GLOBAL RESEARCH ALLIANCE
Croplands Research Group

NEWSLETTER Nº11, October 2022

1. Cropland Research Group GRA Co-Chairs message

We reinitiated the Cropland Research Group Newsletter to share information relevant to mitigate GHG and adapting croplands to climate change. First of all, we would like to recognize and say a big thank you to Mark Liebig, that left the group as a co-chair, and welcome Hero Gollany as the new co-chair, representing USA. This newsletter provides excellent examples of the categorization of the crop ecotypes of legumes across Ecuador to be used as a replacement for the synthetic nitrogen fertilizers, their synthesis and transport causes large GHG emissions. Legume promotion is a nature-based solution linked to agroecology able to reduce fertilizers emission. Also, the design of new prototypes to develop biostimulants and alternative products (carbohydrates, lipids, vitamins...etc.) from microalgae associated to reduce and CO_2 industry emissions, can contribute to the development of a bio-economy to mitigate CO_2 emissions. Improving soil health is key to increasing sustainable land use promoting eco intensification, the optimization of the use of the resources that fulfils the SDGs in many aspects while adapting farming systems to climate change and mitigating climate change. Special issues and a list of very relevant events also provided. Enjoy the reading.

Source: Croplands Research Group Co-Chairs Team, María Rosa Mosquera-Losada, Ladislau Martin-Neto, Hero Gollany.

2. Morphological and eco-geographical diversity of Andean crops in Ecuador

Ecuador is one of the megadiverse countries on the planet, being the Andean area the origin of several crops of high importance for food security such as tarwi (*Lupinus mutabilis* Sweet.), Jícama or yacón (*Smallanthus sonchifolius* [Poepp. & Endl.] H. Robinson), and miso or mauka (*Mirabilis expansa* Ruiz & Pav. Standley.) which represent part of the food and production dynamics of farmers in the Andean region. In a recent study, the morphological and ecogeographic characterization of these three crops was carried out.

The results of the morphological characterization of the tarwi allowed to identify four morphological groups, regarding the yield (grams plant^{-1}), group one presented values of 127 g, group three 72 g, group four 78 g and in group two the yield was 203 g. Moreover, in group two the variability in terms of flower and seed colours was higher compared with the other groups. Regarding the ecogeographic characterization of tarwi, through the ecogeographic diversity map, 30 geographic sites with high ecogeographic diversity were identified, being the provinces of Chimborazo, Imbabura, Pichincha and Cotopaxi those that present optimal agroecological aptitude for production. The phenotypic diversity map determined that areas with high morphological diversity are not necessarily linked to high ecogeographic diversity, probably the genetic variability distribution of the species is linked more to cultural aspects than to environmental conditions.

Figure 1: Tarwi cultivation in Ecuador. a) native tarwi plant; b) tarwi in flowering and fruiting stage; c) tarwi seeds.

In the case of the jicama, it is necessary to carry out new collection missions in 10 provinces of the Sierra region, two provinces of the Costa region, and five provinces of the Amazon region. Considering these geographic areas as a priority in collection processes, will allow to improve the representativeness of the jicama collection, which is conserved in the National Germplasm Bank of the National Institute of Agricultural Research (INIAP) of Ecuador.

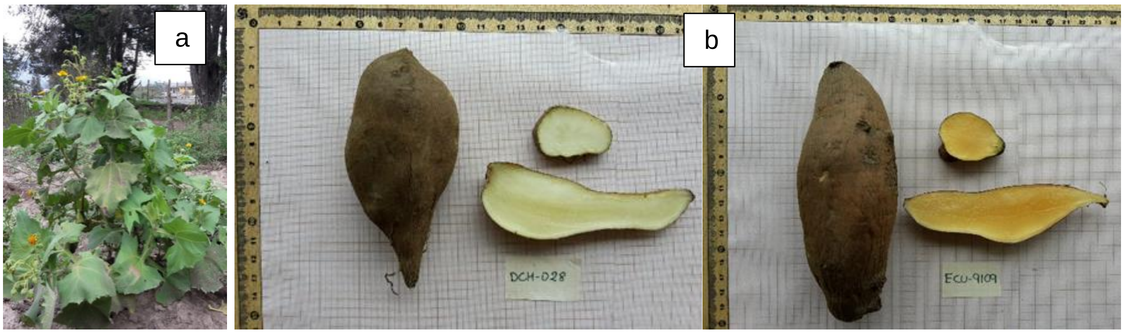

Figure 2: Jicama cultivation in Ecuador. a) plant in flowering stage; b) edible roots

Regarding the morphoagronomic characterization of miso, three morphological groups were identified, differentiated by the colour of the root epidermis and the pulp (white, yellow, light yellow and strong yellow), flower colour (magenta and white). Group two stood out due to its higher production compared to the other groups with a yield of approximately 1 kg plant^{-1}.

Regarding the ecogeographic characterization, six ecogeographic categories were identified that define possible adaptive scenarios, being the annual precipitation, edaphic and geophysical characteristics those that mark differences of adaptation sites of the species. However, this was not observed in the case of the temperature, which gives a guideline to promote the production and conservation of the crop in several provinces of the Ecuadorian Sierra and some foothills towards the Coast and Amazon region.

Figure 3: Miso cultivation in Ecuador: a) indigenous woman with a miso plant in a vegetative state; b) edible root.

Source: Doris Chalampuente Flores (Universidad Técnica del Norte, Ibarra, Ecuador), Antonio M. De Ron (Misión Biológica de Galicia, Spanish National Research Council, Spain), Tapias C (Universidad Técnica del Norte, Ibarra, Ecuador), María Rosa Mosquera-Losada (University of Santiago de Compostela, Spain).

3. Production of unicellular algae and biostimulation in lettuce

Microalgae are a viable option for reducing carbon dioxide levels, thus contributing to the mitigation of global warming. In a recent study, laminar photobioreactors were used for the production of microalgae, through which combustion gases generated by the industries circulate. In the first stage, a greenhouse was implemented, where 16 photobioreactor units were located, which allowed the protection of the photobioreactors from environmental factors, as well as temperature control. Taking into account that industries can have intermittent combustion gas generation, a storage system for these gases was designed that later allows distribution to a mixing chamber to reduce its concentration between 500 to 1500 ppm of CO_2.

To achieve maximum performance in microalgae production, textile materials of Ecuador were evaluated (synthetic felt, wool blend felt, 100% polyester polar fabric and tricot fabric) that allowed the adhesion of microalgae, being the polar fabric the one that presented a production of *Scenedesmus* sp significantly higher than the rest. The recirculation pump ignition system was established throughout the time, as a slight intermittence can decrease production.

Once the microalgae photobioreactor unit system was optimized, different doses of nutrients were evaluated in the recirculating medium, obtaining significant yields with doses of 100 mg N L^{-1}. On the other hand, different concentrations of CO_2 (500, 1000 and 1500 ppm of CO_2) were evaluated, and significant differences in the production of microalgae were not observed

The microalgae (*Scenedesmus* sp.) cultivated in the photobioreactor units were used to study their effect on the growth of lettuce plants (*Lactuca sativa*). The application of microalgae in the germination stage improved the growth of the seedling at a temperature of 20 °C. Moreover, concentrations of 6 x 107 ml^{-1} cells of *Scenedesmus* sp increased the length of the radicle in the germination phase. The microalgae were applied in germination trays and significant changes in the length of the seedlings were not observed. In a hydroponic culture, live *Scenedesmus* sp concentrations were added to the hydroponic lettuce nutrient solution, which increased production during the growing cycle.

Figure 4: On the left, laminar photobioreactors for the production of microalgae and on the right, lettuce plants cultivated with microalgae.

Source: Edmundo Recalde (Pontificia Universidad Católica del Ecuador Sede Ibarra, Ecuador), Luís Roca (University of Valencia, Spain), María Rosa Mosquera-Losada (University of Santiago de Compostela, Spain).

4. Microbian biodiversity and storage of carbon in soils with different land use in the Carchi province (Ecuador Republic)

Intensive agriculture makes excessive use of mechanization, fertilizers and pesticides which has generated the loss of biodiversity, degradation and contamination of soils, which leads to a decrease in soil quality depending on the management and use to which it is subjected. Therefore, modern agriculture faces the challenge of developing sustainable agroecological systems that is based on the replacement of the use of chemical synthesis inputs, by a better management of own resources. The present study characterized the physical and chemical properties, as well as the microbial biodiversity and the storage of carbon in soils with different uses of the province of Carchi (Republic of Ecuador). The results clearly show that the degree of anthropization, translated into the use of mechanization techniques, use of phytosanitary products and number of years of agricultural exploitation of the plots under study, is decisive in the decrease in carbon storage, the content in N, P, and in the increase of heavy metals, as well as in a negative impact on the composition and diversity of microbial communities. The greatest biodiversity was found in areas of intermediate anthropization, but the preservation of natural areas is essential to maintain the microbial biodiversity exclusively associated with these areas with no or low degree of anthropization.

Fuente: https://www.educacion.gob.es/teseo/mostrarSeleccion.do

Figure 5: Plots included in this study with high (a), medium (b) and low (c) anthropization levels.

Source: Diego León Manuel Tapia (Pontificia Universidad Católica del Ecuador Sede Ibarra, Ecuador), Luís Roca (University of Valencia, Spain), María Rosa Mosquera-Losada (University of Santiago de Compostela, Spain).

5. Soil health policy guidebook

Soil health provides critical ecosystem services related to water quality, drought resilience, erosion prevention, crop yields, and carbon sequestration. These benefits - and the practices used to achieve them - vary by region, so state programs in USA are uniquely positioned to support the local soil health work of farmers and ranchers.

Figure 6: Cover of the soil health policy guidebook.

The Soil Health Policy Guidebook: Developing Community-Driven State Soil Health Policy and Programs is a new resource providing practical advice for anyone interested in developing community-driven, state-level soil health policy and programs. Readers will learn how to build an effective and inclusive soil health coalition, logistics to help mobilize a coalition, steps to develop a soil health policy or program, and funding opportunities.

The approach presented within the guidebook is drawn from interviews with over 30 experts, including farmers, ranchers, academics, scientists, funders, state agency staff, and nonprofit organization staff, and highlights case examples throughout.

This guidebook was produced as part of The Yale Center for Business and the Environment's ongoing Regenerative Agriculture Initiative.

Read and Download the Guidebook here.

Source: Abbey Warner and Darya Watnick (Yale School of the Environment, New Haven, USA).

6. Special issues

6.1 Agroforestry systems in the changing climate

A special issue of the Agronomy journal will be accepting papers on agroforestry systems in the changing climate. The Guest Editor of this Special Issue is Dr. Emanuela Forestieri Gama-Rodrigues (Universidade Estadual Do Norte Fluminense Darcy Ribeiro UENF, RJ, Brazil).

This Special Issue aims to contribute to the scientific development of agroforestry systems in the context of global climate change, through a systemic and interdisciplinary view, under different environmental and socioeconomic scenarios. Contributions ranging from local studies to global perspectives on adaptation, mitigation and resilience to the impacts of climate change with a focus on food security; protection and enhancement of biodiversity, soil health; the potential for carbon sequestration; payment for ecosystem services; long-term sustainability of traditional agroforestry systems of indigenous peoples and local communities respecting their beliefs and culture.

Manuscripts should be submitted online at www.mdpi.com. The paper submission deadline is **31st October 2022**. More information here.

6.2. Agroforestry for Sustainable Rural Development

A special issue of the Sustainability journal is currently accepting papers on Agroforestry for Sustainable Rural Development. The Guest Editors of this Special Issue are Dr Andrea Pisanelli and Dr Marco Lauteri (National Research Council, Institute of Research on Terrestrial Ecosystems, Porano, Italy).

The main aim of this Special Issue is to evidence the socio-economic and biophysical impacts of agroforestry systems and practices under different perspectives, involving multi-disciplinary research and addressing a broad range of outputs, thus creating an opportunity to share evidence and to exchange knowledge and ideas

Manuscripts should be submitted online at www.mdpi.com. The paper submission deadline is **15th November 2022**. More information here.

Source: Emanuela Forestieri Gama-Rodrigues (Universidade Estadual Do Norte Fluminense Darcy Ribeiro UENF, RJ, Brazil) and Andrea Pisanelli (National Research Council, Institute of Research on Terrestrial Ecosystems, Porano, Italy).

7. Upcoming events

XXI International N Workshop

The XXI International N Workshop will be held in Madrid, Spain, during **24th – 28th October 2022**. The XXI International N Workshop will receive contributions dealing with different spatial scales (from the plot to global) and system scopes (crop, livestock, agroforestry, forestry, urban and agro-food systems). During the workshop, these communications will be allocated into five regular and three special sessions, together with eight interesting keynotes. More information here.

2nd Summit of the Organic and organo-mineral Fertilisers Industries in Europe (SOFIE)

The 2nd Summit of the Organic and organo-mineral Fertilisers Industries in Europe will be held in Brussels, Belgium, during **17th – 18th January 2023**. SOFIE provides a unique opportunity to meet companies, technology suppliers, regulatory experts and other actors in this fast-developing sector. More information here.

IX International Congress of Agroecology

The IX International Congress of Agroecology will be held in Seville, Spain, during **19th – 21st January 2023**. This congress seeks to generate a space for exchange and collective debate that serves to monitor the progress of the agroecological transition and, more specifically, of the Agroecology-Based Local Food Systems. More information here.

4th Agriculture and Climate Change Conference

The 4th Agriculture and Climate Change Conference will be held in Dresden, Germany, during **7th – 9th May 2023**. The Conference will focus on the likely impact of climate change on crop production and explore approaches to maintain and increase crop productivity into the future. More information here.

XXV International Grassland Congress

The XXV International Grassland Congress will ***be*** held in Kentucky, USA during **14th – 19th May 2023**. The theme of the conference is Grassland for Soil, Animal and Human Health. The conference features academic presentations that highlight research on grassland ecology, forage production and utilization, livestock production systems, grassland sustainability and ecosystems, and grassland policies and social issues. Another highlight of the event will be tours of grasslands throughout the Midwest, Southeast, Northeast, and Pacific Northwest regions of the United States. More information here.

22nd European Grassland Federation (EGF) Symposium

The 22nd EGF symposium will be held in Vilnius, Lithuania, during **11th – 14th June 2023**.The symposium will focus on the future role of ley-farming in cropping systems. More information here.

This is your newsletter! If there's anything you think should be included, please send suggestions to mrosa.mosquera.losada@usc.es for the next issue

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