry. By bringing together farmers, researchers, activists and consumers we can create global awareness of the how regenerative organic agriculture can mitigate climate change through soil carbon sequestration, improve human and environmental health, and provide long-term agricultural productivity and resilience to smallholder family farmers.

Agenda

The final conference and workshop agenda will be set once we have confirmed the participants. We expect over 60 attendees including farmers, researchers, scientists, media/communication professionals and campaign NGOs from all continents across the globe.

There will be morning plenary presentations to set the scene. The afternoon sessions will feature three breakout workshops:

1. **Scientists and Researchers**
   It is critical that all our messages are based on sound science, so that they can be easily defended and promoted to policy makers, governments, etc.

2. **Journalists, Media, and Communication Specialists**
   We need media professionals to develop messages that are clear and easily communicated to our strategic constituencies— consumers, farmers, policy makers, researchers, industry and other stakeholders.

3. **NGO, Campaign, and Advocacy Organisations**
   Successful global campaigns must be based on a sound communication strategy, and backed by a skilled network of translators. By strategically and collaboratively utilizing digital media – newsletters, websites, Facebook, Twitter, etc. we can effectively communicate impactful messages on a global scale.

The final workshop session will bring these groups back together to set the priority messages, and the necessary strategies to communicate them.

Limited funds are available to help pay travel expenses for those who cannot otherwise afford to come, however, we have no outside funding for this conference, and would be grateful if participants can fund their own air travel. Due to limited availability, we cannot guarantee a space for the conference. Please RSVP by April 13th, so that we may finalize the guest list and accommodations.

PLEASE CLICK THE LINK BELOW TO RSVP TO THE CONFERENCE BY APRIL 13th:

http://goo.gl/forms/PnmSTRKszX

We hope that you join us in the formation of the Regeneration International Global Communications Network. It is essential that we work together on a global scale to promote the benefits of regenerative organic agriculture, and counter the growing threat of GMOs and toxic chemicals.

Regards and Solidarity,

Vandana Shiva, Navdanya
Hans Herren, Millennium Institute and Biovision Foundation
Andre Leu, IFOAM
Steve Rye, Mercola.com
Ronnie Cummins, Organic Consumers Association
Tom Newmark, The Carbon Underground

The law of the soil

Soil is the foundation of life, of Earth herself, a thin, fragile and complex layer which surrounds the planet and provides a home to countless bacteria, fungi, insects and other life forms of life.

Soil is the substance in which the roots of most plants find their support and nourishment, so that, in turn, they can nourish animals, through the miracles of photosynthesis and respiration which allow the light of the sun to be stored in food, producing starches, sugars and proteins.

Soil is complex, containing essential mineral nutrients, diverse micro-organisms and organic matter; the soil organic matter, or colloidal humus, holds the nutrients, contributes to soil structure and provides a home for soil organisms, allowing the plants to grow in a healthy and balanced way, if the soil itself is allowed to be healthy and balanced.

Healthy soil with its colloidal humus holds water and air, together with soil organic carbon; the carbon in the soil is essential to life – carbon dioxide in the air is an enemy of animal life, but essential to plant life. We breathe it out, and the plants breathe it in, making the carbohydrates, sugars and proteins essential to life on Earth. Carbon should not accumulate in the air, but should rather be stored in the soil as colloidal humus, reducing global warming and climate change.

Being the fragile mantle of Mother Earth, soil needs your wise protection:

1. Soil will be eroded if it is ploughed without understanding by farmers – conserve it!
2. Soil organic matter will be oxidised and burned by the sun if exposed – cover it!
3. Soil will be damaged if the lungs of the Earth, the forests, are destroyed – preserve forests!
4. Soil is diverse and supports biodiversity – protect plants and soil micro-organisms!
5. Soil is a habitat for life, which we mine, in which we build and on which we live – engineer it carefully!
6. Soil can be easily polluted by chemicals – keep it pure!
7. Soil, water, plants and animals form a complex web of life – respect the complexity, of which we understand so little, and apply the precautionary principle: when in doubt, be cautious and conservative, so that we may keep and care for the soil, and hand on to future generations an environment in a better state than we received it.

Any regulations which result in soil damage endanger our survival and the future of Mother Earth.

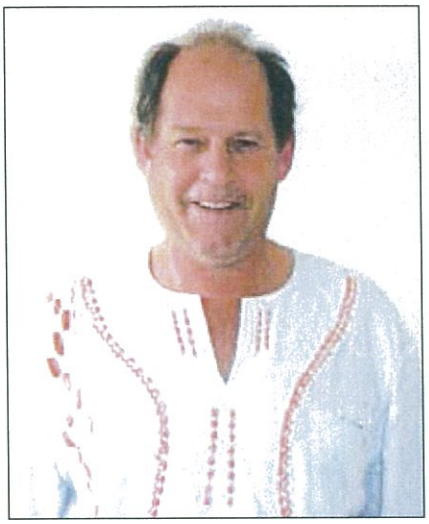
Agricultural practices can damage soil unless there is an understanding of regenerative agriculture; any activities which damage soil structure or destroy soil organic matter, fail to understand how vital soil structure, soil biology and aerobic soil conditions are for life on Earth. Biodiversity, crop rotation, soil organic matter, and the integration livestock, perennial and annual crops, together with fair conditions for famers and farm workers, and a focus on producing food which is truly nourishing for consumers, are the minimum conditions for sustainability.

We call on all people and governments to review the way we live, the products we purchase and all laws which damage the soil; let us promote practices which regenerate soil ecology.

INTERVIEW

Supporting Sustainable Farming in South Africa

Soil Scientist, Professor Raymond Auerbach Discusses Changes in Africa's Farming Scene



Raymond Auerbach crossed our radar at a conference in Costa Rica devoted to a new initiative called Regeneration International. Scientists, business leaders and farmers from 21 nations met in early June to launch a movement to promote a different approach to food production, land use and climate change across the globe, taking advantage of rapidly advancing research in sustainable food production. Auerbach brings a unique perspective to the struggle. As a professor at Nelson Mandela Metropolitan University in George, South Africa, he studies and advises the farmers of the Southern Cape, one of the world's better environments for growing food. The peculiar history of South Africa, which denied a majority of its population many of the benefits of a modern economy until the demise of apartheid, offers an unusual set of challenges. Auerbach trained in organic farming in South Africa and Australia in the 1970s. He farmed organically for 40 years, starting the Rainman Landcare Foundation on his farm near Durban in KwaZulu-Natal, South Africa, where he trained organic farmers and performed soil analysis at his lab. Currently Professor of Soil Science and Plant Production at NMMU, Auerbach is married to an alternative healer and music therapist. He also teaches Sanskrit at the George branch of NMMU's School of Practical Philosophy, which he somehow finds time to run.

Raymond Auerbach, Ph.D.

Interviewed by Chris Walters

ACRES U.S.A. You're supervising an ambitious research slate at Nelson Mandela Metropolitan University. Could you describe what you're trying to accomplish with the various projects?

RAYMOND AUERBACH, PH.D. The work I'm doing now basically involves three major programs. I've just set up long-term comparative research trials at the Nelson Mandela Metropolitan University where I work, the George campus. We're busy with the second season comparing organic and conventional, and we're looking at the changes in soil fertility under two management systems. As you know, soil organic matter, or colloidal humus, is at the heart of organic agriculture. As we improve our organic techniques, we know that we will improve the water-holding and nutrient-holding capacity, so we want to quantify that. We put moisture probes down to 1.2

meters, or about 4 feet, and every half hour we measure the moisture every 20 centimeters, or about 8 inches, down through the soil profile. As the organic matter improves in the organic plots, we believe they will hold more moisture and more nutrients. Equally on the other side, the response to the fertilizer is much quicker, so the yield results are much better on the fertilized conventional fields than on the other because it is a low-fertility field. Technically it is not a good soil, and we have to put a little bit of lime in there to knock out aluminum toxicity, but we want to see the effects of crop rotation, monocropping, water use efficiency, soil organic matter, the yield, and also the food quality of organic versus conventional. In the long-term we will look at the economics as well. So that's a major project – I've got five graduate students on it, and we are quite excited about our preliminary results. We've just started preparing the first two papers for publication.

ACRES U.S.A. Could you place South Africa in context with some of its neighbors?

AUERBACH. We've really been quite slow in developing the organic sector in South Africa even though I've been involved with it for 45 years. The number of organic farmers is disappointingly low, whereas our colleagues in East Africa have done a fantastic job. I've been watching the East African development, particularly in Uganda and further south in Zambia, over the past 20 years. I offered three of the people doing a lot of work in Uganda and Zambia doctoral scholarships through our National Research Foundation to describe the work they're doing. Jane Nalunga, the training manager for the National Organic Growers Agricultural Movement of Uganda – NOGAMU – has been working with 1.2 million farmers. As part of a team, she's been able to offer support to this large number of farmers by developing training capacity and also works to develop markets and governance structure. Funding has dried up in recent years; they are not getting much support from the government, and recent developments have strained the organization's ability to cope with things. Jane's program is one of the major research efforts. In Zambia we have Munshimbwe Chitalu who is the chief executive officer of OPPAZ, the Organic Producers and Processors Association of Zambia. Munshimbwe is looking mainly at the marketing and governance issues. Zambia has a far less mature organic sector though it is growing rapidly. Five years ago they had 40,000 farmers, now they have 100,000 farmers, but it is a far smaller and younger organic sector. When you look at both Uganda and Zambia, you have tremendous resources. You have rain forest areas; you have good soils, but not much infrastructure in terms of the market. What Munshimbwe and his team have been able to do is very encouraging and more similar to where we are in South Africa. Although South Africa has a lot of infrastructure and a lot more research capacity, our organic sector has not grown very fast. So we especially wanted to look at what OPPAZ is doing, and how they've been able to get this rapid growth from a relatively small base, because we believe we have a lot to copy in developing our organic sector.

> "What we've been doing since 2011 is developing 20 scientific indicators of sustainability, rather than having a checklist of 200 questions, and if you tick all the boxes you're organic, and if you don't you're not."

ACRES U.S.A. And the third doctoral student?

AUERBACH. The third doctoral student is a chap called Robert Muntabwe. He's going to describe the research needs of Zambia's organic farmers, the practices that are working and the particular practices that are problematic. We believe those three studies are going to help us develop our organic sector and also help Zambia and Uganda take further steps in developing their organic sectors. We in South Africa can help the rest of Africa because we have a lot of infrastructure and research capacity. At the same time, we lack experience in developing small-scale commercial farming, especially organic agriculture. We tend to be mighty arrogant in South Africa; we think we are the powerhouse of Africa, and meantime we are way behind, certainly in terms of organic development and food security. It's a

disgrace that a country as wealthy as South Africa has 14 million people who go to bed hungry most nights. That's 2 million families. They're not starving – we don't have the heavy starvation in South Africa, but we do have a lot of people who are food insecure.

ACRES U.S.A. What do you have in mind to tackle it?

AUERBACH. We've just been able to get funding, again through our National Research Foundation, for a Center of Excellence in Food Security. This is a massive research program. We have 11 universities in South Africa, plus our Agricultural Research Council, plus a couple of universities in Britain and the States. We are working with these various partners to understand not just the food production side – which is where I'm particularly interested – but also the food governance aspect of food security, as well as the health and safety elements and nutrition. I'm quite involved in the nutrition studies. These four things make up the Center of Excellence which has been going just over a year. We have a movement where we help local people develop food gardens on a very small scale, and we're also developing an Agri-Park. The idea of the Agri-Park is to bring together support structures. We're using a site that is next to our sewage treatment works. We plan to take the sewage stream after the metals have been extracted and put it through an algal ponding system. We'll use the algae growing on the sewage waste to extract the nitrogen, phosphorus and potassium and then use the algae in compost for growing vegetables. The idea is to use the sewage, extract the energy, and then the rest of it will go through the plant where they will deal with the pathogens. At the end of it, we get clean water, and we can use that for irrigation. It's quite an ambitious project, and the idea is that once we've got the processing plants going, we'll be able to get into compost production, and the government money will be used twice. We'll be able to feed schoolchildren at lunch and people in hospitals and prisons, as well as distributing through supermarkets, since the food will be a high-quality organic product that we can sell. That project is in the research-and-development phase. We're also the first in the country to train agroecology teachers. There is a lot of exciting movement happening on campus, and we're quite proud of how quickly it's happened.

> "If you have good marketing people, then the cooperatives are actually a way that you can turn price takers into price makers because there is strength in numbers. That's going to be an important part of turning around agricultural production for smallholder."

ACRES U.S.A. The area around George benefits from the climate of South Africa's Southern Cape, usually described as oceanic or Mediterranean, with mild temperatures and good rainfall. It sounds ideal for agriculture. How does the reality of your area differ from its potential?

AUERBACH. Some of the Southern Cape area is similar to California, and a lot of it is much more like Washington State, the dairy and fruit areas you have there. If you go from here towards Cape Town you've got a lot of deciduous tree orchards, and if you go up and down the south coast you have a lot of dairy farming based on rye grass. Our summer grass is called kikuyu, a tropical grass. We have a lot of irrigated pastures, and we produce a lot of maize for cow feed and also a lot for human consumption. We also have a lot of vegetables and berries in this part of the country. If you go over the mountains just to the north, you then get into the Karoo, which is semi-desert with a lot of sheep and a little bit of cropping. Further west toward Cape Town is a very big wheat-growing area.

ACRES U.S.A. Raised, no doubt, using conventional techniques?

AUERBACH. Yes. Conventional agriculture, as you know, pushes fertilizer onto wheat, and our wheat, if it is rotated at all, is rotated with soybeans. The wheat-soy rotation is heavily fertilized, and a lot of herbicides, Roundup in particular, are used on the crops. We have one of

the highest rates in Africa of GMO use – the main crops are maize, cotton, soybean and canola. There is a lot of GMO development and a lot of opposition to GMOs as well; a great deal of antipathy. I am not militantly anti-GMO, meaning if I am on a platform and the activists talk about what is wrong with GMOs, then I talk about the alternatives to GMOs. GMO seed is not the major issue, but it becomes the issue once it's introduced because you then have bio-safety issues. The major issues are getting soil fertility in place, getting the infrastructure in place and in particular building the market linkages. The conventional agriculture feels very threatened, and they react in quite a nasty way. There is very much a conflictual relationship, and some of the big companies like Monsanto put a lot of their energy into attacking organic activists and organic researchers. They make often totally unfounded claims. We had an acrimonious exchange in the local newspaper about a year ago, and they wound up making ridiculous claims and misquoting sources to show that organic food is no better than conventional food. In the end we were able to show them what the peer-reviewed literature said, and they ended up with quite a lot of egg on their faces. Often they do the kind of thing that destroys people's careers. I do want to say, though, that I think we in the organic sector have been almost as responsible as the other side. Because we've tended to be very exclusive and say, "Oh, those guys are evil," and they look at us and say, "Those guys are weird." It's the kind of polemic I think you are beginning to get away from in some parts of the States and some parts of Europe. Certainly when I was in Denmark the Danish research institutions are really taking organics seriously, and so are the Swiss. Certainly with IFOAM we've been saying for the past five years that we must take down this wall between us and them. I am part of a group called SOAAN, the Sustainable Organic Agriculture Action Network. What we've been doing since 2011 is developing 20 scientific indicators of sustainability, rather than having a checklist of 200 questions, and if you tick all the boxes you're organic, and if you don't you're not. We are trying to develop tools the farmer can take and say, "All right, here are my 20 indicators, on water use efficiency I may be very inefficient though my animal welfare might be good, and my energy use efficiency might be good, and I use very little poison." These indicators of sustainability, I think, are going to become a useful tool to help farmers – whether organic, biological or conservation farmers – to evaluate their weak points and improve their farming systems. I think that's one of the points where we will see less conflict between organic farmers and those conventional farmers who are taking their soil biology seriously. That's why we had this meeting in Costa Rica where we established Regeneration International, and we talked about regenerative agricul-

ture, which includes agroecology, permaculture, organic farming and a host of similar approaches. It's also intending to unmask the greenwashing activities which are going on called Climate-Smart agriculture and Sustainable Intensification. Climate-Smart is basically using GMOs and herbicides and claiming that because we aren't plowing as much we're sequestering more carbon. Sustainable Intensification is pretty well doing what we've been doing all along in industrial agriculture but being a little more careful about how we are using the chemicals.

ACRES U.S.A. What are some of the challenges small-scale farmers face in Africa?

AUERBACH. The challenges are many, varied and darned tough. It's tough to be a large-scale commercial farmer, and it's tough to be a small-scale farmer, but the small-scale farmers have extra challenges. First of all, they are often far from markets. Secondly, they often don't produce enough to be taken seriously. Third, their quality might not be up to scratch. Fourth, they don't have much of a power base – they tend to be price takers not price makers. They also lack market information. These five factors are ones my students have identified in different parts of Africa. They seem to be pretty universal, and a lot of them have to do with being small and powerless. Information technology can make a difference. The technology of cell phones and computers is beginning to get through to these farmers. Although they're often not well-educated, their children certainly have cell phones and increasingly have access to laptops and tablets. They're certainly able to network better than the older generation. That is helping, but the fact of the matter is that the mindset to become a businessperson – to be able to understand your cost structure and your pricing structure and make a profit from the food you sell – that's something that hasn't been traditionally part of African food production. There's been trade in food, but especially in southern Africa it's been far more "I help my neighbor when I've got a surplus, and he helps me when he's got a surplus." It hasn't been as much of a commercial market as Europe and North and South America have developed. I recently visited Guatemala, and it was interesting to see how well the cooperative movement has developed there. Parts of Africa are starting to get cooperative movements going. As soon as you have a cooperative you bring a bunch of small-scale farmers together, and you help them with what they tend to be very weak at, which is the marketing. If you have good marketing people, then the cooperatives are actually a way that you can turn price takers

into price makers because there is strength in numbers. That's going to be an important part of turning around agricultural production for smallholders.

ACRES U.S.A. Are there any other factors that can prove daunting?

AUERBACH. A lot of it has to do with economies of scale. If you only have an acre of land and you don't have a truck, you have to produce at least a little truckload or you have to take it to market on a taxi, and that's expensive. One of my graduate students went to an area where there was really good soil and a little bit of vegetable production. He said to the local farmers, "Okay, I will be here every Thursday, and I will buy everything that you guys can produce." Initially there were just a few cabbages and carrots and whatnot. But after he'd been coming for a few months people said, "This guy is serious," and they started planting. Over the past nine years now he's built up four cooperatives. He developed a little cold store; he spoke to local churches and AIDS orphanages and in places where people wanted to support the small-scale farmers. Just by removing the marketing problem he got four cooperatives going. They're not huge, but together they are producing quite a substantial amount.

ACRES U.S.A. While South Africa generally has great infrastructure, does neglect continue to be a problem?

AUERBACH. We have a good road infrastructure, but in the small, rural areas the roads are terrible. There are gravel roads, and they wash away with the rains and so on. We've seen three major changes since democratic government came in. One is tremendous development of electrification of black areas that didn't have electricity. The second is development of water reticulation, so most houses now have clean municipal water. The third has been a big push to build decent houses that are weatherproof and made available at very low cost

"For the first time in South Africa — and I'm absolutely delighted about it — we are hearing consumers say, "We want to know where our food comes from." The supermarkets like Woolworth's are increasingly getting militant consumers saying, "You say this is milk is from happy, grass-fed cows! We went and checked on the farm, and these cows are up to their hocks in mud sitting in a barn! You are misleading us with wrong advertising!"

to poor families. Those three successes of post-apartheid South Africa have been dramatic, and that infrastructure has helped people a lot. The big failure we have is education. The schools are in a shocking, shambolic state, and the pass rates and the rates of literacy and numeracy are disgracefully low. At the university we see that the students, instead of being better prepared every year are worse prepared every year. We're actually going backward. That's a huge worry, and it does directly affect the farmers. A lot of the farmers' children who would be coming to get a decent agricultural education, while there is financial support for them to get here, the quality of the primary and secondary education is so poor that they are not able to make it into the university. We have a bridging program for kids from disadvantaged backgrounds. We give them a test for their potential, and if we find they have potential to make progress, we then put them through a bridging year in which they get basic numeracy, basic science and English, and very often they go on to do very well. That's the kind of affirmative action we need to make up for the bad years of apartheid. But it's a really sad thing that in 20 years post-apartheid we haven't been able to fix our education. The high schools in particular are in total shambles, and that's a big worry.

ACRES U.S.A. Do you have a scheme for helping farmers get through the organic certification process?

AUERBACH. That's a big challenge. We found that we have groups of farmers who can't afford the cost of standard third-party individual certification, so we brought in what's called group certification, where the cooperative or the farmers' association or sometimes the company that is buying the product organizes the certification. They train the farmers, they train internal inspectors, and while a lot of the inspection is internal, the third-party inspector still comes around and checks very carefully on how the internal quality control system is working. That group certification came in about 10 years ago, and it has brought down the costs, but certification is still daunting for the farmers. What we've developed over the past five years is a thing called participatory guarantee systems. I've been one of the pioneers here together with Konrad Hauptfleisch who is now working with IFOAM in Bonn at their training academy. Konrad and I developed the Participatory Guarantee System Association of South Africa. You guys

have something similar with your Community Supported Agriculture, which uses a PGS-type approach. Essentially all it means is that if it's organic enough for my customers, it's organic enough. If my customers know who I am at the local level, we don't really need a third-party certifier. They'd say, "I know Raymond, I trust his stuff, I've been on his farm." We then don't need the expense of certification. The important thing is that some of the consumers are involved with some of the farmers and the committee goes around and visits the various farmers once or twice a year, and it's a voluntary committee so it doesn't cost anything except the time of people. The beautiful thing about it is, whereas third-party certification is like a visit from the police – the farmer is on the spot and being checked in case he is corrupt or telling lies, very much an interrogation process – a PGS visit is much more like a social thing. You want to visit your farmer, you want to know where your food comes from, and you'd really like to become friendlier with this farmer. Often the consumers look at what they can do. They'll come and help plant trees on the farm to help with windbreaks, or things like that which may not be commercially viable. When I started 45 years ago there was no such thing as certification; it came in about 35 years ago. It initially came in more as a marketing thing, where we wanted to show that our stuff really was organic, and we were proud of it so we got someone else in to say objectively that it is okay. What happened over the past 10 or 15 years is that the certification tail began to wag the organic dog. Certification became so difficult that it terrified a lot of farmers. It puts a lot of farmers off. They just don't want the whole place to be scrutinized to that extent. But the consumers are becoming more and more fussy, and rightfully so. For the first time in South Africa – and I'm absolutely delighted about it – we are hearing consumers say, "We want to know where our food comes from." The supermarkets like Woolworth's are increasingly getting militant consumers saying, "You say this is milk is from happy, grass-fed cows! We went and checked on the farm, and these cows are up to their hocks in mud sitting in a barn! You are misleading us with wrong advertising!" That's an exciting development. I think it will increasingly help drive organic development here in South Africa.

ACRES U.S.A. You describe a breathtaking rate of historical churning, from some areas just recently getting electricity to others generating activist consumers, all in just over 20 years. It's difficult to imagine from an American point of view what this must be like.

AUERBACH. Essentially the wealthy – read "white" – people in South Africa have had all this infrastructure for 100 years, but it is brand

new for most of the black folk. It is very interesting that a lot of rural black people, and black people who have moved recently from the rural areas, still understand the value of good health and would prefer to get good, healthy food. Often, though, money talks and people go for the cheapest option, and that is a great incentive to decentralize the organic movement and get good food grown out in the rural areas so poor people can afford it. That's what we're trying to do – build a mass movement. What I've seen in my years in organic agriculture – since I was a high school kid and started my first organic garden and joined the Soil Association of South Africa – are very poor organizations come into being and disintegrate. Part of the problem has been that we've got such disparate demands. The kind of organization that serves small-scale farmers who have 1 acre and are trying to scrape a living is not the same kind of organization that serves a guy with 500 acres and six tractors. He has very different needs. We have now developed an organization that for the first time looks as if it will serve the whole needs of the South African sector – it's called the South African Organic Sector Organization. It is incredibly difficult because you do have different needs, and because you do have almost a first-world economy and a third-world economy in the same geographical space. That does create a lot of problems, but it also creates opportunities because you do have people with infrastructure who would like to help the local, small-scale farmers. And that's what we're trying to facilitate with an Agri-Park – a new social model that doesn't see race but does see geographical possibilities for efficiency, building infrastructure where there's critical mass and allowing a lot of people to piggyback on that for mutual benefit. I think that's going to be the model we develop.

> "What happened over the past 10 or 15 years is that the certification tail began to wag the organic dog. Certification became so difficult that it terrified a lot of farmers."

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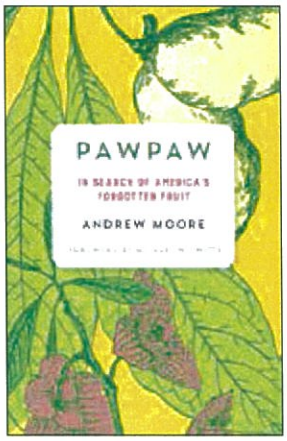
Botany as History & Intensive Vegetable Production

REVIEW

Pawpaw: In Search of America's Forgotten Fruit
by Andrew Moore

Not so long ago it was remarkable when John McPhee wrote an entire book about oranges – a common table fruit, isn't that more like a medium-sized magazine piece? – and made every page of it interesting, even revelatory. He easily could have stolen a riff from Norman Mailer and subtitled it "Botany As History – History As Botany." Decades before it became a publishing trend, McPhee created the microhistory, showing how diving deep into an everyday object or obscure topic can yield a refreshing trove of new angles on history, science and what-have-you. Recent years have seen fine books on the pencil, salt, the Basque region, and host of others. The yield of food books in the past decade or so is especially rich.



Andrew Moore's *Pawpaw* arrives with the added frisson of concerning itself with a worthy foodstuff that really does live in obscurity not only for typical American consumers but probably a great many who pride themselves on their knowledge of produce. Native to North America and tasting at its best like a fortunate blend of banana and mango, the pawpaw grows wild throughout the Deep South, up into the Midwest, and as far north as southern Ontario. Since it cannot be picked prematurely and left to ripen on the ground or in a bin, and since it is a bit harder to ship than other fruits, the pawpaw languishes in commercial obscurity. Since it is also packed with health-promoting procyanidins plus niacin, protein and more iron, zinc, copper and manganese than apples, bananas or oranges, this is a shame. Moreover, growing it doesn't seem to pose many headaches.

Moore is a cheerful and intelligent guide to the world of pawpaws in historical and contemporary America. As a native fruit that could be found all over the place when the continent was covered in forests, the pawpaw under various names found its way onto the dinner tables of the Cherokee Nation, the Wabash, Spanish explorers, settlers and Founding Fathers. Prominent agriculturalists such as Henry A. Wallace were pawpaw partisans. It was immortalized in a folk song called "Way Down Yonder in the Pawpaw Patch" (best heard nowadays by looking for the version by Burl Ives).

Most gratifying of all is the story of the pawpaw's current resurgence, which occupies the lion's share of Moore's book. He visits with noted pawpaw vendor Oriana Keuszewski of Chicago's Green City Market, pawpaw festival founder Chris Chmiel and champion pawpaw grower Jerry Lehman. The news is mainly good – ideal for locavores and casual produce eaters alike, pawpaws are getting rediscovered all over the place. A note of suspense hangs only over the significant question of whether this time the pawpaw will break free of its niche status and enter the diet of America at large. It could happen, as the problems of harvesting, transporting and scale are far from insurmountable. Or it could go on being cherished by a relative handful of food lovers. Time will tell, but this book can help raise the pawpaw's profile.

Pawpaw: In Search of America's Forgotten Fruit by Andrew Moore, 2015. Chelsea Green. ISBN: 978-1603585965.

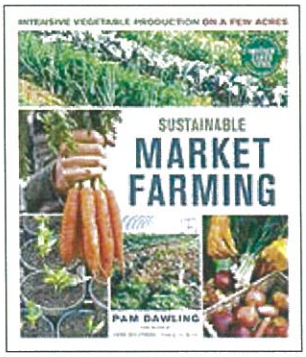
– Chris Walters

REVIEW

Sustainable Market Gardening: Intensive Vegetable Production on a Few Acres
by Pam Dawling

We all know there are plenty of gardening books out there already, so why write, buy or read another one? But this one is like no other: An artful blend of intellectual anecdotal observations, existential need to feed 100 people off of 3.5 acres, combined with cold, hard science – all while explaining the "why" behind the presented ideas.

Although many authors fall into the trap of writing only for their temperate zone and climate conditions, Dawling takes care to mention that this is what works for her, then often offering suggestions for alternate areas. Cutting her teeth in cloudy, clammy England for 17 years, she considers Virginia summers to be sweltering hot; understanding not everywhere is created equal.



This book is not just about gardening, but how to create a garden. Obviously, you are already growing but these suggested methods will bump up your operation. The first half of the book is dedicated to planning for year-round harvesting, planting, crop protection, soil quality, including how to make excellent compost in situ, mulching, weed and pest suppression and much more, using the earth's own soil food web to augment organic, chemical-free techniques, increasing

ONLINE RESOURCES

Cover Crop Chart

www.ars.usda.gov/Services/docs.htm?docid=20323

U.S. Department of Agriculture scientists have developed a Cover Crop Chart that helps growers choose the best cover crop to meet their management and production needs. Soil scientist Mark Liebig and his colleagues with the Agricultural Research Service's Northern Great Plains Research Laboratory in Mandan, North Dakota, created the tool, which can be downloaded for free. The Cover Crop Chart (v. 2.0) is designed to assist producers with decisions on the use of cover crops in crop and forage production systems. The chart, patterned after the periodic table of elements, includes information on 58 crop species that may be planted individually or in cocktail mixtures. Information on growth cycle, relative water use, plant architecture, seeding depth, forage quality, pollination characteristics and nutrient cycling are included for most crop species.

Niche Meat Processor Assistance Network

www.nichemeatprocessing.org

NMPAN is a network and information hub for people and organizations who want small meat processors to thrive. The network offers tools and information for small processors and the farmers, marketers and meat buyers who depend on them.

Hops Growing Guide

www.mightyaxehops.com/category/grow-hops

Minnesota's exploding craft beer industry has not only produced delicious beer but has also created demand for high-quality, local hops. Mighty Axe's Minnesota Hops Grower's Guide is not intended to be the end-all-be-all of hops growing, it is simply an honest account of our experience as local hops growers. While the guide is written for a commercial scale, homebrewers and backyard hops gardeners alike can glean new techniques that will make for better yields and tastier hops. The guide covers everything about local, sustainable hops production: design, install, planting, management, harvest and postharvest handling.

Postharvest Information

postharvest.ucdavis.edu/libraries/publications

UC Davis offers a database containing more than 1,900 articles and presentations authored by UC postharvest specialists, USDA postharvest researchers, and others. The database is organized by topic and is searchable. You can download in PDF format.

yields of nutrient-dense food to great abundance.

Dawling then addresses almost every imaginable vegetable in great detail. From seed starting – soil temperature makes a big difference – to seed propagation (direct sowing or in pots for transplanting), growing to maturity, avoiding insects, furry critters and disease, crop rotation, harvesting, storage and seed saving. Who knew you could produce such a diversity of crops in such a small amount of space, each requiring their own microclimate? Yet, Dawling makes it seem feasible, even easy to accomplish.

To grow enough to feed a non-sectarian, self-sufficient community requires a crew of people. Dawling offers insightful suggestions on how to manage them, based on each individual's natural talents. Her tips on field layout to maximize efficiency and minimize labor prove invaluable, even to solo growers, like myself. For example, watermelons are heavy, so raise them next to a driveway so a truck can haul them off instead of humping those long distances.

Emphasis on succession sowing is a topic most books don't emphasize enough. Being a leafy greens seller; lettuce, arugula and kale my specialties, I find it crucial and practice it religiously. Dawling has taken it to a new level, presenting graphs of sowing dates compared to harvest rates. That sure beats staring at a spreadsheet full of too many numbers. Albeit, it still takes a few moments examining squiggly lines to figure out the complex relationships between shifting ratio of sunlit to dark hours, along with changing daily high and low temperatures. A section on winter farming, in greenhouses and low tunnels, is worth the price of the book, alone. Learning to grow leafy veggies through the dead of winter is better than subsisting on potatoes and hard squash for three months. Dawling offers many suggestions on storing vegetables in a root cellar, along with an exciting story about avoiding snakes in your root cellar.

The only complaints some readers might have with the book is that there is no mention of growing herbs, fruit trees or animal husbandry. Those roles are delegated to other members of the team. After all this is a vegetable growing book. I aspire to write my own gardening book, with a heavy emphasis on growing lettuce for fun and profit, but her chapter on the topic puts my effort to shame. So, I recommend this book, even with a twinge of jealousy. If I had to give up every volume in my library except one, this would be the keeper. That's how powerful and wonderful it is.

Sustainable Market Gardening: Intensive Vegetable Production on a Few Acres by Pam Dawling, 2013. New Society Publishers. ISBN: 9780865717169. For more information visit *www.sustainablemarketfarming.com*.

– Bruce V. Maier

Western Cape Government
Agriculture

Nelson Mandela Metropolitan University

EFFECT OF RYEGRASS SEED AGE ON GERMINATION

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Message

1. Older ryegrass seeds had a higher germination percentage than newly harvested seeds.

Introduction

Ryegrass is one of the major grass weeds of winter cereal crops in Western Cape small grain producing areas (Barros *et al.*, 2007). It is severely competitive in crops in the initial growth stage as it emerges within the first few weeks after planting (Marais, 1985; Botha, 2001; Blackshaw *et al.*, 2005). The repeated use of herbicides over the years resulted to evolution of resistant ryegrass. The high genotypic plasticity and hybridisation for producing *Lolium multiflorum* x *perenne* among these two grass species makes it a decisive production constraint in crop production, as it results in reduced grain yield and quality. Annual ryegrass (*Lolium multiflorum*) has 3-9 flowers in each spikelet with an outer husk with similar length of that of the spikelet, whereas perennial ryegrass (*Lolium perenne*) has 4-14 flowers with the outer husk half the length of the spikelet. Weeds normally have long seed dormancy and survival capacity which result in a bigger challenge to eradicate it.

Objectives

1. To determine the effect of seed age on germination percentage.

Materials & Methods

- Seeds were collected towards the end of the previous season when they were matured but before they were dispersed form the parent plant (October 2009, 2010 & 2011) at Langgewens research farm.
- Harvested seeds were threshed by hand and cleaned to remove chaff and empty seeds, and then stored in sealed paper bags at room temperature.
- The experiment was conducted in 2012 and repeated three times in four weeks interval, in May, July and August in a randomised block design with ten replicates, equaling 100 seeds per sample for each year in which seeds were collected, namely 2009, 2010 & 2011.
- Ten ryegrass seeds of each sample were placed on two layers of filter paper in 95 mm diameter Petri-dishes and moistened with five millilitre (5 ml) distilled water and sealed with Parafilm®.
- Petri-dishes were placed in an incubator set at a 12h/12h day/night cycle and a temperature range of 22°C during the day and 14°C at night.
- Germination was determined after seven and fourteen days of incubation respectively, by counting the number of seeds germinated.

Results & Discussion

Table 1 Percentage germination after 7 & 14 days of incubation for three experiments

	Experiment 1		Experiment 2		Experiment 3	
Years	Germination after 7 days (%)	Germination after 14 days (%)	Germination after 7 days (%)	Germination after 14 days (%)	Germination after 7 days (%)	Germination after 14 days (%)
2009	86^{a}	87^{a}	71^{bc}	75b^{c}	72^{bc}	77^{abc}
2010	77^{ab}	81^{ab}	66^{bc}	72b^{c}	64^{c}	66^{c}
2011	42^{d}	43^{d}	40^{d}	44^{d}	39^{d}	39^{d}
LSD ≤0.05	12	12	12	12	12	12

*Means with the same letter are not significantly different at the 0.05 probability level

- The results showed that cumulative germination percentage of 2011 seeds differed significantly from those collected in both 2009 and 2010 (Table 1).
- It also shows significant differences between 2009 seeds in experiment 1 and experiment 2 with a high germination percentage of ryegrass seeds after fourteen days of incubation.
- The germination percentage after seven and fourteen days was significantly affected by time and age. This is in agreement with Benech-Arnold (2000) who reported that dormancy release fluctuate seasonally. It varied between years with significantly lower germination which occurred in 2011 seeds (Figures 1 & 2).
- The major increase in germination percentage on old seed was due to loss of dormancy of seeds over time as dormancy inhibitor release increase with age of the seed.
- The cumulative germination of above 50% for seeds collected in 2009 and 2010 indicates that seeds had already after ripened and had been stored long enough to break primary dormancy and reach peak germination.

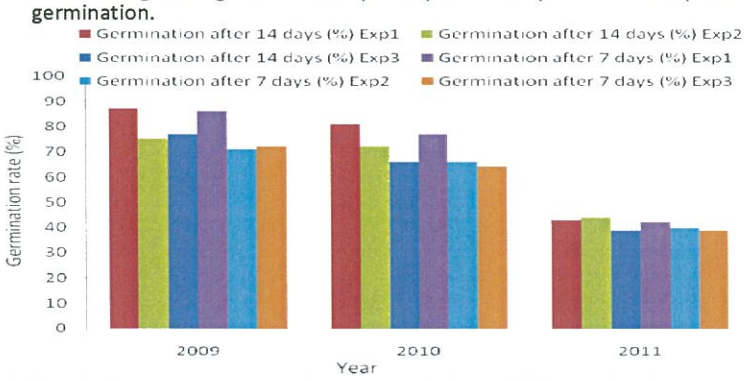

Figure 1 Germination percentage of ryegrass seeds after 7 & 14 days of incubation in three experiments

Figure 2 Germination percentage of ryegrass seeds after 7 days of incubation in three experiments

Conclusion

- Mature old seeds can enter into a secondary dormancy when conditions are unfavourable and lengthen its viability period. The germination percentage of below 50% indicates that seed after-ripening and dormancy release were not met at the time of the experiments.
- The germination of newly harvested seeds was inhibited by dormancy (after-ripening) compared to older seeds that had high germination percentages.
- Seed age has an effect on germination percentages of ryegrass seeds.

Acknowledgments

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Evaluating crop yields, crop quality and soil fertility from organic and conventional farming systems in South Africa's Southern Cape.

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Abstract

Climate change, water scarcity and degraded soils jeopardise the ability of agriculture to ensure food security. The dependence on agrochemicals and monoculture practices in agriculture is not only environmentally destructive and expensive, these practices also produce foods of poor nutritional value. Here we report on the initial results of a long-term comparative controlled experiment at the NMMU Saasveld campus in George to test the differences in yield and nutritional quality of crops grown under different agricultural practices. A baseline study showed considerable variation in the soil fertility of the experimental site. As anticipated from the soil analysis results, the baseline crop had varying growth from one replication to the other. Initial organic treatment yields were lower and initial nutritional levels were inconclusive.

The experimental site accommodates a randomised complete block design with four replications for three agricultural treatments: conventional, organic and controlled. The

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crops included cabbage (*Brassica olaracea, var. capitata L.*), sweet potato *(Ipomea batatas)* and cowpeas *(Vigna unguiculata)*. Our results show that the cabbage and cowpea yields grown under organic conditions were 20% and 24% less than conventional yields respectively.

Introduction and background to the study

South Africa is food secure at national level, yet half of the population is impoverished (Statistics SA, 2013), and two million households with 14.4 million people are vulnerable to household food insecurity (Wilson and Cornell, 2012; Leibrandt *et al.*, 2012). This can be linked to a lack of employment, low wages and high food prices (Ziervogel and Frayne, 2012). The problem of food insecurity is further compounded by malnutrition due to poor diets (energy dense but low nutrient foods) chosen over healthier alternatives due to big price differences (May and Rogerson, 1995; Zezza and Tasciotti, 2010).

Currently of the total 122,081,300 ha of potentially active land, 67% is white owned agricultural, 15% is black communal land, and 10% is state owned land. In total 8% is urban areas where about 60% of South Africa's population reside (Walker and Dubb, 2013). According to Greenberg (2010) there are approximately 40,000 large scale, capital intensive white farmers linked to export and domestic markets. The large scale farmers dominate agricultural production in both formal and informal markets (Greenberg, 2010).

There are also 1.3 million black small-scale, labour-intensive farmers, producing for household consumption and/or markets (Walker and Dubb, 2013). Despite increases in the agricultural budget little change has been made to invest more in small-scale farmers

(Hall and Aliber, 2010). The small-scale farmers farm primarily to supplement their household food requirements (Scialabba, 2007). This is the main but not the only way for people to supplement their food requirements as well as nutritional quality and diversity.

Troosters (2015) found that small scale farmers usually have limited resources and therefore adopt agricultural practices that require minimum expensive external inputs, and in his study in southern KwaZulu-Natal, he identified five barriers to smallholder agricultural production, and showed how organic farming and co-operative marketing could help farmers to access high-end markets. Organic agriculture focuses on building and maintaining soil health, prohibits the use of many chemicals, requires minimum external inputs and favours diverse crop planting (IFOAM, 2009; Scialabba, 2007). This creates an opportunity for the adoption of organic agriculture by small-scale farmers.

However organic farming is not without its challenges. A number of long-term studies have shown that crop produce from organic farming systems is usually less (about 80%) than that of conventional farming systems (Mäder *et al.*, 2006; Rasmussen, 2006; Hepperly *et al.*, 2006; Scialabba, 2007; Rodale Institute, 2011, de Ponti *et al.*, 2012). However, work at Rodale Institute (2011) suggests that once organic systems are optimised, yields can come close to those of conventional farming. Most of the above long-term studies show that once soil biology has improved, organic treatments take two to four years to stabilise at these higher yield levels.

This "conversion period" can translate to a decrease in profits and, together with issues such as the high labour requirements, and poor research and institutional support, many farmers are reluctant to adopt organic farming systems (Fairweather, 1999; Mäder *et al.*, 2006; Darnhofer *et al.*, 2005; Scialabba, 2007). On the other hand, it has been shown

that organic farming across Africa is far more cost effective and successful than high external input systems as a developmental tool for improving food security (Auerbach, 2013). Agricultural practices can be labelled as successful if they increase the natural resource base, are financially viable, yield sufficient produce and add to the wellbeing of living organisms (Reganold, 2012). Most agricultural methods fall short in one way or another, but in the context of climate change and food insecurity, sustainable agriculture should be researched, as other trade-offs justify investment in organic farming.

Chemical residues, Food and Nutrition

For example diet and environmental toxins play a major role in the development and/or prevention of diseases such as cancer, obesity, type 2 diabetes and cardiac and celiac disease (Samsel and Seneff, 2013). A diet high in antioxidants can reduce the chances of the development of such diseases (Halvorsen *et al.*, 2001, Baránski *et al.*, 2014). Antioxidants are substances that work to either reduce or delay the oxidative nature of free radicals, reactive oxygen species (Marathe *et al.*, 2011; Ou *et al.*, 2002, Pellergrini *et al.*, 2003). Different classes and types of antioxidants can be found in plant foods (Pellergrini *et al.*, 2003; Halvorsen *et al.*, 2001). The most common antioxidants include Vitamin A, Vitamin E, β-carotene, α-tocopherol, polyphenols and flavonoids (Marathe *et al.*, 2011; Ou *et al.*, 2002, Halvorsen *et al.*, 2001).

There is also a general agreement that a plant based diet provides the antioxidants required to reduce the chances of oxidative–stress related diseases, but information which identifies the most beneficial dietary plants is very limited (Halvorsen *et al.*, 2001). There is strong evidence that organically produced foods often contain more anti-oxidants

and less pesticide residues than conventionally grown foods (Baránski *et al.*, 2014, Lairon, 2009; Niggli *et al.*, 2007).

In this study the same crops grown under conventional and organic systems were harvested and their yields were compared. Nutritional analysis was done using the Oxygen Radical Absorbance Capacity (ORAC), Ferric Reducing Antioxidant Power (FRAP) and Trolox Equivalent Antioxidant Capacity (TEAC) methods, and this will be reported after the second season. Quality parameters, soil fertility, water use efficiency and carbon sequestration will also be measured in the course of the research, as will chemical and biological pest and disease control effectiveness.

Baseline study

A first baseline study using Caliente mustard (*Brassica juncea*) as an indicator crop preceded this study and showed considerable variation in the soil fertility of the experimental site. As anticipated from the soil analysis results, the mustard showed deficiency symptoms after a few weeks of growth. The poor growth of the mustard was weakly but significantly correlated to yield height, soil phosphorus, soil pH and replication (Mashele & Auerbach, in preparation). The results from this baseline characterised the soil fertility, and quantified plot variability and its initial effects on crop yields.

Experimental site

{Insert Figure 1}

In 2013 a long-term research project was initiated at the Nelson Mandela Metropolitan University's George Campus (altitude 160 mas; co-ordinates: 22° 32' 6. 546" E 33° 57'

49.289" S) on ground that has been undisturbed for about twenty years and dominated by kikuyu grass (*Pennisetum clandestinum*). The site was fenced with a 2.4m high electric fence to keep the baboons and bush pigs out.

Soil at the research site is grey in colour, acidic and predominantly sandy loam, with a soil carbon content of about 2.5%. The soil profile consists of an Orthic A horizon on an E-horizon at a depth of 70 cm, which becomes waterlogged during certain periods due to an underlying impervious clay layer. This results in lateral movement of water and nutrients (Soil Classification Working Group, 2009). The climate is temperate, exhibiting an all year round rainfall pattern with a mean annual precipitation of 863mm (ICFR, 2013). Soils were low in available P (4-14 mg/kg), adequate in K (130-220 mg/kg), and with high Al levels (1500-2500 mg/kg); pH (KCl) was 4.8 to 6.3.

Experimental design

The experimental area is 1200m², and was divided into four replications. Each replication had ten plots of 5m x 6m each (gross) and a net plot area of 4m x 5m. The experimental design is a randomised block design (with 4 x 2 treatments arranged in split plots), with four plots organic, four plots conventional and two control plots in each replication. Within each system block, the three rotational crops and the continuous cabbage crop were randomised; the control plots were also randomly allocated.

The site is naturally watered (rain fed). Due to the size of the experimental area and the design of the plots, tillage was uniform for all the treatments. A mechanical chopper and a tine cultivator with a weed-extracting roller were used to cultivate the soil.

Crop rotations

Crops planted in a rotational sequence are cabbage (*Brassica olaracea var. capitata L.*) – classified as a heavy feeder; sweet potato (*Ipomoea batatas*) - light feeder; and cowpea (*Vigna unguiculata*) - legume. Each system also includes one mono-cropped cabbage treatment in each replication. Thus there are four plots per replication in the organic system, and four in the conventional (Table 1). Two unfertilised control cabbage mono-crop treatments were included in each replication, to facilitate comparisons between treatments (Cochran & Cox, 1992).

Insert table1

As soil Al levels were high and soil Mg was much lower than soil Ca, one t/ha of dolomitic lime was applied to all plots a month before planting. Compost from the local George nursery was applied to the organic plots. Compound fertiliser was applied to the conventional crops. The compost and fertiliser formulations are presented in table 2.

Insert table 2

Cabbage (Common names: khavishi)

Cabbage (*Brassica oleracea var. capitata L.*) is a crop commonly grown around the country as it easily adapts to different climates and soils, though it grows at its best in cool and humid climates with sandy loam soils (Allermann and Young, 2005; DAFF, n.d). It is a heavy feeder requiring large amounts of mineral nutrients and thus depletes the soil of nutrients. Cabbage is popular and also an important source of food for small scale farmers as well as the urban and rural population (Fening *et al.*, 2014).

Planting

Seedlings were planted in randomly designated plots. Each plot had five rows of ten plants each (80 cm x 60 cm). Eight organic plots, eight conventional plot and eight control plots were planted to cabbage, making a total of 24 plots planted to cabbage.

Sweet Potato (Common names: ibatata, soetpatat)

Orange fleshed sweet potato (*Ipomoea batatas L.)* is an indigenous African crop with more Beta-carotene than other sweet potato varieties, an important precursor of Vitamin A (Low *et al.*, 2007). This characteristic is important, as many Africans suffer from vitamin A deficiency (DAFF, 2011; Low *et al.*, 2007).

Planting

A new orange fleshed variety (higher dry matter than the purple variety) developed by the Agricultural Research Council (ARC) in Pretoria was planted between the 15th and 20th of October from cuttings. Each plot had five rows (10 cm x 30 cm).

Cowpeas (Common names: Dinawa, Tinyawa, Munawa, Imbumba, akkerbone)

Cowpeas (*Vigna unguiculata*) are legumes that can grow in a wide variety of environments, surviving in marginal areas with poor ecological health, even in areas with 85% sand and less than 0.2% of organic matter content (Dube and Fanadzo, 2013; Singh *et al.*, 2003). Cowpea is both drought tolerant and shade tolerant (Singh *et al.*, 2003). These qualities make it an attractive and important indigenous African crop for subsistence farming especially in dry areas. The quick growth and rapid ground cover of these plants helps reduce erosion (Singh *et al.*, 2003).

All parts of the crop can be used for food, the green leaves, green pods and dry pods can be eaten in different dishes (DAFF, 2013; Dube and Fanadzo, 2013; Singh *et al.*, 2003). Nutritious young leaves can also be harvested (Dube and Fanadzo, 2013).

Cowpeas are not only beneficial for consumption but also improve soil properties, they form a symbiotic relationship with rhizobium to fix nitrogen in the soil, making it available to the plant and also improving soil fertility (AATF, 2012, Singh *et al.*, 2003).

Planting, harvesting and nutrient analysis

Cowpea seeds were inoculated before planting, eight plots were planted to Cowpea, four under organic treatment and the other four under conventional treatment.

All parts of the plants are harvestable throughout the growing period of the plant, however for this study the entire plant was harvested upon maturity of the pods. For each plot, all pods (young- mature) were harvested first and weighed, thereafter the remaining plant biomass. A sub-sample was selected to determine yield components, and samples of leaves and pods were analysed.

After harvesting the cowpeas, the four organic plots were cleared of all debris to make furrows for the vetch (*Vicia sativa L.)* seeds (3-5 cm deep). The seeds were inoculated before planting with 50 g inoculum which contained Trichoderma spp. 5 x 10^7 CFU/g; Rhizobium spp. 5 x 10^9 CFU/g. Oats (*Avena sativa*) was then broadcast over the entire plot and seed raked in; this cover crop was ploughed in a month later.

Weed, Pest and Disease Control

Weeds were mechanically controlled in all plots using a hand hoe. It is critical that the first few weeks after planting, weeds be monitored and removed. Weeds play a major role in

determining the crop yield with losses of approximately 2% (potential yield) every day from 30-60 days after planting moreover a direct correlation was found between yield and weed control (Auerbach, 1995) thus the earlier weeds are removed the better the crop yields (Rosenberg and Linders, 2004). The site is prone to invasion by nutsedge (*Cyperus esculentis*) and kikuyu, and these weeds were manually controlled.

Cutworm attacked the cabbage seedlings and a few had to be re-planted. Cutworm bait (Sodium fluosilicate) was applied on cabbage seedlings growing on the conventional and control plots. The cabbages were severely damaged by cabbage loopers (*Trichoplusia ni*) and white caterpillars (*Pieris brassicae*). The biological control agent was not available in time for use on the organic cabbages. As a preventive measure against insect pests, a spray was prepared for organic plots which consisted of crushed garlic mixed with liquid paraffin. The conventional and control cabbage plots were sprayed using a mixture of spinosad diluted in water.

Challenges

In 2015 the experimental site was damaged by baboons pulling out most of the sweet potato plants. As a result there was little harvest in seven out of the eight plots. Baboons also damaged 11 plots of cabbages (Figure 2) but mostly ate plants in the border rows. During rainfall events Plot 10 experienced waterlogging and a few of the cabbage plants were submerged in water for several days (Figure 3).

RESULTS AND DISCUSSION

Cabbages

Cabbages under organic treatment in the first replication had slower growth rates in comparison to cabbages under conventional treatment. Control plot cabbage growth and development was slower than both organic and conventional treatments.

Replication 2 organic cabbages were larger (size) and more developed than conventional and control plots (Figure 4). The two organic plots had a total yield of 120.9 kg while the two conventional plots yielded only 77 kg. The control plots yielded up to 49.3 kg. The overall yield (247.2 kg) in this replication was the lowest out of the four replications.

Growth in Replication 3 was the slowest in growth catching up after two months into planting (organic and conventional plots). Growth and development in control plots remained slow. Contrary to the growth of the mustard during the baseline study where the plants ran out of nitrogen and phosphate, turning red/purple, and were stunted, this replication had the highest yield of 355.5 kg. A possible reason for the high yield could be that Al levels had decreased to half of the initial baseline levels. This decrease (probably an effect of the liming) increased the amount of plant-available P.

Replication 4 (Figure 5) showed similar but even more severe symptoms than the mustard plants (baseline study crop) in Replication 3, and yet had the second highest cabbage yield (332.4 kg). The control plots in this replication yielded heavier and better developed cabbages compared to control plots in the other reps, yielding the highest of all control plots at 66.3 kg.

Potential baboon damage forced us to harvest the cabbages earlier. The net plot (three middle rows, 24 heads) in each plot was carefully inspected, with each cabbage being evaluated to determine whether or not the head was firm enough to be harvested

regardless of its size or stage of maturity before harvesting could commence. Each cabbage was first weighed for gross weight (as harvested) after which it was trimmed of the outer leaves. The head (Figure 6) was then weighed as the net weight.

Differences in yield

Statistical analysis using a non-parametric test illustrated the yield differences of the cabbages under different treatments (Figure 7). The results show a small (0.6 kg) difference between the average weights of cabbages between conventional and organic. No statistically significant differences were found in weight of the average cabbage between the two main treatments. A larger difference was found between cabbages from the control plots and the other two treatments.

Figure 8a shows that in three of the replications conventional cabbages outyielded organic, however in replication 2 organic (120.9 kg) outyielded the conventional (77 kg) plot. The reason for the poor growth in the conventional plots is unclear as the pH of both conventional and organic plots was similar (5.3; 5.1 and 5.1; 5.2 respectively). The yields from control plots were low in all replications. This is not surprising as the control plots received no form of nutrient input which is essential for plant growth and development. Figure 8b illustrates the overall yield differences between the replications across treatments. Replication 3 yielded the highest (355.5 kg) while replication 2 yielded the lowest (247.2 kg). Growth patterns are contrary to baseline results.

The total yield for cabbages grown conventionally was 575.8 kg, Organic cabbages weighed 458.4 kg and the control plot cabbages totalled 212.5 kg. The yield of the organic Cabbages was 20% less than conventional cabbage yields. This supports findings in

similar studies (Hepperly *et al.*, 2006; Rodale 2011; Mäder *et al.*, 2006). This is mainly due to the fact that organic agriculture focuses on building up the soil health to a point where it is self-sustaining entity. After the initial three- five year period during which the soil health is built, yields may increase to match those of conventional systems.

Organic systems are much more complex than conventional systems and require a great deal of planning and nutrient management. The various practices such crop rotation, mulching and cover cropping improve soil properties such as the soil microbial community, soil stability and water use efficiency (Watson *et al.*, 2002; Mäder *et al.*, 2002). Such properties lead to an increase in organic matter and can boost not only the yield but the resilience of the farming system.

The yield from the control plots was much less than the other treatments. It was 63% less than the conventional and 54% less than the organic treatments. This is not surprising and shows that plants need a combination of water, adequate nutrient supply.

A negative correlation was found between treatments and the yield of the plot with the conventional treatment yielding highest, though not significantly higher than the organic; both treatments were significantly higher than the control plots.

Cowpeas

In replication 1 plants from both treatments showed similar deficiency/disease patterns. The plants were stunted, leaves had a light green/yellow colouration, and some leaves had a rusting effect on the upper margins. The growth for the organic plot was poorer for all replications, with poor germination and ground cover and a gross yield of 38.6 kg. The

conventional plot was denser and taller in comparison (94.8 kg). During rainfall events there was waterlogging on the organic plot in this replication.

The growth of the cowpeas was slow and the majority of the plants appeared to be stunted across the treatments in the early stages of growth in replication 2, with plants increasing in density and height much later. A common trend across the treatments was the leaves showing a light green/yellow, rusting colouration. The overall growth and yield in this replication was the lowest (126.2 kg) in comparison to the other replications.

In the early stages of plant growth, plants growing in replication 3 (conventional plot) showed more leaf discolouration and patterns characteristic of nutrient deficiencies/ mosaic disease. The organic plot was denser, healthier looking and had a higher yield (88 kg) than the conventional plot (77 kg).

The conventional plot in replication 4 was the densest in terms of ground cover as well as plant height and greenest of all four replications. The organic plot had a few plants that were stunted and showed signs of deficiencies (light green/yellow colouration of leaves).

Figure 13 above shows the yield components of the cowpeas, the conventional treatment had an overall yield of 375.6 kg, while the organic treatment had an overall yield of 279.43 kg. The yield of the organic cowpea biomass was 24% less than the conventional biomass. In both cropping systems the pod production was low, with pod yields from organic plots up to 51% less than conventional pods.

The low pod yields can be attributed to a number of factors. Cowpeas can grow in various climates but prefer high temperature areas (Baidoo and Mochiah, 2014; DAFF, 2011,

Dube and Fanadzo, 2013), George is a cool area with high rainfall. High rainfall encourages excess vegetative growth (SARI, 2012) this could result in reduced reproductive growth. Cowpeas are also sensitive to waterlogging (DAFF, 2011; SARI, 2012) and as found in this study, during heavy rainfall events some of the plots were waterlogged, and this may have interfered with the growth of the plants.

The density and plant seed rate is dependent on the variety of the seeds planted. This particular variety yielded many leaves that were roughly textured and hairy even at early stages of development, thus making it much more suitable for forage rather than human consumption. Cowpeas are usually grown for both leaf and pod/seed consumption, with the leaves being harvested continuously till flowering (Dube and Fanadzo, 2013; DAFF, 2013, DAFF 2011). Leaf harvesting reduces pod/seed production (Dube and Fanadzo, 2013), however at no stage in this study were the leaves harvested, ruling this factor out as a possible cause of low seed production. High pest and disease incidences have been implicated as the cause for low cowpea yields (Baidoo and Mochiah, 2014, DAFF, 2011). Few pests were found in the course of this study, and the mosaic virus was visible only on some of the plots. An interaction of all climatic conditions and seed variety could have resulted in the low yields of the cowpea pods.

Conclusions

The study set out to evaluate yield differences of crops grown under different agricultural systems. Organic cabbage yields are were approximately 20% less than conventional yields. Organic cowpeas were 24% less (leaves) than conventional cowpeas, and pods are 51% less. It takes several seasons for organic soil conditions to improve to the point where yields are comparable with conventional. The soil conditions are still below optimum. It is likely that the high Al levels impede P availability. Future seasons will also

evaluate and compare food quality, soil organic matter changes, water use efficiency and crop health.

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National Research Foundation | RISA Research and Innovation Support and Advancement

Contact person : Marinky Tshephe
Direct telephone : (012) 481-4060
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e-mail : maria@nrf.ac.za

Reference: RTF14010959996
12 May 2014

Prof RMB Auerbach
School of Natural Resource Management
Nelson Mandela Metropolitan University
raymond.auerbach@nmmu.ac.za

Dear Prof Auerbach

Research and Technology (RTF) fund Approved grant for 2014

I am pleased to inform you that the RTF panel has approved support for the project as specified in your proposal, with the following details:

Short title: African Organic Farming Systems Research Project
Institution: Nelson Mandela Metropolitan University
Duration of funding: 2014 - 2014

	2014
RTF Contribution	**790,000.00**

Industry Partner Name	Financial Value	Bursary Value
Shaddad Tractor Service Pty Ltd	75,000.00	0.00
Total	75,000.00	0.00

General information

The award is subject to acceptance of the enclosed "RTFConditions of Grant".

The approved RTF funds will be released upon receipt of:

* The completed "Acceptance of Conditions" form signed by yourself and the appropriate authority within your organisation;

* A certification by the Institution Research Administration that the funds received from the industrial partner will only be used for this research project.

Yours sincerely,

National Research Foundation

RISA
Research and Innovation Support and Advancement

Mr Lebusa Monyooe
Grant Director: KFD-GMSA

- Enclosures
- Feedback from Advisory Panel

Contact person : Marinky Tshephe
Direct telephone : (012) 481-4060
Direct fax : (012) 481-4197
e-mail : maria@nrf.ac.za

Reference: RTF150420117426
Grant No: 98629
24 November 2015

Prof RMB Auerbach
School of Natural Resource Management
Nelson Mandela Metropolitan University
raymond.auerbach@nmmu.ac.za

Dear Prof Auerbach

Research and Technology (RTF) fund Approved grant for 2016

I am pleased to inform you that the RTF panel has approved support for the project as specified in your proposal, with the following details:

Short title of project: *African Organic Farming Systems Research Project*
Institution: Nelson Mandela Metropolitan University
Duration of funding : 3

Category	2016 Award	2017 Award	2018 Award
Student Support			
No Amount Students Summary	100,000.00	100,000.00	100,000.00
Research Operating Costs			
Running Expenses	200,000.00	200,000.00	200,000.00
Total	300,000.00	300,000.00	300,000.00

General information

The award is subject to acceptance of the enclosed "RTFConditions of Grant".

The approved RTF funds will be released upon receipt of:

* The completed "Acceptance of Conditions" form signed by yourself and the appropriate authority within your organisation;

* A certification by the Institution Research Administration that the funds received from the industrial partner will only be used for this research project.

Yours sincerely,

National Research Foundation | RISA Research and Innovation Support and Advancement

Electronic signature
Lebusa Monyooe
Director
Grants Management and Systems Administration (GMSA)

Copies to: Nelson Mandela Metropolitan University

Trip to Europe (Denmark, Germany and Switzerland) 14 June – 25 June 2014

Student: Jama Mashele

Masters Research: Investigating sustainable agricultural farming systems by comparing two farming systems and measuring certain parameters to use as indicators of which of these systems is environmentally sound, affordable and can be used to abate food insecurity.

Visit Purpose: Peer review of overall project proposal and information sharing with and from Institutions that have established research similar to what we have started here in George.

14TH-15TH June- travel to and arrival at Frankfurt Airport, from the airport we travelled via train to Aarhus (Denmark).

1. **Institution**: International Center for Research in Organic Food Systems (ICROFS)

   Date: 16-17th June

   Agenda 16th June

We met the ICROFS team and shortly thereafter had a meeting with Niles Halberg (director of ICROFS), Lise Andreasen (Interntaional coordinator) and Esther Waweru (Assistant International coordinator). The meeting centered on possible collaborations between ICROFS and African countries, discussing project ideas and developing proposals for research in agroecological farming systems in Southern Africa.

Agenda 17th June

Seminar on Agroecological sustainable agricultural research in Southern Africa, attended by researchers from the department of Agroeceology from Aarhus University. The Danish counterparts shared on completed and ongoing agricultural trials, the finding and implications of the findings. We presented about our project here in George and were open to questions, criticism and corrections.

Site visit: to see the long-term arable crop rotation trials started in 1997 where in conventional cropping methods are compared to organic cropping methods. The cropping systems and findings thus far were discussed, allowing also for questions with regards to equipment, pest and disease problems and water use efficiency.

18th June - Travelled via train from Viborg (Denmark) to Oldenburg (Germany) – where we were received and accommodated by Prof Berndt Siebenhüner and his wife Malve van Moellendorf from the Carl von Ossietzky Oldernburg University

2. **Institution**: Carl von Ossietzky Oldenburg University
   Date: **19th June**

   Agenda 19th June

Meeting with the COAST (Center for Environmental and Sustainable Resources) group.

Seminar presentation on Organic farming systems and our comparative research trial in George.

23rd June - Train to Frick to meet the FibL Swirtzerland team

3. **Institution**: FibL (Research institute for organic agriculture)

   Date: 23rd June

   Agenda 23rd June

Met Noah Adamtey, a soil scientist working at FibL who is heading up comparative research trials in Kenya, comparing organic agriculture systems to conventional systems. He explained the set-up of their research which has been running for the past 7years, their preliminary findings as well as difficulties. The meeting proved very enlightening as he advised us on what will work and what will not and also factors that we had overlooked, equipment to aid with some of the objectives (water use efficiency), the crop rotations and parameters to measure.

Agenda 24th June

Site visit to the DOK (D-biodynamic, O- Organic and K- conventional) comparative research trial with Andreas Gattinger (head of climate change and organic farming research at FibL) which has been running since 1978. Andreas explained in detail the crops used, the duration of the rotations, the different treatments and findings obtained thus far from the trial.

Lessons learned

Seeing projects that have been up and are running put what we are trying to start here into perspective. The field trips completed the picture I had of these projects from just having read about them to actually seeing the groundwork, the amount of time and labour that is required in such a project.

The daunting part with seeing all of the projects was the amount of money required for such research. These institutions receive support from their respective countries as opposed to the

current situation in South Africa, they thus have access to equipment I had never seen let alone heard of. However such issues are not reason enough for us to not proceed with our project, everything starts small and gains momentum as it goes, the hope is that as the project progresses and we record and publish what the findings, it will gain the attention of policy makers and hopefully that will mean more funding will be allocated to such research throughout the country to ensure that our food systems are sustainable and food insecurity can slowly be eradicated.

Overall Experience

The opportunity to travel abroad was and proved exciting and was highly appreciated. We were well received, accommodated and well fed in all the places we went to. The language barrier which limited social interactions with locals. The meetings with the various institutions were long but well-structured and information packed thus the objective of the trip was achieved.

Personally I felt privileged to have been granted such an opportunity. Seeing new places and people, the architecture and scenery was beautiful. A lot of the people I came across were hospitable, friendly and accommodating. Most of the travel and site seeing was done inside a train but that too was a pleasant experience. I got to taste and eat new food, hear strange languages. The trip was worthwhile and I could never have imagined travelling to such places, it really was an experience that I am grateful for.

Pictures of research and academic activities: Raymond Auerbach

Jama Mashele discusses diversity during the Academic Diversity practical with first-year students in February 2016; in the background, masters student Marike Swanepoel (who is taking over the agronomic research from Jama) facilitates another group. The other two groups were facilitated by B Tech students Viwe Cutu and Luxolo Dyakopu. Marike can be seen below harvesting cabbages in the long-term comparative organic farming systems research trials.

Students listen to mega-farmer Nelius van Greunen of Van Greunen Boerdery, as he explains that the greatest resource a farm has is the people who work on the farm; he is showing a slide of the farm school and pre-school on one of the farms run by the four van Greunen brothers.

Below, Prof Robin Meeske of the Outeniqua Research Farm (W Cape Dept Agriculture) shows first year students the dairy calf-rearing system which has been developed to increase dairy productivity; these visits were part of the District Orientation practical for the first year Agricultural Management students in their first week at the George Campus.

Student Catherine Eckert is doing her masters on water use efficiency; here she is sen with UKZN Prof Simon Lorentz, well-known hydrologist, who is her co-supervisor. Below, she uses the new equipment to measure the increase in water use efficiency due to organic matter in the soil and mulch on the soil.