Proceedings of the 1st African Forum on Synecoculture

Editors: André TINDANO, Masatoshi FUNABASHI

Sony CSL

AFIDRA

United Nations Educational, Scientific and Cultural Organization

uniTwin

COMPLEX SYSTEMS DIGITAL CAMPUS

ISSN 2432-3950

Citation Form: André Tindano and Masatoshi Funabashi, editor « Proceedings of the 1st African Forum on Synecoculture » (English Version). Research and Education material of UniTwin UNESCO Complex Systems Digital Campus, e-laboratory: Open Systems Exploration for Ecosystems Leveraging, No.5.
Editors: André Tindano, Masatoshi Funabashi

Original French version:
André Tindano et Masatoshi Funabashi « Actes du 1er Forum African sur la Synécoculture » Matériel éducatif et de recherche du Complex Systems Digital Campus, programme UniTwin de l'UNESCO, laboratoire en ligne : Exploration en systèmes ouverts pour l'effet de levier écosystémique, No. 4.

Table of contents

INTRODUCTION: 4

CHAPTER I: Proceedings of the Symposium 5

Conduct of the ceremony

DAY I: 19 October 2016 5

First presentation

Second presentation

Third presentation

Fourth Presentation

Fifth Presentation

DAY II: 20 October 2016 7

First presentation

Second presentation

Third presentation

Fourth Presentation

DAY III: 21 October 2016 9

First presentation

Second presentation

CHAPTER II: REPORTS..... 11

II.1 ACTIVITY REPORT OF THE PILOT FARM OF SYNECOCULTURE

IN TAPOA, BURKINA FASO:

Description of the experiment 3/2015-11/2016

Results

Implication of the results of synecoculture

Observation and photos of the field

Conclusion

II.2 REPORT OF THE WORKING GROUPS ON THE PLANNING

OF A NEW SYNECOCULTURE PILOT FARM IN FADA N'GOURMA: 37

II.3 REPORT IN RELATION TO THE NEW CONSTITUTION OF BURKINA FASO: 38

CHAPTER III: DECLARATIONS AND NOTICE OF SUPPORT

III.1: FADA N'GOURMA DECLARATION: 40

III.2: SUBSCRIPTION LIST TO THE FADA N'GOURMA DECLARATION: 42

III.3: NOTICE OF SUPPORT: 43

Governor of the East Region (Inauguration speech)

Minister of Agriculture and Hydraulic Planning

Ambassador of Japan in Burkina Faso

President of the UniTwin UNESCO CS-DC program

APPENDICES: 48

QUIZ and answers

Pictures of the forum

List of participants

ACKNOWLEDGEMENTS : 56

REFERENCES : 57

INTRODUCTION

Synecoculture is an alternative for agriculture that respects the preservation of the environment and the reconstruction of biodiversity. It is a synthesis between humans and nature, which also converges to the ultimate challenge of organic farming and conservation agriculture. Synecoculture suppresses tillage and does not use fertilizers or pesticides. In a context of reduced arable land, desert growth, climate change and growing population pressure, this method of production in the Sahel countries is a strong expectation as a panacea for sustainable development.

AFIDRA with the support of the Japanese researcher Masatoshi Funabashi, the financial support of Sony CSL and the online technical and software support of UniTwin UNESCO CS-DC, held the first African forum on synecoculture in the city of Fada N' Gourma, Burkina Faso, for the dissemination of this new cropping method for experimentation at the African scale. The meeting was held under the theme: "Synecoculture for sustainable, economic and ecological agriculture". This meeting brought together participants from Cameroon, Benin, Togo, Sierra Leone, Niger, Mali, Tunisia, Belgium, France, Japan, the United States and several regions of Burkina Faso, which allowed interactive exchanges of their experiences, and to propose the right strategy to popularize this technology.

The objective of the organization of this first African forum was to raise awareness and responsibility for our way of production, aiming to create a framework of exchanges around the synecoculture. That is why AFIDRA devoted three days of reflection and exchange around this new technology as an NGO with particular focus on self-managed rural development. The motivation was to sensitize public and private actors of civil society, and strengthen institutional coordinations between local and regional authorities at the African level on the importance of the practice of agriculture that reconstructs ecosystems, while at the same time giving a critical analysis on the current cultural practices in the countries of the Sahel. This meeting of Fada N'Gourma made it possible to identify the major challenges and the prospects for the integration of syecoculture in the situations of African agriculture. The presentations made by the Japanese expert and the field trip on the site of the new farm of synecoculture near Fada N'Gourma called for the foundation of the African Center of Research and Training in Synecoculture (CARFS), which will elaborate the bases of the theoretical concepts and practices necessary for the development of synecoculture in Africa. For the part of the presentations on current agricultural practices (the limitations, constraints, perspectives and recommendations for the integration and practice of synecoculture), the work took place in plenary and the lectures have been ensured by agricultural experts in Burkina Faso with high level of practice and research.

The meeting resulted in a declaration with a commitment to defend the right of biodiversity, which was widely accepted by the participants.

Chapter I: Lecture note of the symposium

Lecture note of the Forum on Synecoculture held from 19 to 21 October 2016

Conduct of the ceremony

In the year 2016 from October 19 to 21 took place in Burkina Faso at the Hotel Panache of Fada N'Gourma the first African Forum on Synecoculture around the subject: "Synecoculture for a sustainable and ecological agriculture: Challenges and Prospects for Africa ".

The forum was attended and remotely participated by 64 agricultural researchers, students and practitioners from 13 countries in Africa, Asia, Europe and the United States of America.

The opening ceremony was presided over by Colonel Ousmane TRAORE, governor of the East region. It was marked by two speeches: André TINDANO, General Secretary of AFIDRA, and the opening speech of the Governor of the East region. Both welcomed the participants and indicated that this forum is set timely in view of tackling environmental problems in sub-Saharan countries, as it will allow participants to better understand the concept of synecoculture, its benefits and how it can be adopted in Africa in face of the climate change.

Before the opening remarks, Mr. André TINDANO made a brief presentation of AFIDRA:

Created in 2009, AFIDRA is a technical division of the “Organisation Pan-Africaine de Développement et d’Appui aux Initiatives des Cadres (OPADAIC)”, and aims to improve the living conditions of populations through research, action and training to develop their intrinsic autonomy and self-sufficiency in a quality environment.

DAY I: 19 October 2016

The first day was marked by five presentations:

First presentation: "Lecture on the Green Economy", led by Mr Becquet Polycarpe BATIONO, Director of Promotion in Entrepreneurship and Green Investments (DPEIV), Directorate General for Green Economy and Climate Change (DGEVCC), Ministry of Environment, the Green Economy and Climate Change (MEEVCC).

The Green Economy and Green Jobs are concepts in vogue today in all spheres where sustainable development issues are discussed. Burkina Faso has adopted its ten-year plan of action on sustainable consumption and production, with the precautions against the following problematics that the green economy can avoid:

- Accelerating change;
- Stagnation of yields;
- Depletion of fishery resources;
- The increase in deforestation;
- Compromise of biodiversity;
- Toxic products increasingly disseminated.

In this type of economy, income and employment growth must come from public and private investment that reduces carbon emissions and pollution, enhancing resource efficiency and energy efficiency, and preventing loss of biodiversity and environmental services.

The green economy recognizes the value of natural capital, the value of investing in it and plays an essential role in the fight against poverty, creating jobs and strengthening social equity.
In terms of environmental issues, it:
- Limits the depletion of natural resources, environmental degradation and reduces the impacts of climate change.
- Fight against degradation of natural resources (soil, water resources, biomass and biodiversity).
(This degradation has the following consequences: A decrease in biomass and land cover, pollution, misuse and loss of water resources.)
In terms of good practice, there is a promotion of:

- ❖ Energies (Hydroelectricity, Solar photovoltaic energy, Biodiesel, ...)
- ❖ Forestry and landscape (Valorization of forest products and landscaping activities)
- ❖ Agriculture and Livestock (Sustainable Agriculture, Organic Farming, Arboriculture)
- ❖ Sanitation (waste management)
- ❖ Construction and buildings (Valorization of local materials).

The presenter concluded that the green economy was an opportunity for clean development that preserved biodiversity, natural resources and enriched their valorization, the creation of decent green jobs and guaranteed social cohesion for a long-term commitment to effective actions.

<u>The second presentation</u> is entitled "Look to the land: agriculture and forestry for a green economy; Going beyond production in the 21st century "presented by Mr Becquet Polycarpe BATIONO, Director of the Promotion of Entrepreneurship and Green Investments (DPEIV), Directorate General of the Green Economy and Climate Change (DGEVCC), Ministry of Environment, the Green Economy and Climate Change (MEEVCC).
The presenter began his presentation by pointing out that forests occupy 30% of all land, and 40% for agriculture, which produces more than 20% of greenhouse gas emissions into the atmosphere.
In the light of this situation, global commitments and political solutions at the national/local level have made it possible to develop concepts of sustainable ecosystems, agro-ecological practices and integrated landscape management.

<u>The third presentation</u> was presented by Mr Alain GOUBA of the Educational Concerns for Hunger Organization (ECHO) under the theme: "What is the future for family farming?".
The communicator wished to recall that in 2014 was declared the International Year of Family Farming by the United Nations, which made it possible to shed more light on this concept that many people were ignoring. The UN insisted that agriculture, especially small and medium-sized farms, must become a central issue on the international agenda.
In the case of family farming, the definition used is that of the Research Institute for Development (IRD), which states that: "Family farming comprises farming activities under the management of a family, essentially depending on family labor. "
He states that family farming has crucial multifunctional roles; as it contributes to social cohesion in rural areas and rural / urban dynamics and has the capacity to curb migration through job creation and contribution to food security.
In terms of problematics and challenges, family agriculture must integrate a smart management of natural resources into production and ensure income and employment for the rural population to reduce migration to cities. In terms of the critical challenge, more needs to be done to respond to demographic pressure.
He poses the question: Faced with so many challenges and stakes, is there still a future in family farming ?
His answer: We think so, because family farming is the first "restorer" of humanity. It would be a shame if it were to lose this function because the consequences would be incalculable and burdensome for all.
Since family farming is the "mother" of all present forms of agriculture, should we leave it because it is too old? Since no one has an interest in seeing family farming disappear, at least not in the short term, everyone (international institutions,

governments, NGOs and farmers) should be aware of its role and responsibility and play fully its partition.
Mr GOUBA ended his presentation by saying: If it is true that family farming "is not going to save the world by itself", it is equally true that its absence would be a major disaster for food security and stability of the world. It is why we believe that it is undoubtedly one of the possible solutions, because it has genuine practical knowledges and is already a unignorable source of employment that is feeding nearly 70% of the world's population.

Mr Souleymane OUEDRAOGO of the Institute of the Environment and Agricultural Research (INERA), National Center for Scientific and Technological Research (CNRST) animated the 4th presentation: "Organic farming in Africa: state of play and perspectives. "
Organic farming is an agricultural production method based on the respect for life and life cycles.
We can say that organic farming is a sustainable production option for small producers.

Fifth presentation: Mr Masatoshi FUNABASHI
"Introduction to syecoculture: a global context"
We can retain from the definition of synecoculture, that it is a synecological agriculture, based on the ecology of plant communities. It is a high density polyculture system with diverse edible plants (about 200+ species / 1000m^2), without the application of fertilizers, plowing and pesticides.
The observation made in Japan shows twice as much productivity and five times more profitability on 1000m^2 .
To finish, the synecology allows a good conservation of natural resources, especially water.

DAY II: 20th October 2016

The second day was divided into four presentations:
- Three presentations made by Mr Masatoshi FUNABASHI, Japanese expert in synecoculture
- A presentation by Mr André TINDANO, Secretary General of AFIDRA

First presentation: "The general condition of synecoculture and the result in Japan"
Presenter: Mr Masatoshi FUNABASHI
Part 1: the general condition of synecoculture
He began his presentation by defining the synecoculture as coming from the **synecology**; from a general division of ecology that includes autecology and synecology.
Autecology is the study of individuals taken separately in their environments (biotope) in contrast to population ecology. In autecology, elements are in focus.
While the **synecology** or ecology of communities is an ecological discipline that studies the relationships between populations of different types of biocenosis, that is, all organisms of any type in an ecosystem. These are the relationships between components and the environment of ecosystems.
At the level of conventional agriculture which corresponds to the autecology, there is a correspondence one by one between the elements and the functions. While in synecoculture, which treats production at the level of synecology, there is a many-to-many correspondence between elements and functions.
In synecoculture, food production can be used for the construction of anthropogenic ecosystems through practices without plowing, fertilizer and chemical treatment. Harvests are maximized by ecological optimization as opposed to the physiological one. He explained how to optimize total synergy: adaptive diversification; How to choose between physiological and ecological optima: Integrated Model of Physiological and Ecological Optima (IMPEO). He explained the modality of harvest, management and comparison of crops between synecoculture and conventional agriculture using the space-time coordinates. The diversity and density of plants are particularly increased in synecoculture.

Part Two: Results of Experiments in Japan

In terms of experience in Japan, a pilot farm in the Mie prefecture started synecoculture by introducing more than 200 species on an area of 1000 ㎡ to 2010. According to the sales between June 2010 and May 2014, there are twice productivity with five times more profitability over 1000 ㎡ . Comparing synecoculture with conventional agriculture in Japan, the following observation emerges:

Synecoculture shows high fluctuations in productivity but with reduced production costs. More product diversity gives more profit with the constant maintenance cost. A self-organization of the ecosystem that enriches the soil without plowing or fertilizing is observed. While conventional agriculture has a stable productivity with rising costs in face of climate change.

Targets for future action:

- ❖ 1000 species of useful plants on 1000㎡ (thousand thousandth project);
- ❖ The challenge of creating the most intensive biodiversity hotspot in the history of life as an anthropogenic ecosystem;
- ❖ Implementation status: +/- 400 species, 1000+ varieties / 120㎡ at the experimental farm in Tokyo.

He showed images of synecoculture farms distributed in Japan in collaboration with Sony CSL. He also showed images showing that the Nansei islands in the southwest of Japan are home to rich biodiversity with the coexistence of temperate and tropical species.

He concluded that one of the fundamental challenges of synecoculture is to restore marine ecosystems by recovering the healthy material cycles between the land and sea.

<u>Second presentation</u>: “Report of the pilot farm on the one-year practice of synecoculture at Tapoa”, by Mr André TINDANO, General Secretary of AFIDRA in Burkina Faso.

The presentation gave an interpretation of the synecoculture in the African context and its introduction in Burkina Faso. Details are reported in Chapter II: 1. Activity report of the pilot farm of the syecoculture in Tapoa, Burkina Faso, 6/2015-11/2016. "

<u>Third presentation</u>: "The concrete explanation of the strategies that constitute the synecoculture. 1- General remarks. "

Presenter: Mr Masatoshi FUNABASHI

The presenter defined synecoculture as a field cultivation method that allows under the restrictive conditions: without tillage, fertilizer (fertilizer and soil amendment), pesticides, and without introducing other than seeds or seedlings, to produce useful plants in a state of ecological optimum using best the characteristics of each species and building and controlling the ecosystem.

The three main areas of synecoculture are:

- Method of production;
- Method of application;
- Method of sales.

<u>Fourth presentation</u>: "The concrete explanation of the strategies that constitute the synecoculture. 2- Detailed expositions. "

Presenter: Mr Masatoshi FUNABASHI

For the initial installation of farming ecosystem, trees serve in priority order to:

- Create a mid-shade area for vegetables;
- Attract insects and birds to help pollination, and their excrements and dead bodies provide micro-elements;

- To obtain the formation of humus thanks to the dead leaves;
- Harvest the fruit.

The presenter pointed out that in synecoculture the term "invasive grasses" is used instead of "weeds". In order to control them, it is necessary to do mowing in three stages:

- General mowing;
- Mowing to the height of vegetables;
- Removing large grasses on a case-by-case basis.

Another use is to let the invasive grasses grow as a part of the strategy to improve the soil.

As for the harvest, it must be done in three simultaneous actions:

- Harvesting;
- Transplantation of seedlings;
- Reseeding.

At the end of these presentations, participants asked pertinent questions about the subject and found satisfactory answers by the presenter. The day ended around 6 p.m. with a visit to the site of the future synecoculture farm near Fada N'Gourma for research and training.

DAY III: 21st October 2016

It was marked by the two presentations animated by Mr. Masatoshi Funabashi.

First presentation: "Valorization of the products with several aspects in synecoculture. "

It is important to reconsider that biodiversity is a source of nutrition because:

- Various bioactive compounds are derived from ecological interactions;
- Importance of secondary metabolites on the long-term health protective effect.

As a goal :

• Re-introduction of products grown in natural state into human foods;
• Integration of environmental and health measures at the scale of evolution of our metabolism.

It should be noted that synecoculture takes into account the synergies of three dimensions: Environment, health and food.

Second presentation: "The use of information and communication technologies (ICTs) in synecoculture. "

It should be noted from this communication that:

- Conventional agriculture is based on the science of "closed system";
- Synecoculture is an open system;
- In syecoculture, sharing information is important for the development of collective knowledge with the principle of open source;
- Biodiversity being very complex, it would be necessary to manage the cost of information, hence the necessity and the effectiveness of the ICT.

The day ended with a Quiz where the first two winners each gained the prize of a mobile phone. We took the group photo of participants and handed in the completion certificates.

The presentations were filmed and broadcast as the 1st e-event of UniTwin UNESCO Complex Systems Digital Campus. The videos are available on the website of CARFS.

Written at Fada N'Gourma on 11/11/2016

The reporters

DAWEGA E. Bastalé

Accountant LNSP

Tel: (+226) 70347657

E-mail: bdawega@yahoo.fr

ONADJA Honoré

Engineer MAAH

Tel: (+226) 70458838

E-mail: onahonore@yahoo.fr

Control

André TINDANO

AFIDRA

Approval

Masatoshi FUNABASHI

Sony Computer Science Laboratories, Inc.

Chapter II: Reports

II.1 Activity report of the pilot farm of syecoculture in Tapoa, Burkina Faso, 6/2015-11/2016, by l'Agence de Formation et d'Ingénierie du Développement Rural Autogéré (AFIDRA).

-Description of the experiment 3/2015-11/2016

History

It all began in January 2015 at the ECHO West Africa Networking Forum in Ouagadougou, Burkina Faso, where the AFIDRA Secretary General (Mr André TINDANO) made his first encounter with this technology, which was presented by the Japanese Masatoshi FUNABASHI.

Mr TINDANO was immediately attracted by the idea and made contact with the presenter. Upon his return to Fada and convinced that this technology could be a prominent tool for the future of small-scale producers in Burkina Faso and all Africa, he started making efforts to effectively launch the testing activities of this technology (at Mahadaga village, situated in Tapoa province).

We started with a hard, arid soil that did not recover vegetation naturally. The ecosystem has undergone a regime shift towards desertification by the previous agricultural practice. Obtaining this land was very easy given that no one in the village needed it because of its advanced state of degradation. But after a few months of recovery through installation of our synecoculture farm, the difference is clearly visible (Figure 1).

Figure 1. Demonstration area of synecoculture after 18 months of installation (left, 7 Sep 2016, angle B). We have also preserved a control area in the neighboring land (right, 17 Nov 2016, angle D).

We started with an area of 500m² where 150 edible species were introduced (Table 1). The cultivation followed the definition and rules of the synecoculture, the high density mixed polyculture without tillage, fertilizer, and pesticides (Funabashi, 2016a, Funabashi, 2016b). We produced some of the seedlings such as Moringa oleifera in the nursery before transplanting them after 8 weeks. As a timeline, we started the installation work in March 2015, harvesting started in June 2015 and continued to this day (November 2016).

In addition to synecoculture, other methods such as the system of rice intensification (SRI), conservation agriculture, permaculture, traditional and bio-intensive market gardening have been tested in the same location for a comparative study.

The definition of SRI can be found in the reference (Zotoglo and Kouyaté, 2011). In our experiment, we additionally introduced Moringa oleifera and other trees (intolerant in the shade) in order to recover the ecosystem. Conservation agriculture conforms to (BASE, 2016) and permaculture to (Mollison and Holmgren, 2006; Mollison, 2011). Traditional and bio-intensive market gardening has been based on (Verheij and Waaijenberg, 2008), with commonly adapted local practices in the region for the traditional market gardening, and the intensification with tipping irrigation and water conservation equipments used in organic farming for the bio-intensive market gardening, respectively. The bio-intensive method was developed by AFIDRA to compare the traditional practice and improvements that can be made.

Conservation agriculture and permaculture fields were set up in February 2014. Synecoculture, traditional and bio-intensive market gardening in May 2015, SRI in June 2015. We have also left the control area across the sites as the negative control of all experiments. The control area was left without recovery work and all the land (3ha) was fenced with wire netting to avoid the trampling effect by humans and animals.

The sponsor of the project (AFIDRA) received no financial support from Sony CSL for the experimentation of synecoculture. Synecoculture has been independently tested by AFIDRA with information supports on the modality of practice by Sony CSL. The result of the synecoculture does not therefore contain the bias from the interest of investment.

Table 1. List of 150 cultivated species (131 introduced species + 19 spontaneous species) in the pilot farm of synecoculture at Tapoa, Burkina Faso.

List of 131 introduced species		
No.	**Common/Local name**	**Latin scientific name**
1	Ail	*Allium sativum*
2	Aloé	*Aloé Vera*
3	Amarante	*Amaranthus hybridus*
4	Amarante graine	*Amaranthus spinosus*
5	Anguivi	*Solanum anguivi*
6	Anserine	*Chenopodiunz ambrosioïdes*
7	Antanan	*Centella asiatica*
8	Arbre à pain indigène	*Myrianthus arboreus*
9	Arbre à suif	*Vetarium senegalense*
10	Armoise de Chine	*Artemisia annua*
11	Banane	*Musa ×paradisiaca L*
12	Baobab	*Adansonia digitata*
13	Baselle	*Basella alba*
14	Basilic	*Ocimum basilicum*
15	Betterave	*Beta vulgaris L*
16	Bissap	*Hibiscus sabdariffa*
17	Borreria verte	*Borreria verticillata*
18	Boungou	*Plante non repertoriée*
19	Café-nègre	*Cassia occidentalis*
20	Calebasse	*Crescentia cujete*
21	Cannelle	*Cinnamonum zeylanicum*
22	Carotte	*Daucus carota subsp. sativus*
23	Casse occidental	*Cassia fistula*
24	Cassefétide	*Anagyris foetida*
25	Célosies	*Celosia cristata*
26	Chanvre de guinée	*Hibiscus cannabinus*
27	Chou brocoli	*Brassica oleracea var. italica*
28	Chou pommé	*Brassica oleracea var. capitata*
29	Chrysanthellum americanum	*Chrysanthellum indicum*

30	Citron de mer	*Ximenia americana*
31	Citronnelle	*Cymbopogon citratus*
32	Citronnier	*Citrus ×limon*
33	Citrouille	*Cucurbita maxima*
34	Citrouilles	*Cucurbita pepo ssp. pepo*
35	Citrulus	*Citrullus lanatus*
36	Concombre	*Cucumis sativus*
37	Concombre africain	*Momordica charantia*
38	Corète	*Corchorus olitorius L*
39	Courge	*Cucurbita pepo*
40	Courge locale	*Cucurbita ficifolia*
41	Courgette africaine	*Micrococca Mercurialis*
42	Courgette locale	*Cucurbita ovifera*
43	Cumin noir	*Nigella sativa*
44	Dartrier	*Cassia alata*
45	Dolique	*Dolichos Lab Lab*
46	Dug daani	*Landolphia hirsuta*
47	Epinard	*Spinacia oleracea L*
48	Éponge végétale	*Luffa aegyptiaca*
49	Fausse oseille de Guinée	*Momordica charantia*
50	Faut cotonnier	*Cochlospermum tinctorium*
51	Ferou	*Corchorus tridens*
52	Gaabou	*Afzelia africana*
53	Gabanein	*Detarium microcarpum*
54	Gentianelle pourprée	*Gentiana lutea*
55	Gingembre	*Zingiber officinale*
56	Gombo	*Abelmoschus esculentus*
57	Gongon yiri	*Saba florida*
58	Goyave	*Psidium guajava*
59	Grassé	*Talinum triangulare*
60	Gynandro	*gynandropsis gynandra*
61	Haricot vert	*Phaseolus vulgaris*
62	Herbe d'éléphant	*Andropogon gayanus*
63	Herbe fataque	*Panicum maximum*
64	I juunfaani	*Chenopodium antrosioïde*
65	Igname	*Dioscorea convolvulacea*
66	Ihaani	*Lophira lanceolata*
67	Jujubier	*Ziziphus abyssinica*
68	Jujubier	*Ziziphus mauritania*
69	Kapokier rouge	*Bombax costatum*
70	Karitier	*Butyrospermum paradoxum*
71	Kinkeliba	*Combretum micranthum*
72	Kpankpandi	*Corchorus olitorius*
73	Kuguruba	*Mitracarpus scaber*
74	L'akée	*Blighia Sapida*
75	Langue de boeuf	*Piliostigma reticulatum*
76	Lemba lemba	*Brillantaisia patula*
77	Maïs	*Zea mays L*
78	Maniguettes	*Aframomum melegueta*
79	Manioc	*Manihot esculenta*
80	Margose	*Momordica charantia*
81	Marula/ arbre-éléphant	*Sclerocarya birrea*
82	Melon	*Cucumis melo*
83	Millet blanc	*Panicum miliaceum album*
84	Morelle	*Solanum rostratum*
85	Moringa	*Moringa Oleifera*
86	Moringa	*Moringa Stenopetala*
87	Mucuna	*Dolichos pruriens*
88	néré	*Parkia biglobosa*
89	Nétier	*Parkia biglobosa*

90	Niébé	*Vigna unguiculata subsp*
91	Oignon	*Allium cepa*
92	Oseille	*Rumex acetosa L*
93	Oseille de Guinée	*Hibiscus asper*
94	Oseille de la brousse	*Rumex acetosella*
95	Palmier	*Phoenix reclinata*
96	Papaye	*Carica papaya*
97	Paprika	*Capsicum annuum*
98	Pastèque fourragère	*Citrullus lanatus*
99	Pécher africain	*Nauclea latifolia*
100	Pervenche de Madagascar	*Catharanthus roseus*
101	Piment	*Capsicum pubescens*
102	Piment de Cayenne	*Capsicum frutescens*
103	Plaqueminier	*Diospyros mespiliformis*
104	Pois d'Angole	*Cajanus cajan*
105	Pois de terre	*Vigna subterranea*
106	Pois mangetout	*Pisum sativum L*
107	Poivron	*Capsicum annuum*
108	Pomme de terre	*Solanum tuberosum*
109	Pomme-canelle du Sénégal	*Annona senegalensis*
110	Pommier cajou	*Anacardium occidentale*
111	Pourpier	*Portulaca oleracea*
112	Prunier mombin	*Spondias mombin*
113	Quinquina	*Cinchonae cortex*
114	Rauwolfia	*Rauwolfia serpentina*
115	Sanfito	*Moghania faginea*
116	Séné africain	*Cassia italica*
117	Sissan	*Landolphia owariensis*
118	Soalma	*Corchorus fascicularis*
119	Souomi	*Landolphia hendolotti*
120	Tabac	*Nicotiana tabacum*
121	Talmante	*Geranium dissectum*
122	Tamarinier	*Tamarindus indica*
123	Tarvine	*Boerhavia diffusa*
124	Tchaboule bali	*Carissa edulis*
125	Thé de gambie	*Lippia chevalieri*
126	Tihalfadi	*Strychnos spinoseolum*
127	Tomate	*Solanum lycopersicum*
128	Vernonias	*Vernonia fasciculata*
129	Vetiver	*Vetiveria nigritana*
130	Zaban	*Saba senegalensis*
131	Zaban	*Guiera senegalensis*

No.	**Common/Local name**	**Latin scientific name**
132	Ciangou	*Pennissetum pedicellatum*
133	Coukou	*Schizachirium exile*
134	Fapebili	*Proteamadiensis*
135	Foumbou	*Butyrospermum parkii*
136	Goungoundo	*Digitaria horizontalis*
137	I haani	*Pitcairnia maidifolia*
138	I talmante	*Maclura africana*
139	Jaguoli	*Dichrostachys cinerea*
140	Kogoabili	*Acacia senegal*
141	Komboanga	*Cassia tora*
142	Kpewoku	*Pitcairnia bifrons*
143	Louonnouagou	*Cissus quadrangularis*
144	Maani	*Oryza barthii*
145	Mi juunfaama	*Ficus asymetrica*
146	Nabagindi	*Hyptis spicigera*
147	Tampouna	*Vetiveria nigricans*
148	Tanmouayaama	*Loudetia togoensis*

149	Ti kpankpandi	*Agave sisalana*
150	Yimkpini	*Diospyros mespiliformis*

-Results

Productivity and recovery of the environment

Table 2 summarizes the methods tested in relation to the area of experience, annual productivity, and recovery level by placing grades between 1-6 according to the following criteria (primary succession from desert):

Level 1: Bare rock, sand
Level 2: Lichens
Level 3: Small annual plants and lichens
Level 4: Grasses and perennials
Level 5: Grasses, shrubs and shade-intolerant trees
Level 6: Shade-tolerant Trees

Among the species introduced into the synecoculture, trees such as Saba senegalensis, Afzelia africana, Aloe vera show tolerance to shade, which have not succeeded in settling in the other methods.

Productivity at each area is normalized compared to the annual scale of June 2015-May 2016, except for the synecoculture the sum of 18 months between June 2015-November 2016 is multiplied by 2/3. Detailed monthly results of synecoculture production are shown in Tables 3-8.

Table 2. Level of ecosystem recovery with respect to primary succession, area surface and annual productivity of tested methods.

Methods	Recovery level	Surface(m²)	Annual Productivity (CFAF)
Synecoculture	6	500	7572000
System of Rice Intensification + Trees	5	2500	786000
Conservation Agriculture	5	10000	917000
Permaculture	5	10000	884250
Bio-intensive Market Gardening	2	500	720500
Traditional Market Gardening	2	500	720500
Control	1	30000	0

Table 3. Synecoculture productivity (price in CFAF / month / 500m²) in June - November 2015

	Productivity in June – November 2015					
Products (in French)	**June**	**July**	**August**	**September**	**October**	**November**
Ail	25300	25325	25300	22300	22100	22300
Betterave	12650	12650	12650	12650	12650	12000
Bissap	21250	21250	21250	21250	21250	21250
Calebasse	10000	10000	10000	10000	10000	0
Carotte	17500	17500	17500	17500	17500	17500
Chou brocoli	31200	31200	31200	31200	31200	31200
Chou pommé	32300	32310	32300	32300	32300	32300
Citron	26800	26800	26800	26800	26800	26800
Citrouille	12500	12500	12500	12500	12500	12500
Concombre africain	24600	24640	24600	24600	24600	24600
Courge	15400	15400	15400	15400	15400	15400
Courgette africaine	16300	16300	16300	16300	16300	16300
Epinard	16800	16800	16800	16800	16800	16800
Fausse oseille de Guinée	25100	25100	25100	25100	25100	25100
Gombo	15500	15500	15500	15500	15500	15500
Goyave	0	0	27100	27100	27100	7100
Haricot mangetout	25000	25130	25000	25000	25000	25000
Haricot vert	12000	12000	12000	12000	12000	12000
Ignam	0	0	0	17600	17600	7600
Manioc	0	0	0	20500	20500	21500
Melon	12300	12300	12300	12300	12300	12300
Moringa	36000	36000	36000	36000	36000	36000
Mucuna	0	0	0	12300	12125	1785
Oignon	27800	27800	27800	27800	27800	27800
Oseille de la brousse	21500	21500	21500	21500	21500	21500
Papaye	0	0	0	19000	19000	9000
Paprika	12400	12400	12400	12400	12400	12400
Pastèque fourragère	6200	6200	6200	6200	6200	6200
Pois de terre	29150	29150	29150	29150	29150	29150
Poivron	17200	17200	17200	17200	17200	17200
Tomate	23750	23750	23750	23750	23750	23750

Table 4. Synecoculture productivity (price in CFAF / month / 500m²) in December 2015 - May 2016

	Productivity in December 2015 – May 2016					
Products (in French)	**December**	**January**	**February**	**Mars**	**April**	**May**
Ail	15900	25300	21300	25325	25310	25300
Banane	0	33500	30500	32500	13500	33500
Betterave	12650	12650	12650	12650	12650	12650
Bissap	21250	21250	21250	21250	21250	21250
Calebasse	10000	10000	10000	10000	10000	10000
Carotte	17500	17500	17500	17500	17500	17500
Chou brocoli	31200	31200	31200	31200	21200	31200
Chou pommé	32300	32300	30300	32300	12300	32300
Citron	26800	26800	26100	26800	21950	26800
Citrouille	12500	12500	12500	12500	12500	12500
Concombre africain	24600	24600	24600	24600	24600	24600
Courge	15400	15400	15400	15400	15400	15400
Courgette africaine	16300	16300	16300	16300	16300	16300
Epinard	16800	16800	16800	16800	16800	16800
Fausse oseille de Guinée	25100	25100	25100	25100	25100	25100
Gombo	15500	15500	15500	15500	15500	15500
Goyave	27100	27100	27100	27100	27100	27100
Haricot mangetout	25000	25000	25000	25000	25000	25000
Haricot vert	12000	12000	12000	12000	12000	12000
Ignam	17600	17600	17600	17600	17600	17600
Manioc	20500	20500	21500	22500	10500	20500
Melon	12300	12300	12300	12300	12300	12300
Moringa	36000	36000	36000	36000	46000	36000
Mucuna	7500	30500	30500	30500	10500	30500
Oignon	27800	27800	27800	27800	27800	27800
Oseille de la brousse	21500	21500	21500	21500	21500	21500
Papaye	19000	19000	19000	19000	19000	19000
Paprika	12400	12400	12400	12400	12400	12400
Pastèque fourragère	6200	26300	26300	26300	26300	26300
Pois d'Angole	0	26750	26750	26750	26750	26750
Pois de terre	29150	29150	29150	29150	29150	29150
Poivron	17200	17200	17200	17200	17200	17200
Tomate	23750	23750	23750	33750	23750	23750

Table 5. Synecoculture productivity (price in CFAF / month / 500m²) in June 2016 - November 2016

	Productivity in June – November 2016					
Products (in French)	**June**	**July**	**August**	**September**	**October**	**November**
Ail	1300	25000	15900	10000	5900	15200
Banane	13500	33700	13700	1950	12100	22000
Baobab	0	0	0	0	0	10750
Betterave	12650	12650	12650	12650	10650	21250
Bissap	21250	21250	21250	21250	21250	10025
Calebasse	10000	11000	20025	11025	11025	17800
Carotte	17500	7500	17500	17500	27500	25000
Chou brocoli	31200	21900	31200	11400	31500	21300
Chou pommé	32300	32300	42100	12500	32400	21100
Citron	26800	24800	19800	6800	20800	12700
Citronnelle	0	0	0	0	0	11700
Citrouille	12500	12500	12500	2500	12500	16300
Concombre africain	24600	14600	34600	14300	14500	7800
Courge	15400	15400	15400	10400	15500	15900
Courgette africaine	16300	16300	17300	26300	16700	21300
Epinard	16800	16800	26000	10800	15800	25100
Fausse oseille de Guinée	25100	25100	20100	15200	20700	22400
Gombo	15500	15500	15500	5700	25000	15600
Goyave	27100	27100	31100	37100	20300	12700
Haricot mangetout	25000	25000	27050	5000	5000	26200
Haricot vert	12000	12000	12000	12400	12300	21200
Ignam	17600	17600	17600	27000	26100	22150
Manioc	20500	20500	10900	21200	20500	15700
Melon	12300	12300	12300	2300	12300	10300
Mente	0	0	0	0	0	1750
Moringa	46500	47900	47500	45700	45100	47500
Mucuna	30500	31500	10250	10525	10700	9300
Oignon	27800	27800	29800	7800	7950	12100
Oseille de la brousse	21500	21500	21500	22500	20500	20600
Papaye	19000	19000	29050	23100	9000	20450
Paprika	12400	12400	12400	10400	2400	10100
Pastèque fourragère	26300	26300	26300	16300	21300	9200
Patate douce	0	0	0	0	0	32100
Pois d'Angole	26750	26750	16750	6950	21750	7175
Pois de terre	29150	29150	9150	9750	9150	15200
Poivron	17200	17200	17200	27200	7900	10650
Tomate	23750	31750	20750	20950	30150	30200

Table 6. Number of harvest days / months of synecoculture in June - November 2015

	Number of harvest days / month in June - November 2015					
Products (in French)	**June**	**July**	**August**	**September**	**October**	**November**
Ail	4	4	4	4	4	4
Betterave	4	4	4	4	4	4
Bissap	5	5	5	5	5	5
Calebasse	4	4	4	4	4	0
Carotte	5	5	5	5	5	5
Chou brocoli	5	5	5	5	5	5
Chou pommé	6	6	6	6	6	6
Citron	6	6	6	6	6	6
Citrouille	4	4	4	4	4	4
Concombre africain	5	5	5	5	5	5
Courge	4	4	4	4	4	4
Courgette africaine	4	4	4	4	4	4
Epinard	6	6	6	6	6	6
Fausse oseille de Guinée	4	4	4	4	4	4
Gombo	6	6	6	6	6	6
Goyave	0	0	5	5	5	6
Haricot mangetout	7	7	7	7	7	7
Haricot vert	6	6	6	6	6	6
Ignam	0	0	0	4	4	4
Manioc	0	0	0	4	4	4
Melon	4	4	4	4	4	4
Moringa	8	8	8	8	8	8
Mucuna	0	0	0	4	4	3
Oignon	4	4	4	4	4	4
Oseille de la brousse	6	6	6	6	6	6
Papaye	0	0	0	4	4	6
Paprika	6	6	6	6	6	6
Pastèque fourragère	6	6	6	6	6	6
Pois de terre	4	4	4	4	4	4
Poivron	6	6	6	6	6	6
Tomate	6	6	6	6	6	6

Table 7. Number of harvest days / months of synecoculture in December 2015 - May 2016

	Number of harvest days / month in December 2015 - May 2016					
Products (in French)	**December**	**January**	**February**	**Mars**	**April**	**May**
Ail	4	6	6	6	6	6
Banane	0	8	8	8	8	8
Betterave	4	6	6	6	6	6
Bissap	5	8	8	8	8	8
Calebasse	4	6	6	6	6	6
Carotte	5	8	8	8	8	8
Chou brocoli	5	9	9	9	9	9
Chou pommé	6	8	8	8	8	8
Citron	6	11	11	11	11	11
Citrouille	4	10	10	10	10	10
Concombre africain	5	12	12	12	12	12
Courge	4	9	9	9	9	9
Courgette africaine	4	8	8	8	8	8
Epinard	6	20	20	20	20	20
Fausse oseille de Guinée	4	15	15	15	15	15
Gombo	6	10	10	10	10	10
Goyave	5	9	9	9	9	9
Haricot mangetout	7	12	12	12	12	12
Haricot vert	6	12	12	12	12	12
Ignam	4	9	9	9	9	9
Manioc	4	8	8	8	8	8
Melon	4	10	10	10	10	10
Moringa	8	31	29	31	30	31
Mucuna	4	8	8	8	8	8
Oignon	4	9	9	9	9	9
Oseille de la brousse	6	8	8	8	8	8
Papaye	4	8	8	8	8	8
Paprika	6	9	9	9	9	9
Pastèque fourragère	6	10	10	10	10	10
Pois d'Angole	0	10	10	10	10	10
Pois de terre	4	15	15	15	15	15
Poivron	6	15	15	15	15	15
Tomate	6	15	15	15	15	15

Table 8. Number of harvest days / months of syecoculture in June - November 2016

	Number of harvest days / month in June - November 2016					
Produit	**Juin**	**Juillet**	**Août**	**Septembre**	**Octobre**	**Novembre**
Ail	4	6	6	6	6	7
Banane	8	8	8	8	8	9
Baobab	0	0	0	0	0	30
Betterave	6	6	6	6	6	9
Bissap	8	8	8	8	8	10
Calebasse	6	6	6	6	6	11
Carotte	8	8	8	8	8	13
Chou brocoli	9	9	9	9	9	12
Chou pommé	8	8	8	8	8	10
Citron	11	11	11	11	11	11
Citronnelle	0	0	0	0	0	30
Citrouille	10	10	10	10	10	15
Concombre africain	12	12	12	12	12	8
Courge	9	9	9	9	9	8
Courgette africaine	8	8	8	8	8	9
Epinard	20	20	20	20	20	15
Fausse oseille de Guinée	15	15	15	15	15	19
Gombo	10	10	10	10	10	21
Goyave	9	9	9	9	9	12
Haricot mangetout	12	12	12	12	12	14
Haricot vert	12	12	12	12	12	8
Ignam	9	9	9	9	9	3
Manioc	8	8	8	8	8	2
Melon	10	10	10	10	10	8
Mente	0	0	0	0	0	30
Moringa	30	31	31	30	31	4
Mucuna	8	8	8	8	8	4
Oignon	9	9	9	9	9	8
Oseille de la brousse	8	8	8	8	8	15
Papaye	8	8	8	8	8	4
Paprika	9	9	9	9	9	8
Pastèque fourragère	10	10	10	10	10	8
Patate douce	0	0	0	0	0	10
Pois d'Angole	10	10	10	10	10	10
Pois de terre	15	15	15	15	15	15
Poivron	15	15	15	15	15	15
Tomate	15	15	15	15	15	10

Cost of works and materials

For the synecoculture, the seed costed 195 750 CFAF (to be noted that we received some seeds of ECHO for free and we also harvested certain seeds of natural vegetation on site, which is counted in the working cost).

The worker costed 500 CFAF / h. One person worked 20 hours a week in the field of synecoculture from May 2015. The work consists essentially of directing the creeping plants to avoid, for example, that they strangle the upright crops, harvesting a variety of different crops and selling these products (Figure 2).

Conservation agriculture, permaculture and SRI were practiced only in the rainy season, and traditional and bio-intensive market gardening only in the dry season.

Inputs (pesticides, fertilizers and inoculants) costed 326 700 CFAF and were shared between conservation agriculture, SRI, traditional and bio-intensive market gardening. Permaculture used inputs of 235 000 CFAF separately.

The synecoculture used a sprinkler irrigation bought on an installment plan of 3000 CFAF / month (until May 2017). The use of water in synecoculture reached 887 400 CFAF / year, which is not yet optimized with respect to the minimum requirement.

It should also be noted that the cost of animal protection fence, which is 375 000 FCFA, is amortized over 7 years. The working tools 245 000 FCFA amortized over 3 years, the storage warehouse 750 000 CFAF amortized over 5 years. This is shared between different methods according to the use as the costs of the tools. For synecoculture, the cost of watering machine is converged in tool costs.

Tables 9 and 10 show the annual costs of the experiments.

Figure 2. Left: Leaf harvest of Moringa oleifera. Right: Sale of our products on site.

Table 9. Costs of seeds and works.

Methods	Seed cost CFAF / yr	Number of working people	Working hours	Period of work
Synecoculture	195750	1	20h/week	All year
System of Rice Intensification + Trees	30000	2	4h/day; 5day/week	May to November
Conservation Agriculture	175000	2	4h/day; 6day/week	May to November
Permaculture	175000	2	6h/day; 6day/week	May to November
Bio-intensive Market Gardening	192000	2	6h/day; 6day/week	November to May
Traditional Market Gardening	215000	2	6h/day; 6day/week	November to May

Table 10. Costs of materials normalized with 500m^2.

Methods	Water cost CFAF / year / 500㎡	Total inputs CFAF / year / 500㎡	Total tools CFAF / year / 500㎡
Synecoculture	887400	0	78389
System of Rice Intensification + Trees	69990	12100	47059
Conservation Agriculture	0 (Only rainwater)	12100	55506
Permaculture	0 (Only rainwater)	11750	55506
Bio-intensive Market Gardening	259399	12100	42389
Traditional Market Gardening	129675	12100	42389

Productivity, cost effectiveness and annual profitability of synecoculture and other methods on 500m² in Burkina Faso.

The products are sold on site or delivered in box, with prices of 1.5 to 2 times the market prices for its quality and the organic aspect of the production. With the synecoculture, we were able to obtain on average 631 000 CFAF (962 Euros) / month / 500㎡ .

Table 11 summarizes the productivity, cost effectiveness, and profitability calculated by the difference between productivity and costs. Only synecoculture was profitable in the sense of achieving positive profitability. Moreover, in the other methods, the increase in productivity was associated with higher costs, which was negatively reflected to profitability. The poor performance of other methods coincides with the general reality that the installation of agricultural production in Burkina Faso are dependent on subsidies. The total cost effectiveness of the synecoculture has reached the value 10 times higher than the average of the other methods. These results clearly show that synecoculture is exceptionally situated in the synergy between the productivity, production efficiency and the construction of ecosystem, which is summed up in total profitability and the highest recovery effect of the land and vegetation.

Table 11. Productivity, cost-effectiveness, and profitability of the methods. The definitions of the cost-effectiveness parameters are: Water efficiency = Productivity / Water cost; Work efficiency = Productivity / Working cost; Materials efficiency = Productivity / Cost of tools and total inputs; Total efficiency = Productivity / Total cost; Profitability = Productivity - Total cost.

Methods	Annual Productivity CFAF/yr/500㎡	Water efficiency	Work efficiency	Materials efficiency	Total efficiency	Profitability CFAF/yr/500㎡
Synecoculture	7572000	8.53	14.52	96.60	5.09	6084782
System of Rice Intensification + Trees	157200	2.25	1.29	2.66	0.63	-94235
Conservation Agriculture	45850	-	1.25	0.68	0.44	-58442
Permaculture	44213	-	0.80	0.66	0.36	-78072
Bio-intensive Market Gardening	720500	2.78	0.66	13.22	0.51	-683674
Traditional Market Gardening	720500	5.56	0.66	13.22	0.57	-553950

Implication of the results of synecoculture

Comparison with conventional vegetable production

According to (EASYPol, 2007: I-4. Données sur les principales spéculations maraîchères), vegetable production in Burkina Faso has an average yield of 117755 ± 68060 FCFA / year / 500㎡ on 10 representative crops. Compared to this conventional level of production, the results of synecoculture achieved **40-150 times more productivity**, while recovering soil degradation and rebuilding the ecosystem:

Synecoculture is exceptionally situated outside the trade-off between productivity and environmental preservation that other modes of agriculture confront. It achieves a highly induced synergy between productivity and ecosystem construction through the megadiversity introduced into the field.

Comparison to Gross National Income (GNI) per capita

The annual output of 500㎡ managed by a person in synecoculture corresponds **20 times more than the per capita GNI** of Burkina Faso in 2015 (World Bank, 2016).

Comparison with the absolute monetary poverty threshold

The absolute monetary poverty threshold for life in Ouagadougou is estimated at 153,530 CFAF in 2014 (INSD, 2015). The annual yield of synecoculture is **50 times more than this threshold**. This means on average 10 ㎡ of the field of synecoculture is sufficient to sustain the minimum economical life of a person in the capital.

Compared to the absolute monetary poverty threshold in 1994 and 1998, the yield of synecoculture in 2015-2016 corresponds to 104 and 184 times, respectively.

At what scale do we have to expand the practice of synecoculture in order to eradicate poverty, at least in terms of the absolute monetary threshold? The population of Burkina Faso is estimated at 17,589,198 in 2014 (Word Bank, 2016), and 40.1% (the 95% confidence interval between 37.8% and 42.5%) lives below the poverty line (INSD, 2015).

The linear extrapolation of our result shows that 7,151 hectares of the synecoculture fields (the 95% confidence interval between 6740-7579 hectares) are sufficient to lift the entire population of Burkina Faso above the poverty threshold. With the unit of practice of synecoculture in 500㎡ by one person, this implies the creation of jobs for 143,012 (134,809 - 151,572) people throughout the year in agricultural production.

This target is realizable by a systematic propagation of the practice: The instruction of synecoculture to 10 main leaders of agricultural sector in each of 13 regions of Burkina Faso, followed by the transmission in each location to 10 farmers per year. If each trained farm transmitted the knowledge of synecoculture to 10 other farms per year, this would cumulate in 4 years to the total number of practitioners as follows:

$$\sum_{t=1}^{4} P_i P^{t-1} = 144430.$$

Where Pi is the initial training of 130 people from 13 regions, P is the transmission rate, such as 10 people per year by a person already trained in synecoculture.

If appropriate technical and institutional supports were gathered in a timely and effective manner, this goal could be fairly achieved by 2020.

Achieving the Aichi Biodiversity Targets by 2020

The promotion of synecoculture at the national level in Burkina Faso and other African countries in the Sahel could be used to establish an intensive and effective way to realize the Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets (CBD , 2010).

Among the Aichi Targets, the followings goals are expected to directly link to the effective installation of synecoculture in

large scale:

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

1. By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

2. By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

5. By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

7. By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

8. By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

13. By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for
minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and wellbeing, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation
and adaptation and to combating desertification.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

18. By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values functioning, status and

trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Observation and photos of the field

Observations

When observing the synecoculture field, there is a change in soil color (darker brown) that indicates better health, life in the soil has increased, and the structure of soil is improved.

A particular point that attracted the attention of all visitors to our experimental site was the aspect of the plants. They are of a more vivid color and showing strong growth (despite some few holes on the leaves). In addition, there is the frequency of harvests, especially in leafy vegetables. Harvests are more often possible for the same species compared to traditional farming. One of the many visitors called this method "magical agriculture"!

Schematic map of the ground

The field composition and the angles of photos in this report are shown in Figure 3.

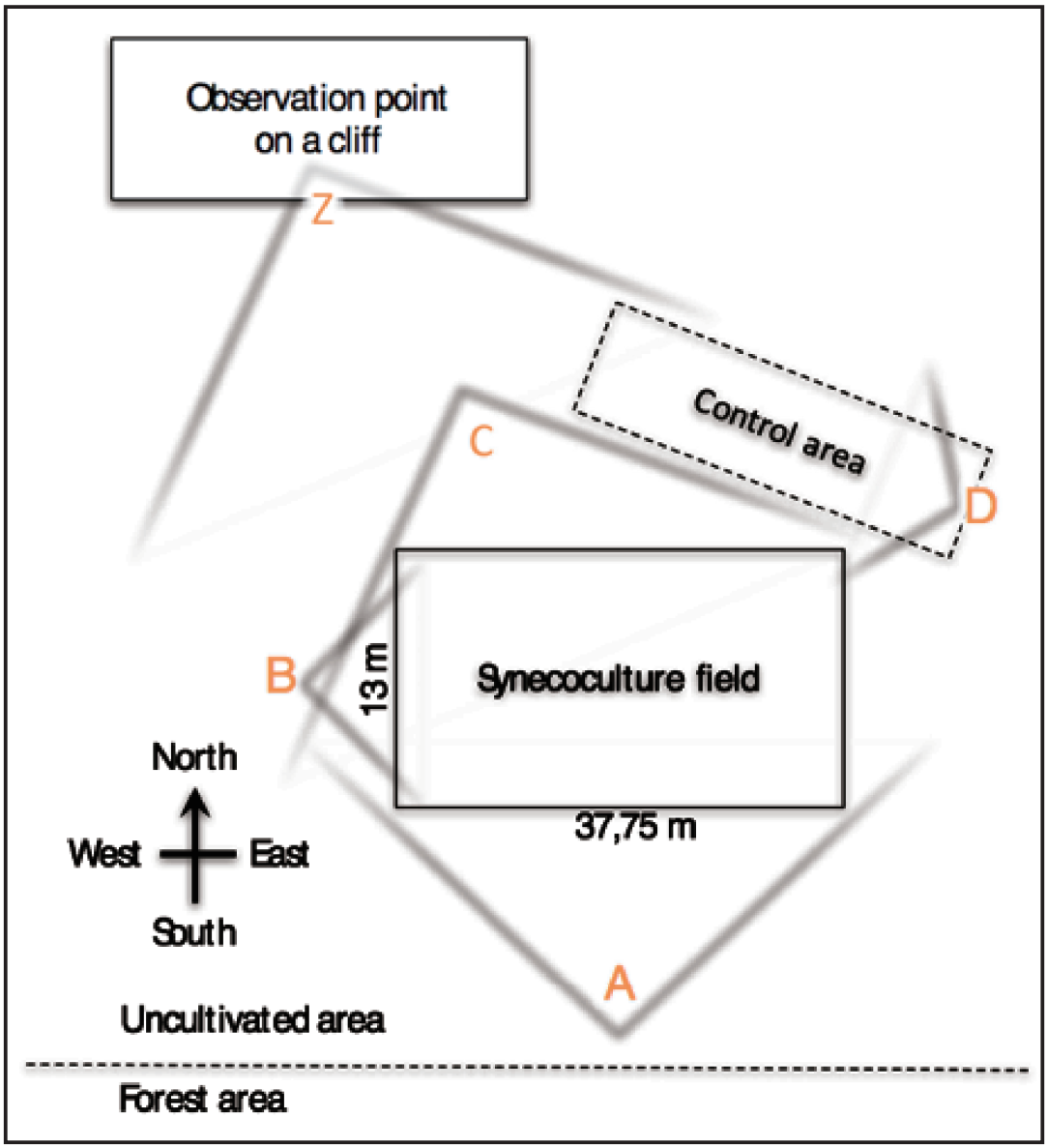


Figure 3. Schematic map of the experimental fields of synecoculture and control area. The angles of the photos are defined according to the shooting positions A, B, C, D, and Z.

Field Photos: Before the installation of synecoculture, at the end of the dry season

Dates are displayed by the order of year / month / day. The shooting angles are defined in Figure. 3.

Date: 2014/04/14, Angle: A

Date: 2014/04/14, Angle: A

Date: 2014/04/14, Angle: A

Date: 2014/04/14, Angle: A

Date: 2014/04/14, Angle: B

Date: 2014/04/14, Angle: B

Field Photos: Control area

Beginning of the rainy season. Date: 2015/05/29, Angle: D

End of the rainy season (beginning of the dry season). Date: 2016/11/17, Angle: D

Beginning of the dry season. Date: 2016/12/13, Angle: D

Beginning of the dry season.Date: 2016/12/13, Angle: D

Photos of the syecoculture field: The comparison between the dry (November - April) and rainy (May - October) seasons

The state of vegetation during the dry season. Date: 2016/12/13, Angle: C

Same angle in the rainy season. Date: 2016/9/21, Angle: C

Photos of the syecoculture field: The rainy season between May – October

Date: 2015/05/10, Angle: A

Date: 2015/05/10, Angle: A

Date: 2015/05/10, Angle: B

Date: 2015/05/10, Angle: C

Date: 2015/05/10, Angle: C


Date: 2015/06/10, Angle: A


Date: 2015/06/10, Angle: A

Date: 2015/06/10, Angle: A

Date: 2015/06/10, Angle: A

Date: 2015/06/10, Angle: A

Date: 2015/06/10, Angle: A

Date: 2015/08/10, Angle: A

Date: 2015/08/10, Angle:B

Date: 2015/08/25, Angle: A

Date: 2015/08/25, Angle: A

Date: 2015/08/25, Angle: B

Date: 2015/08/25, Angle: B

Date: 2015/08/25, Angle: C

Date: 2015/08/25, Angle: C

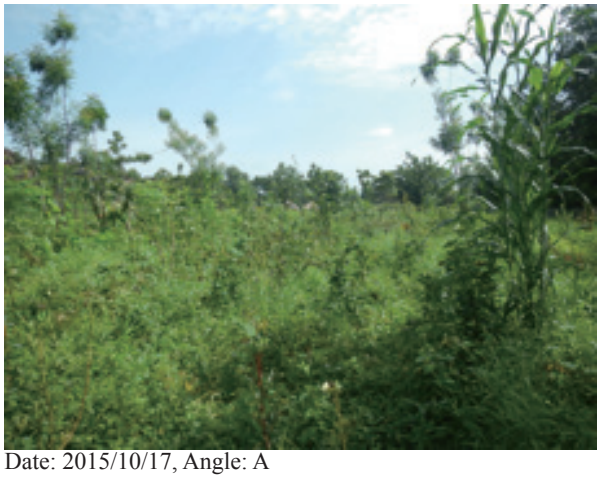
Date: 2015/09/30, Angle: A

Date: 2015/09/30, Angle: A

Date: 2015/09/30, Angle: A

Date: 2015/09/30, Angle: B

Date: 2015/09/30, Angle: C



Date: 2015/10/17, Angle: A

Date: 2015/10/17, Angle: A

Date: 2016/07/19, Angle: A

Date: 2016/07/19, Angle: A

Date: 2016/07/19, Angle: A

Date: 2016/07/19, Angle: B

Date: 2016/07/19, Angle: B

Date: 2016/07/19, Angle: C

Date: 2016/09/07, Angle: A

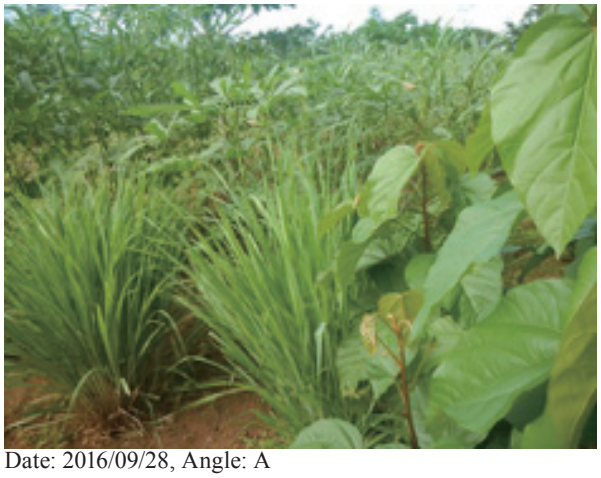
Date: 2016/09/07, Angle: A

Date: 2016/09/07, Angle: B

Date: 2016/09/07, Angle: B

Date: 2016/09/07, Angle: C

Date: 2016/09/07, Angle: C



Date: 2016/09/28, Angle: A

Date: 2016/09/28, Angle: B

Date: 2016/09/28, Angle: B

Date: 2016/09/28, Angle: C

Date: 2016/10/20, Angle: A

Date: 2016/10/20, Angle: B

Date: 2016/11/23, Angle: A

Global photos of the field from the cliff

Beginning of the installation, at the beginning of rainy season. The high-right uncultivated area corresponds to the field of synecoculture. Date: 2015/05/29, Angle: Z

Rainy season. The control area aligned across the fields remained uncultivated. Date: 2015/09/24, Angle: Z

The System of Rice Intensification (SRI) area during the rainy season. Date: 2015/09/24, Angle: Z

20 months after the installation of the synecoculture (left), at the beginning of the dry season. Other cultivation methods fade completely (right). Date: 2016/12/13, Angle: Z

20 months after the installation of synecoculture (back in the center), at the beginning of dry season. The synecoculture area remained green throughout the year with constant harvests. Date: 2016/12/13, Angle: Z

Conclusion

We have tried a new method of market gardening, the synecoculture, based on the high-density mixed polyculture of vegetables and useful trees and the harvesting modality suitable for the ecological optimization of the crops.

This system could be a solution, a salvation for small producers, a powerful lever for family farming, while ensuring the productivity and preservation/construction of the environment.

It should be noted that we are only at the embryonic stage of the adaptation of the synecoculture to the African context. For this year 2016-2017, we also plan to introduce medicinal and forage species. It is important to involve more equipped structures such as INERA and institutional supports to the project.

Reporters: André TINDANO

Secretary General of AFIDRA,

Zina Karifo Hervé

Agricultural Technician

Analysis and approval: Masatoshi FUNABASHI

Sony CSL

II.2 Report of the working groups on the planning of a new synecoculture pilot farm in Fada N'Gourma

This work is carried out during the round tables of the forum by the participants grouped in 4 teams around 4 subjects for the implementation of synecoculture in a new pilot farm in Fada N'Gourma.

1. Group One

Subject: Maximum Diversity

We propose three strategic axes for maximum diversity in the new farm of Fada N'Gourma:

- ❖ The conservation of all the vegetation found on site with the FMNR (Farmer-Managed Natural Regeneration)
- ❖ The introduction of plants according to their use (forage, traditional medicine, human food, cosmetics, etc.)
- ❖ Introduction of stockbreeding

2. Group two

Subject: Maximum Productivity

We propose strategies for maximizing productivity such as:

- ❖ Setting up a reliable water source
- ❖ Introduction of high productivity plants
- ❖ A strong diversification and integration between plant and animal production

3. Group Three

Subject: Minimum cost

We propose as actions to reduce the cost:

- ❖ Long-term investment: put a wire fence and stabilize it with a hedge
- ❖ Use local species
- ❖ Harvest and produce the seeds ourselves and valorize local edible species that are not considered as such

4. Group Four

Subject: Minimum risk

Contextual analysis: Local risks arise from the lack of community participation or access to land. Though as the design of our model requires only a small amount of land (1ha of the model farm and 1ha of the production area is sufficient), this allows us to work even in the place where the conditions would be unfavorable for large farms.

Propositions: There may still be challenges with ongoing operations and motivation. Again, we rely on our past experiences (those of the pilot farm in Tapoa) and this allows us to use a franchise type of propagation model. Instead of having extension agents for training who receive full-time salaries after implementation, they will essentially "lease" AFIDRA assets and earn their living from their training, extension services and product sales as well as the benefits of the farm. This helps maintain motivation not only for production, but also for the maintenance of equipment. AFIDRA has had great success with this model.

The main risk management tool that we have been offering has a reputation for being flexible and adapting quickly. Since we live and work in the midst of our area of interest rather than being far away in a big city, we can quickly understand the reality and change if necessary. We can also respond promptly to problems and provide continuous support. We are also able to learn from each other and allow the network to grow in capacity rather than just being managed from the main office of AFIDRA.

Reporters: DAWEGA E. Bastalé, ONADJA Honoré

II.3 Report in relation to the new constitution of Burkina Faso

Participation in the Constitutional Commission of Burkina Faso

The fruits of the symposium, the results of the experiments and the scientific analysis were brought to the Constitutional Commission by Mr. Yumanli LOMPO, President of AFIDRA, and included in the discussion for the establishment of the new Constitution of Burkina Faso.

The Constitutional Commission adopted the following articles in relation to the sustainable practice of agriculture and the equitable access to natural resources to be put to the referendum:

Extracts from the new constitution of Burkina Faso (Original French texts)

Article 26

L'Etat assure la promotion et la protection du secteur agro-sylvo-pastoral en vue d'assurer la souveraineté alimentaire et le développement durable.

Article 23

Les ressources naturelles appartiennent au peuple. L'Etat veille à lui en assurer le bénéfice de l'exploitation pour l'amélioration de ses conditions de vie.

L'exploitation des ressources naturelles s'opère dans le respect des principes de transparence, de participation des populations locales et de l'environnement, de manière à assurer le développement durable et le bien-être des générations actuelles et futures.

Article 39

Toute personne a droit à un environnement sain. L'Etat veille à la protection et à la préservation de l'environnement et du climat dans l'intérêt des générations présentes et futures.

L'Etat veille à l'évaluation et au contrôle des impacts environnementaux et sociaux de tout projet et programme de développement.

La protection, la défense et la promotion de l'environnement sont un devoir pour tous.

Article 40

La production, l'acquisition, le stockage, la manipulation et l'évacuation de produits chimiques dangereux sur le territoire national sont réglementés par la loi.

L'importation, le transit, le stockage, le déversement et le traitement dur le territoire national de produits chimiques dangereux étrangers ainsi que tout accord y relatif, constituent un crime environnemental.

Tout dommage causé à l'environnement doit faire l'objet d'une juste réparation.

Relationship between Fada N'Gourma declaration and the new Constitution of Burkina Faso

At the level of human rights, these articles of the new constitution refer to the right to environment, that is to guarantee people's access to healthy environments by the state, in order to realize sustainable agriculture.

On the other hand, the environmental preservation movements in the world have given fruition to the rights of nature, which is to admit the natural ecosystems have rights just as human beings have rights. The pioneer examples are the Rights of Nature defined in the Constitution of Ecuador (Article 71), and the Law of the Rights of Mother Earth in Bolivia.

Fada N'Gourma declaration established at the first African symposium on synecoculture (chapter III) emphasizes the "right to subsistence of ecosystems" in the context of increasing biodiversity through the intensive use of synecoculture. This is the integration of environmental and nature rights in the face of dynamic changes in the Anthropocene: We must guarantee access to and use of natural resources efficiently and intensively with respect to the productivity and

biodiversity. At the same time, it introduces drastic changes of environment as an anthropogenic augmentation of ecosystems (Funabashi, 2016b). As a result, ecosystems that can adapt to climate change and population pressure could not remain the same in terms of species composition, but will become more enhanced at the level of ecosystem functioning and services, in order to achieve sufficient socio-ecological subsistence. Here, importance is placed on the subsistence by transitioning to a new regime of ecosystem and society, rather than remaining in the old conflict between development and preservation. As the results of productivity and recovery of the ecosystem indicate (chapter II.1), this is proved to be possible exclusively by the synecoculture among the 7 tested methods. With this evidence, our challenge by the current practice of synecoculture finds the possibility and justification beyond the trade-offs between the actions exercised by the environmental rights for men and the rights of intact nature. By means of the augmentation of ecosystems, we aim to realize a new form of symbiotic Earth between humans and nature, which implies coexistence, diversification and mutual use, through the restructuring of agricultural sector without precedent.

Reporters: Yumanli LOMPO, André TINDANO, and Masatoshi FUNABASHI

CHAPTER III:
DECLARATIONS AND NOTICE OF SUPPORT

III.1: Fada N'Gourma declaration

Synecoculture Africa

Fada N'Gourma declaration, 2016

We declare at the 1st African Forum on Synecoculture, based on the initiative of the executive committee as a consensus of the participants' opinions, a series of agreements that will guide the collaborations on the practice of synecoculture in future development.

According to the definition and rules of synecoculture, we will pursue the possibilities of using, applying and developing the synecoculture in African countries.
Without being constrained by past ideas, we will overcome the difficulty by ourselves and commit ourselves to realize what could be possible with the use of open complex systems science that constitutes the synecoculture.
We will carry through this activity with consistent intellectual efforts, even in case of 1% possibility, we will continue to seek the new means that open the way to the coexistence of human and nature.
With this perspective, we are ready to renew traditions, even when competing with conventional methods, we will reconcile and judge in the long term what would benefit most for the sustainability of social-ecological system as a whole.

We will each act with autonomous actions and management, in order to guarantee the sustainability of each locality and establish a true solidarity granted by the foundation of self-sufficiency.

We defend the right to subsistence of ecosystems as an underlying and fundamental support for the right to life of men.
Through the practice of synecoculture, we augment ecosystems with respect to the biodiversity and associated ecosystem functions, from which we obtain the necessary ecosystem services for our lives in a sustainable way and build the ecosystem beyond a natural state. This principle is universal throughout our practices even under the contexts of population growth and climate change.

We will fight the desertification with synecoculture as our arms, and provide peace against violence, producing healthy foods as a universal language.

We introduce women as well as men, and work together with gender equality in the practice of synecoculture.

We respect the principle of open source in the development, sharing, dissemination and popularization of synecoculture as a citizen science open to all participants of good will.

Thus, we set the year 2016 as the first year of synecoculture in Africa, with a view to initiating the coordination and proliferation of projects on several scales of the practice, organization, research, and institutional efforts, as a first step of Men of integrity to live together on this beautiful land.

Executive committee

André TINDANO

Agence de Formation et d'Ingénierie
du Développement Rural Autogéré (AFIDRA)
Fada N'Gourma, Burkina Faso

Masatoshi FUNABASHI

Sony Computer Science Laboratories, Inc.
Tokyo, Japan

III.2: SUBSCRIPTION LIST TO THE FADA N'GOURMA DECLARATION

Table 12. Subscription list to the Fada N'Gourma Declaration (Subscription before 31 December 2016).

No.	LAST and first Name	Country
1	BALMA Juliette	Burkina Faso
2	BANKOUAMBA A. Emmanuel	Burkina Faso
3	COULIBALY Mariam	Burkina Faso
4	DAMOLGA Samson	Burkina Faso
5	DAMOUE D. Jean	Burkina Faso
6	DIANOU Ali	Burkina Faso
7	DAWEGA Bastalé	Burkina Faso
8	DIABRI Dapouguidy Hubert	Burkina Faso
9	DOLLY S. Ruben	Burkina Faso
10	EGLE Homenya Komla	Togo
11	GBANGOU Paul	Burkina Faso
12	GOUBA Alain	Burkina Faso
13	IDANI Otoniel	Burkina Faso
14	LANKOANDE Talata Samuel	Burkina Faso
15	LOMPO Michel	Burkina Faso
16	LOMPO Yumanli	Burkina Faso
17	LOMPO/GNOULA Folpoa	Burkina Faso
18	LOUGUE Gassi	Burkina Faso
19	MADIEGA D. Léon	Burkina Faso
20	MANDOBIGA Yentema	Burkina Faso
21	NANKAP DJANGUE Marlyse	Cameroun
22	ONADJA Honoré	Burkina Faso
23	OUALI Adjima	Burkina Faso
24	OUALI/LOMPO Bahanla	Burkina Faso
25	OUATTARA Balli	Burkina Faso
26	OUBDA Parfait	Burkina Faso
27	OUBDA Sylvain	Burkina Faso
28	OUEDRAOGO Alida	Burkina Faso
29	OUEDRAOGO Harouna Hubert	Burkina Faso
30	OUEDRAOGO JUSTINE	Burkina Faso
31	OUEDRAOGO Souleymane	Burkina Faso
32	OUOBA Bernard	Burkina Faso
33	OUOBA Yempabou	Burkina Faso
34	PALE Blaise	Burkina Faso
35	PALLO Danialemba	Burkina Faso
36	ROUAMBA Armel	Burkina Faso
37	SAWADOGO Aminata	Burkina Faso
38	SAWADOGO Karim	Burkina Faso
39	SAWADOGO Mahamadou	Burkina Faso
40	SOMDA B. Béatrice	Burkina Faso
41	TANKOANO Foldoa	Burkina Faso
42	THIOMBIANO J. Jacques	Burkina Faso
43	THIOMBIANO Y. André	Burkina Faso
44	TINDANO Abraham	Burkina Faso
45	TINDANO Kiankiarou	Burkina Faso
46	TINDANO Noumpoa Clarisse	Burkina Faso
47	YONLI Namihanla Albert	Burkina Faso
48	ZONGO Somaila	Burkina Faso
49	MICHEL Bernadette	Belgium
50	LISAN Benjamin	France
51	ELEE Messaoudi	Tunisia
52	FUNABASHI Masatoshi	Japan
53	太田 耕作	Japan
54	KITAMURA Yoko	Japan
55	佐藤 雄二	Japan
56	植田 貞子	Japan
57	甲斐 豊美	Japan
58	白河 三來	Japan
59	趙 千鶴	South Korea
60	田尻 大也	Japan
61	遠藤 秀一	Japan
62	掘 滋	Japan
63	高倉 真紀子	Japan
64	遠藤 理絵	Japan
65	富永 健太	Japan
66	TESHIGAWARA Hajime	Japan
67	太田 正仁	Japan
68	福江 満子	Japan
69	HIKARIAME Yusuke	Japan
70	松本 由香	Japan
71	吉村 誠栄	Japan
72	深水 真紀子	Japan
73	山下 邦宏	Japan
74	河岡 辰弥	Japan
75	田中 淳一	Japan
76	稲村 ひろみ	Japan
77	佐藤 尚子	Japan
78	市場 史路	Japan
79	玉井 幸助	Japan
80	花巻 ゆみ	Japan
81	對馬 葉子	Japan

III.3: NOTICE OF SUPPORT

Governor of the East Region (Inauguration speech)

OPENING ADDRESS BY THE GOVERNOR OF THE EAST REGION ON THE OCCASION OF THE FIRST AFRICAN FORUM ON SYNECOCULTURE

FADA N'GOURMA, 19/10/2016

Precedence

- **Mr Governor of the East Region;**
- **Mr High Commissioner of Gourma Province;**
- **Mr Regional Directors;**
- **Mr/Ms Directors and Heads of Services;**
- **Mr representatives of cooperatives;**
- **Mr/Ms participants;**
- **Honoured guests;**
- **Ladies and gentlemen.**

Before starting my speech, I would like to convey the congratulations and encouragement from the Minister of Agriculture and Hydraulic Planning for the individual and collective efforts made to contribute to the sustainable intensification of agricultural production.
In particular, I would like to congratulate the initiators and organizers of this forum and thank all the participants of the various participating structures for this reflection.
It is a pleasure for me to chair this day, October 19, 2016, the work of this symposium to share experiences and formulate a strategy to expand the technology of synecoculture in our country and in Africa.
I would like to congratulate the promoter of this innovative cropping technique and its accompanying technology, I would like to mention Mr. Masatoshi Funabashi.
May the actors and animators of the experiments carried out also receive my congratulations and encouragement.

Ladies and gentlemen;
The effects of the multifaceted crisis (financial, energy and food) of recent years have brought the issue of agricultural growth back to the heart of the debate and agenda of development policies in sub-Saharan Africa and particularly in Burkina Faso.
Against this backdrop, and in view of the perverse effects of climate change on agricultural production, ecological agriculture is now an important option for the Government to secure and sustainably increase food production in our country.
It is in this context that the intensification of production through the practice of synecoculture, materialized in the establishment of a pilot farm for the African region, is considered as a measure to preserve the national sovereignty of our countries.

Ladies and gentlemen;
Honoured guests;
The most important open systems in the next century are primary industries such as agriculture, forestry, fishing and livestock, where humans are in direct contact with nature. Throughout human history, agriculture has been destructive to the environment. Even today, modern agriculture, based on the reductionist principle, creates a devastating effect on natural environments, degrading the quality of food, and threatening our health. With the use of open systems science,

this new system of agriculture, called "synecoculture", which is based on symbiotic associations of edible species, the practice is strongly balanced and reconstitutes natural environment in all arable climate conditions. Beyond conventional reductionism, the synecoculture seeks to achieve a "symbiotic Earth" where every living species can manifest its function to its full potential through primary industries under human control.
In this sense, the technology of synecoculture has proved its effectiveness in Japan and the experimentation which is carried out in Burkina Faso is satisfactory.
Indeed, its introduction in Burkina Faso, in Tapoa, has resulted in promising results, as you will see in the presentations.
These results therefore give high hopes that this technology will contribute significantly to the drastic reduction of poverty by reducing the import bill of fertilizers and increasing the income of rural households.
These prospects bode well for better self-sufficiency and African food sovereignty.

Dear participants;
Ladies and gentlemen;
It is with these prospects that I welcome the holding of this forum organized to reflect on a strategy to popularize these formidable techniques and technologies.
This forum will enable the actors concerned to:
- absorb and appropriate the results of the demonstration tests, and to work on their expansion on pilot sites installed for this purpose;
- develop a strategy with a roadmap for extension on a large scale, in this case in all African countries.
- make a joint declaration and commit to respect it
In order to do this, I hope that the exchanges will be fruitful to enable us to achieve the objectives of the meeting and to have concrete, objective and feasible proposals to submit to the Authorities.
There is in this room, all the people with skills gathered to come to this end.

Ladies and gentlemen,
No development policy and strategy is meaningful unless we find the right channels for its operationalization. Today, particular emphasis must be placed on consolidating actions such as synecoculture, increasing ecosystems with respect to biodiversity and associated functions, from which we obtain the ecosystem services needed for our lives, in a sustainable manner that builds the ecosystem beyond the natural state. This principle is universal through our practices even under the contexts of population growth and climate change.
Based on the successes witnessed on the ground, I invite the heads of Institutions, technical and financial partners, project and program managers, technicians and producers to support this AFIDRA initiative by consolidating the promising results on the ground. It is only with such commitment that we will be able to win the challenge of boosting the sustainable productivity of agricultural sectors, as a promising measure to definitively eradicate poverty in our countries.

Honored Guests;
Ladies and gentlemen
I can not end my remarks without reiterating on behalf of the Minister of Agriculture and Hydraulic Planning, my thanks to AFIDRA for its multifaceted actions to promote sustainable soil management, a guarantee of a lasting improvement in the productivity.
I renew my sincere gratitude for having responded positively to this invitation and, while wishing to participate effectively and successfully in our work, declare the opening of the First African Forum on Synecoculture.

Thank you.

Ousmane TRAORÉ

Governor of the East Region, Burkina Faso

Minister of Agriculture and Hydraulic Planning

Ministry of Agriculture and Hydraulic Planning in Burkina Faso
General Secretariat

Ouagadougou, 31 March 2017

Notice of Support

I, the undersigned, Mr OUEDRAOGO Jacob, in my capacity as Minister of Agriculture and Hydraulic Planning, express my support for the African Center for Research and Training in Synecoculture (CARFS), a structure created by the joint initiative between l'Agence de Formation et d'Ingénierie de Développement Rural Autogéré (AFIDRA) and Sony Computer Science Laboratories, Inc.

I note that this organization develops the substantial and important channels for the operationalization of the new agricultural technology called "synecoculture". Given the vulnerability of the countries in the Sahelian zone, emphasis should be placed on consolidating actions such as synecoculture, which could contribute to the challenge for the augmentation of ecosystems.

The use of this new technology will contribute to the development of the agricultural sector and to the resolution of the environmental issues facing the Sahelian countries, including Burkina Faso. The importance of this synecoculture project is undeniable in increasing the production and productivity of the agricultural sector, all of which will make it possible to combat food and nutrition insecurity, especially in the contexts of population growth and climate change.

According to the successful results in the field, I invite the heads of institutions, the technical and financial partners, the project and program managers, the technicians and the producers, to support this AFIDRA-CARFS initiative by consolidating the promising results already obtained. It is only this commitment that will make it possible to win the bet on the reliable and sustainable productivity of the agricultural sector, which would lead to a definitive eradication of poverty in the Sahelian countries.

I would therefore like to reiterate my support for CARFS with regards to the efforts and the certain impacts of this new technology for the well-being of poor rural populations, and to affirm my subscription to the Fada N'Gourma declaration. I quote "Thus, we set the year 2016 as the first year of synecoculture in Africa, with a view to initiating the coordination and proliferation of projects on several scales of the practice, organization, research, and institutional efforts, as a first step of Men of integrity to live together on this beautiful land."

Jacob OUEDRAOGO

Officer of the National Order

Ambassador of Japan in Burkina Faso

Embassy of Japan in Burkina Faso

Ouagadougou, 22 November 2016

Notice of Support

I, the undersigned, Masato FUTAISHI, Ambassador Extraordinary and Plenipotentiary of Japan in Burkina Faso, express the support of the Embassy to the African Center for Research and Training in Synecoculture (CARFS), a structure created by the joint initiative between AFIDRA and Sony Computer Science Laboratories, Inc.

Given the situation of the countries in the Sahelian zone, it is essential to place particular emphasis on the consolidation of actions such as synecoculture, which takes up the challenge of augmentation of ecosystems.

This synecoculture project, developed by the private sector of Japan and Burkina Faso, is the result of academic research by Sony Computer Sciences Laboratories, Inc. Its academic objectivity is very high in that it has been verified independently in Japan and Burkina Faso. It is a project that will contribute to the development of the agricultural sector and to the resolution of the environmental issues that Burkina Faso and the African countries are facing.

Moreover, the promotion of the employment base for economic agriculture will contribute to the social stability of Burkina Faso and neighboring countries. Moreover, the Government of Japan considers this project to be particularly beneficial to both countries.

Given the commitment of the participants to the first African forum on synecoculture to combat desertification with synecoculture and to provide peace and produce healthy foods, I reiterate the support of the Japanese Embassy, who subscribes to the Fada N'Gourma declaration 2016.

Masato FUTAISHI

Ambassador Extraordinary and
Plenipotentiary of Japan in Burkina Faso

President of the UniTwin UNESCO CS-DC program

Paris , 5 /11/2016

Notice of Support

I undersigned, Paul Bourgine, President of UniTwin UNESCO CS-DC (Complex Systems Digital Campus), express the support of the CS-DC to the 1st African Forum on Synecoculture which took place on 19-21 October at Fada N'Gourma in Burkina Faso.

The synecoculture project started as soon as the CS-DC was founded and it contributed substantially to the challenges of our program to achieve a fair and sustainable world at all levels of organization, from farm to planet. The project provides open-source information and tools to which the CS-DC gives its best support: it proposes efficient and innovative ways of leading the world's farms towards sustainable agriculture and inventing the transition towards a new form of territorial governance by the autonomous and decentralized organization of the various societal actors (DAOs; Decentralized Autonomous Organisation of producers, consumers and scientific e-teams) and Governments.

I confirm that this activity is one of the great achievements of "smart farms" with the powerful support of complex systems science, which meets the criteria of the Sustainable Development Goals 2015-2030 of the United Nations.

This forum was broadcast free of charge on-line as one of the first e-events of the CS-DC, which will ensure its dissemination for scientific and societal purposes in line with the preamble of the CS-DC.

Thus, the CS-DC subscribes to the membership list of the Fada N'Gourma declaration 2016, which demonstrates the primary objectives for the development of future collaborations while strengthening our alliance for the contribution to humanity and life on the Earth.

Paul Bourgine

President
UniTwin UNESCO CS-DC

APPENDICES

-QUIZ and answers

Q1. This year of 10 species tested, a lot of carrots was harvested but not for others. So next year we will all invest in carrots only and eliminate the others.

A: No. It is always necessary to guarantee more than a dozen species in mixed polyculture.

Q2. 10 species were planted in one place but only 2-3 species were grown. So we continue the cultivation with these 2-3 species for this season, in order to transition to others thereafter.

A: Yes. It is not necessary to grow more than 10 species at the same time in the same place, but you must always keep the aspect of the temporal transition that involves more than 10 species on an annual scale.

Q3. Small manual ground disturbance is allowed if this causes in total the richer environmental biodiversity.

A: Yes. It is a positive disturbance to biodiversity.

Q4. Fully clearing the vegetation in large areas is allowed if the green band around the plot has been kept.

A: No. Keep the vegetation covered as much as possible inside the plot.

Q5. My land is too poor to accept any spontaneous vegetation. I dug holes and laid the organic material (manure) at the beginning on the surface.

A: Yes. This is acceptable as the phase of transition to the synecoculture.
However, it should not be continued during production with the denomination of synecoculture.

Q6. Productivity declined after a few years of practice. The land has become inevitably poor, so I put the fertilizer back in order for it to recover.

A: No. The decline in production is the result of mismanagement. To cover it, it is necessary to pass rather by an increase of biodiversity, without using the fertilizers.

Q7. I use the natural pesticide to reassure that my field will not be invaded by insects.

A: No. Avoid using pesticides, regardless of the source. In this case, it is not the use of the natural pesticide but rather its blind mode of use which is against the principle. If one does not have criteria to evaluate the effectiveness, it is a blind use that does not serve to improve management.

Q8. I made a barrier to block the large animals that are doing damage to the farm. This is permissible because it does not interfere with other faunal species that serve to construct and regulate the ecosystem in the field of synecoculture.

A: Yes.

Q9. By using ICT, one can eventually arrive at an ultimate algorithm that could have all the autonomous decision of the synecoculture.

A: No. Always renew the decision-making system and explore new possibilities because the environment is constantly changing by its nature.

Q10. I found a possibility of plant association which is against the traditional experience. Is this a correct practice?

A: Yes, and congratulations! Knowledge must be renewed by experience.

Q11. I need to share all the data on my farm if I participate in the synecoculture.

A: No. Data sharing follows the open source principle and it is your will that the data is shared. Sharing helps to improve the experiences of others as well as yours.

Q12. In general, the greater the biodiversity in the fields, the more it contributes to enriching the components beneficial to the health in the product.

A: Yes.

Q13. In general, the more we have the biodiversity in the field, the more we have the quality of harvest from even poor land.

A: Yes.

Q14. In order to start synecoculture, it is always better to solicit grant/subsidy from outside.

A: No. The attitude of autonomy must be maintained. The practice of synecoculture is better and sustainable if it is self-managed. The scale should not be increased immediately by depending on external budget. We must seek means not to lose, not to hasten to win.

Q15. What are the names of these plants? What are the utilities (at least 3)?

A: Conducteur du soleil (left), Langue du boeuf (right)

-Photos of the forum

The national gendarmerie ensuring the security of the forum.

Reception of the Governor of the East Region.

From left to right: André TINDANO (Secretary General of AFIDRA), Colonel Ousmane TRAORE (Governor of the East Region) and Masatoshi FUNABASHI (Researcher at Sony CSL, international expert on synecoculture).

Mr. Masatoshi FUNABASHI, international expert of the synecoculture in full presentation at the First African Forum on Synecoculture.

View of participants in the conference room.

Field investigation for the discovery of plants on the site of new synecoculture farm near Fada N'Gourma

Field investigation for the discovery of plants on the site of new synecoculture farm near Fada N'Gourma

Souvenir photo around the baobab of the new farm of synecoculture in Fada N'Gourma

-List of participants

Table 13. List of participants on site.

No.	LAST and first name	Affiliation	Country
1	BALMA Juliette	Élève	Burkina Faso
2	BANKOAMBA A. Emmanuel	BPC Gayéri	Burkina Faso
3	COULIBALY Mariam	DRAAH/Centre Sud	Burkina Faso
4	DAMOLGA Samson	CFBA/Niendouga	Burkina Faso
5	DAMOUE D. Jean	AFIDRA	Burkina Faso
6	DAWEGA Bastalé	LNSP	Burkina Faso
7	DIABRI Hubert	Représentante Maire	Burkina Faso
8	DOLLY S. Ruben	AFIDRA	Burkina Faso
9	EGLE Homenya	GRAPHE	Togo
10	GBANGOU Paul	producteur	Burkina Faso
11	HIEN Masséoukoum	DGPV/DPVC	Burkina Faso
12	IDANI Otoniel	CFBA/Niendouga	Burkina Faso
13	LANKOANDE Mariam	AFIDRA	Burkina Faso
14	LANKOANDE T. Samuel	étudiant	Burkina Faso
15	LOMPO Michel	CFBA/Niendouga	Burkina Faso
16	LOMPO Yumali	AFIDRA	Burkina Faso
17	LOMPO/GNOULA Folpoa	CFBA/Niendouga	Burkina Faso
18	LOUGUE Gassi	DREA HBS	Burkina Faso
19	MADIEGA D. Léon	CFBA/Niendouga	Burkina Faso
20	MANDOBIGA Yentema	OPADAIC/FADA	Burkina Faso
21	Masa FUNABASHI	SONY CSL	Japan
22	NANKAP DJANGUE M.	Université de Yahoundé 1/UPB	Cameroun
23	ONADJA Honore	MAAH	Burkina Faso
24	ONADJA Nindia	ADM	Burkina Faso
25	OUALI Adjima	OPADAIC/FADA	Burkina Faso
26	OUALI/LOMPO Bahanla	CRA EST/FADA	Burkina Faso
27	OUATTARA Balli	Conseil Regional de l'EST	Burkina Faso
28	OUBDA Parfait	CCP/FADA	Burkina Faso
29	OUBDA Sylvain	ACF	Burkina Faso
30	OUEDRAOGO Alida	OSC	Burkina Faso
31	OUEDRAOGO Armand J.N.	NOVICOM	Burkina Faso
32	OUEDRAOGO Hubert	ARFA	Burkina Faso
33	OUEDRAOGO Justine	MAAH	Burkina Faso
34	OUEDRAOGO P. Alido	agent des OSC	Burkina Faso
35	OUEDRAOGO Souleymane	INERA/BOBO	Burkina Faso
36	OUOBA Bernard	AFIDRA	Burkina Faso
37	OUOBA Yempabou	Étudiant	Burkina Faso
38	PALE Blaise	Étudiant	Burkina Faso
39	PALLO Danialemba	OPADAIC/FADA	Burkina Faso
40	ROUAMBA Armel	MAAH	Burkina Faso
41	SAWADOGO Adama	INERA/BOBO	Burkina Faso
42	SAWADOGO Aminata	Élève	Burkina Faso
43	SAWADOGO Karim	MANITESE	Burkina Faso
44	SAWADOGO Mohamed	Étudiant	Burkina Faso
45	SOMDA B. Béatrice	INERA/FADA	Burkina Faso
46	TANKOANO Foldoa	CFBA/Niendouga	Burkina Faso
47	THIOMBIANO J. Jacques	ADE/AACE	Burkina Faso
48	THIOMBIANO Ramata	AFIDRA	Burkina Faso
49	THIOMBIANO Y. André	ADE/AACE	Burkina Faso
50	TINDANO Kiankiarou	MAAH	Burkina Faso
51	YONLI N. Albert	CFBA/Niendouga	Burkina Faso
52	ZONGO Somaila	IDR/UPB	Burkina Faso

ACKNOWLEDGEMENTS

We sincerely thank all the members and associate members of the organizing committee and the secretariat of AFIDRA for the preparation and the conduct of this forum. Sony CSL offered funding and administrative support. We would like to thank Julien Baudry and Paul Bourgine of UniTwin UNESCO CS-DC for the special support for webcast and our driver Souleymane Kone for the transport. Hotel Panache welcomed us during these 3 days in its pleasant atmosphere. We thank the gendarmes and the police for the maintenance of order and security during the preparation and running of this forum. This forum is the result of the combined efforts of all the participants who have contributed greatly to the development of synecoculture in Africa. Layout of the act of symposium is carried out by Akira Tamaki.

REFERENCES

✓ Synecoculture Manual available here:
https://www.elab-ose4el.net/?p=327
✓ Site of CARFS (under construction):
http://yenttdn.wixsite.com/synecoculture-africa
✓ Facebook page of CARFS:
https://web.facebook.com/carfs.org/
✓ Synécoculture Africa Facebook community:
https://web.facebook.com/groups/1631931377118869/

(Funabashi, 2016a) Masatoshi Funabashi “Synecological farming: Theoretical foundation on biodiversity responses of plant communities”. Plant Biotechnology, Vol. 33 (2016), No. 4, 213-234.
(Funabashi, 2016b) Masatoshi Funabashi “Manuel d’agriculture synécologique, édition 2016” (édition française). Matériel éducatif et de recherche du Complex Systems Digital Campus, programme UniTwin de l’UNESCO, laboratoire en ligne : Exploration en systèmes ouverts pour l'effet de levier écosystémique, No. 3.
(Zotoglo et Kouyaté, 2011) Kokou Zotoglo, Djiguiba Kouyaté, « Manuel de formation - Système de riziculture Intensive (SRI) », sur USAID, Expanded Agribusiness and Trade Promotion (USAID E-ATP) / Mali - Initiatives intégrées pour la croissance économique au Mali (IICEM), juillet 2011
(BASE, 2016) http://asso-base.fr/-L-Agriculture-de-Conservation-.html
(Mollison et Holmgren, 2006) Bill Mollison, David Holmgren, “Perma-culture, tome 1.” Equilibres d'aujourd'hui (1 mars 2006)
(Mollison, 2011) Bill Mollison, “Perma-culture, tome 2.” Equilibres d'aujourd'hui (15 novembre 2011)
(Verheij et Waaijenberg, 2008) Ed Verheij et Henk Waaijenberg, “Le jardin potager dans les zones tropicales” Agrodok 9, Fondation Agromisa et CTA, Wageningen, 2008
https://publications.cta.int/media/publications/downloads/1436_PDF.pdf
(EASYPol, 2007) FAO EASYPol, “Analyse de la filière maraichage au Burkina Faso.” Ressources complémentaires, Module EASYPol 107, 2007
http://www.fao.org/docs/up/easypol/887/analyse-filiere-maraichage_107fr.pdf
(World Bank, 2016) http://donnees.banquemondiale.org/pays/burkina-faso
(INSD, 2015) Institut national de la statistique et de la démographie (INSD), “Profil de pauvreté et d’inégalités.” Enquête multisectorielle continue (EMC) 2014, Novembre 2015
(CBD, 2010) Convention sur la diversité biologique, “plan stratégique 2011-2020 pour la diversité biologique et les objectifs d’Aichi.” https://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-FR.pdf