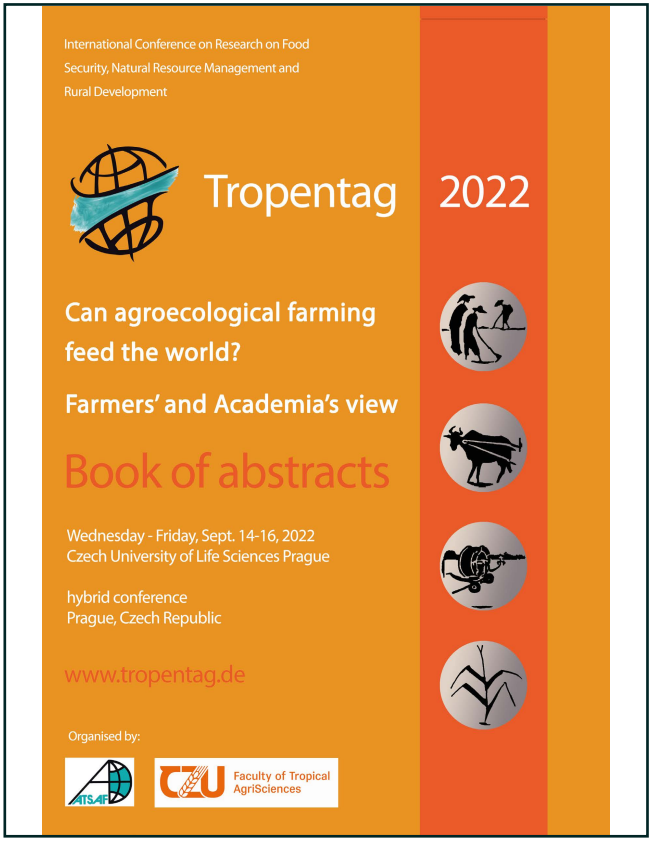
Eric Tielkes (Herausgeber)

Tropentag 2022 – International Research on Food Security, Natural Resource Management and Rural Development

Can agroecological farming feed the world? Farmers' and academia's views



https://cuvillier.de/de/shop/publications/8697

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: https://cuvillier.de

Plenary speeches

Jacobo Arango:
Agroecological transformation of tropical livestock production through improved forages and silvopastoral systems 8

Larissa Mies Bombardi:
Agroecology as a path in the face of chemical dependent agriculture 9

Patrick Worms:
"It's the economy, stupid": Why a 1980s American political slogan is a perfect illustration of the drivers for restoration in the Sahel 10

Agroecological transformation of tropical livestock production through improved forages and silvopastoral systems

Jacobo Arango

International Center for Tropical Agriculture (CIAT), Colombia

Livestock production and consumption of animal foods around the globe are currently under scrutiny, as consumers usually associate these activities to the environmental damage largely caused by extensive cattle ranching and deforestation. However, a change in the narrative is gaining track among key stakeholders giving more visibility to the how livestock foods are produced, differentiating extensive and sustainable cattle raising. Using examples from the tropical belt it can be demonstrated that sustainably managed forages with different strata (e.g., silvopastoral systems) can contribute to all the agroecological principles, mainly recycling, input reduction, soil health, animal health, biodiversity, synergy, social values, and economic diversification. Silvopastoral systems, based in improved forages, have been largely acknowledged for the potential to contribute to climate change mitigation and adaptation. Improved feeds based on mixtures of grasses and legumes (usually local genetic resources) influence modulating the ruminants' digestive microbiota, and hence reduce enteric methane emissions per unit product (kg meat/L milk). Moreover, in a global N fertiliser shortage, agroecological livestock production through silvopastoral systems benefit from the legumes capacity to fix N, with estimates ranging from 80 to 600 kg N per hectare per year, which avoids about 4.5 kg CO_2eq per kg N than if applied via fertiliser. Currently, diverse technologies have been proposed pointing for sustainable livestock production, however, silvopastoral systems stand out among them for the potential contribution to all agroecological principles, increasing livestock productivity while providing ecosystem services, including reduction of the carbon balance of the system.

Contact Address: Jacobo Arango, International Center for Tropical Agriculture (CIAT), A A 6713, Cali, Colombia, e-mail: j.arango@cgiar.org

Agroecology as a path in the face of chemical dependent agriculture

Larissa Mies Bombardi
University of São Paulo, Department of Geography, Brazil

With the worldwide economy, particularly after World War II, agriculture started to take on a global scale, not only in the sense that a significant part of the agricultural production started to be globally commercialised, becoming a commodity, but also because it began to become dependent on chemical industries of fertilisers and pesticides and, more recently, on patented seeds. The industrialisation of agriculture – which allowed agricultural production to be carried out on a very large scale and in a homogeneous way – became known as the "Green Revolution" and had, as a justification for its implementation, the promise of overcoming hunger, through the use of technology.

However, more than half a century has passed and, even so, the only constant still is hunger. Currently, the number of hungry people in the world has increased. In 2020, from 9.2 % to 10.4 % of the worldwide population faced hunger.

Not only has hunger increased, but, in addition, the environment and human health have been intensely contaminated by chemical substances used in agriculture.

To look at the human and environmental tragedy resulting from this agricultural model, let us focus on Brazil, the country that is the largest worldwide exporter of soy, beef, sugar, coffee and orange juice, among other products.

In Brazil, the emblematic expansion of soy – which currently covers an area equivalent to the entire territory of Germany and whose production has grown exponentially – shows us how devastating the monoculture expansion scenario for exportation is.

Between 2010 and 2020, the use of pesticides in Brazil substantially increased by 78.3 %. As a consequence of this increase, we are witnessing chemical violence, oftentimes indirect, silent and subtle, which arises as an unfolding of the aforementioned Green Revolution.

Facing the model imposed by the Green Revolution, which reveals itself to be external, homogenizing, dangerous and colonialist, agroecology appears as an alternative, proposing changes to the way economic processes unfold.

The need for a progressive transition to the path of agroecology is urgent. Otherwise, we will continue on a route that will result in a collision against ourselves.

Contact Address: Larissa Mies Bombardi, University of São Paulo, Department of Geography, São Paulo, Brazil, e-mail: larissab@usp.br

"It's the economy, stupid": Why a 1980s American political slogan is a perfect illustration of the drivers for restoration in the Sahel

Patrick Worms
World Agroforestry (ICRAF), Belgium

The vast drylands of Africa's Sahel region stretch from Mauritania and Senegal in the west to Eritrea and Djibouti in the East and are home to hundreds of millions of people, mostly farmers and pastoralists. Land use systems appear to have been adequate and sustainable for many centuries but were profoundly damaged by colonialism and the subsequent rise of the regulatory state, which emasculated evolved natural resource governance systems. Rapid population growth, serious droughts in the 1970s and 1980s, and maladapted regulatory systems and development priorities have led to a rapid degradation of land and ecosystem health indicators, the progressive worsening of rural livelihoods and a concomitant rise in outmigration and banditry. We propose a number of conceptual principles to apply in the effort to restore these landscapes to high ecosystemic productivity at scale, taking into account the range of modelled changes to local climates. Informed by decades of research and partnerships with development efforts across the region, these principles ask practitioners, regulators, donors and researchers to consider contexts, incentives and drivers, land, tree and livestock management strategies, scale, and nested regulatory and economic governance systems.

Contact Address: Patrick Worms, World Agroforestry (ICRAF), Brussels, Belgium, e-mail: p.worms@cgiar.org

Crops and cropping systems

1)	**Crops and cropping systems I**	**13**
2)	**Crops and cropping systems II**	**45**
3)	**Farmer's perspectives and innovations in cropping systems**	**95**
4)	**Agroecology and plant protection**	**113**
5)	**Agroecology and organic production**	**135**

Crops and cropping systems I

Oral Presentations

Abel Chemura, Lisa Murken, Gloy Nele, Paula Aschenbrenner, Sophie von Loeben, Christoph Gornott:
Crop diversification under climate change: a comparative assessment in Ghana, Burkina Faso, Ethiopia and Niger 17

Katja Kehlenbeck, Jillian Waid, Abdul Kader, Amanda S. Wendt, Sabine Gabrysch:
Crop species richness in homegardens increased in a homestead food production cluster-randomised trial in Bangladesh 18

Amit Kumar Srivastava, Thomas Gaiser, Frank Ewert, Andreas Enders, Alparslan Demircan:
Climate change impact on mixed-crop livestock systems in sub-Saharan Africa 19

Gildas Assogba, Myriam Adam, David Berre, Katrien Descheemaeker:
Can low-input agriculture in semi-arid Burkina Faso feed its soil, livestock and people? 20

Selorm Y. Dorvlo, Helena A. Nyanteh, Edmond K. S. Aziato, Beatrice Adjei, Belinda N. S. Djabeng, Ibrahim Sakibu, Lisa Desbordes, Daniel Ninson:
Urban household vegetable production through the use of a developed vertical garden 21

Posters

Mark Spoelstra:
Selection of varieties of deep-water rice for the *cuvelai* system of seasonal wetlands in Namibia 22

Richelyn Rose Clavero, Manuel José C. Regalado, Mathias Becker, Shyam Pariyar:
Drivers and pathways of changing rice production systems in Luzon, Philippines 23

Christian Simanjuntak, Thomas Gaiser, Hella Ahrends, Amit Kumar Srivastava:
Spatial and temporal patterns of agrometeorological indicators in maize producing provinces of South Africa 24

Evelyn Pérez Rodríguez, Raymundo Vento Tielves, Juan Carlos Cruz Hurtado, Reinaldo Demesio Alemán Pérez, Roldán Torres-Gutiérrez:
Ecological status of the Pitahaya crop of the San Jorge farm, Pastaza, Ecuador 25

Jakob Herrmann, Matias Siueia Júnior, Alberto Luis, Sebastião Famba:
Participatory research for agronomic salinity management: Experiences from coastal peri-urban vegetable production in Maputo, Mozambique 26

Eneyew Tadesse Melaku, Michael Henry Böhme:
Cultivation of niger-seeds – a treasure plant to secure availability of edible oil in Ethiopia 27

Ali Abd-Elkader, Ahmed Zaki, Anas Salama, Mohamed Aboul Fotouh, Mohamed Abdelsattar, Emad Abd El-Samad, Sayed Hussin, Sayed Eisa:
Key physiological mechanisms involved in salt tolerance by comparing quinoa genotypes of various geographical origins 28

Gebeyanesh Worku Zerssa, Bettina Eichler-Löbermann:
Combining mineral fertilisers with compost for sustainable maize production and reduction of greenhouse gas 29

Boris Ouattara, Gerald Forkuor, Michael Thiel, Barbara Sponholz, Heiko Paeth, Claudia Kuenzer:
Crops monitoring and yield estimation using sentinel products in semi-arid informal irrigation systems 30

Julia Doldt, Kidist Yilma, Jim Ellis-Jones, Steffen Schulz:
The potential of integrated soil fertility management for closing the yield gap in Ethiopia 31

Elyeza Bakaze, Rockefeller Erima, Priver Namanya Bwesigye:
Phenotyping the banana biodiversity to identify climate smart varieties with optimal market potential in Africa and Europe 32

Lilli Scheiterle, Vinay Kumar Reddy Nannuru, Regina Birner, Karl Schmid:
Certified seeds or certified bags? Using genotyping-by-sequencing to validate the identity of maize in Ghana 33

Lisa Murken, John Adriko, Karlijn van den Broek, Kati Kraehnert, Christoph Gornott:
Does land demarcation affect improved seed uptake? Evidence from farmers' mental models in eastern Uganda 34

Itohan-Osa Abu, Zoltan Szantoi, Andreas Bernhard Brink, Marine Robuchon, Michael Thiel:
Detecting cocoa plantations in Côte d'Ivoire and Ghana and their implications on protected areas 35

Huong Thi Thu Truong, Binh Vu Thai:
Assessment the impact of dikes on economic efficiency of models for rice farming in Dongthap, Vietnam 36

Harison Kipkulei, Sonoko Dorothea Bellingrath-Kimura, Stefan Sieber, Marcos Lana:
Synthesis of field experiments for the assessment of yield response to different management options in diverse agro-ecological zones in Kenya using the CERES-Maize model 37

Phyu Thaw Tun, Thanh Thi Nguyen, Andreas Buerkert:
Patterns and drivers of medium-term agricultural landscape transformation in Kyunsu township, southern Myanmar 38

Online posters

Bio Zime Sounon Orou, André Adjogboto, Zakari Sissou, Pierre B. Irénikatché Akponikpe, Marnik Vanclooster:
Agro-ecological water and crop management practices' effect on rice yield and water productivity in lowlands: a meta-analysis 39

Yanelis Avilés-Tamayo, Yans Guardia-Puebla, Lázaro Valdes-Izaguirre, Quirino Arias, Raul Lopez, Gert Morscheck, Bettina Eichler-Löbermann:
Comparative characterisation of humic substances obtained from anaerobic digestate of horticultural residues 40

Gbègnidaho Mègnissè Bignon Inès Justine Zohoun, André Adjogboto, Sissou Zakari, Pierre B. Irénikatché Akponikpe, Joost Wellens:
Do agro-ecological practices improve water productivity in irrigated vegetables crops? 41

Kauser Parveen, Muhammad Abu Bakar Saddique, Shoaib Ur Rehman:
Identification and characterisation of salt stress-responsive NHX gene family in chickpea 42

Siyabusa Mkuhlani, Eduardo Garcia Bendito:
Optimum planting dates and season length for maize in Kano, Nigeria 43

Regina Magaña Vázquez, Fetriyuna Fetriyuna, Ratna Chrismiari Purwestri:
Potential use of sago (*Metroxylon sagu*) for feed and agro-industry 44

Crop diversification under climate change: a comparative assessment in Ghana, Burkina Faso, Ethiopia and Niger

Abel Chemura[1], Lisa Murken[1], Gloy Nele[1], Paula Aschenbrenner[1], Sophie von Loeben[1], Christoph Gornott[2]

[1]*Potsdam Institute for Climate Impact Research (PIK), Climate Resilience, Germany*

[2]*University of Kassel & Potsdam Institute for Climate Impact Research (PIK), Fac. of Organic Agricultural Sciences, Germany*

Diversified farming systems as an agroecological measure maintain functional biodiversity at multiple spatial and temporal scales in order to be productive, resilient and efficient. However, the potential for transforming or maintaining diversified agricultural systems depends on the ability of the selected crops to be sustained under the climate of the specific areas they are grown. Climate change can affect the ability of one or more crops to grow within specific niches and thereby reducing their potential to be part of a crop diversification strategy. In this study, we assessed the agro-climatic suitability of four major food crops in Ghana (maize, sorghum, cassava and peanut), Ethiopia (maize, sorghum, teff and wheat), Burkina Faso (maize, sorghum, cowpea and peanut) and Niger (maize, sorghum, cowpea and peanut) under current and projected climatic conditions using the ECOCROP crop suitability model. We find that suitability for four crops will decrease in Burkina, Ghana and Niger, while it will increase only in Ethiopia with the magnitude dependent on the climatic scenario. Positive changes in suitability are also projected for three crops in Ghana (up to 26.3 %) and for Ethiopia (up to 7.7 %), while in Burkina Faso area suitable for three crops will decrease (up to -36.8 %) and remain relatively unchanged in Niger(≈ 1 %). Instead, areas that are suitable for only one crop will increase in Burkina Faso, Ghana and Niger, while it will decrease only in Ethiopia. We therefore conclude that the potential for higher crop diversification will be negatively impacted by climate change. The impacts will vary within and across countries and thus, will influence planning for scaling up diversification as an agroecological measure.

Keywords: Climate impacts, crop suitability, farming systems, food crops, multiple cropping

Contact Address: Abel Chemura, Potsdam Institute for Climate Impact Research (PIK), Adaptation in Agricultural Systems, Potsdam, Germany, e-mail: chemura@pik-potsdam.de