Regenerative Agriculture rising in the Middle East and North Africa

By Michael Tanchum

Photo: Date farm among the rocky hills in the Oman

Regenerative agriculture is on the rise in the Middle East and North Africa (MENA), a region where 82 percent of the territory is comprised of desert. In contrast to Western countries where regenerative agriculture is primarily promoted as means of combatting climate change by reducing greenhouse gas emissions, MENA countries are embracing regenerative agriculture's focus on improving soil health as a means to counteract desertification and to increase crop yields. The imperatives driving MENA's advances in regenerative agriculture are more local and immediate – to achieve higher domestic agricultural output through regenerative agriculture to enhance food security and ensure political stability.

The central thrust of MENA regenerative agriculture is improved water-use efficiency. Among the 10 farming, ranching, and land use practices listed by Regeneration International as contributing to regenerative food systems, only biochar and no-till farming have risen to prominence – with the United Arab Emirates (UAE) pioneering the former while Morocco spearheading the latter. Both countries are global players in fertilizer and agri-food trade flows. The ability to receive international incentives for the development of these technologies on the basis of carbon reduction and the monetization of carbon credits has catalyzed business development creating new international joint ventures and market opportunities.

MENA Regenerative Agriculture Meets International Climate Change Concerns

A landmark report by the United Nations' Food and Agriculture Organization (FAO) conducted in collaboration with the European Commission's Joint Research Centre, finds "food systems account for over one-third of global greenhouse gas emissions," putting modern conventional agriculture in the crosshairs of the political debate on how to combat climate change. The report identifies modern agriculture methods and synthetic fertilizers as the main culprits, asserting that about 66 percent of food system emissions comes from agriculture, land use and changes in land use. Of this two-thirds of global food systems emissions, the FAO study claims that production processes – specifically identifying "inputs such as fertilizers" – are the leading contributor with 39 percent of the total, closely followed by land use with 38 percent of the total.

The World Economic Forum has assumed the mantle of advocate for regenerative agriculture, similarly claiming that "Agriculture today, including the use of heavy machinery, fertilizers and pesticides to maximize food production, is contributing to soil degradation and loss." After suggesting that modern conventional agriculture could result in catastrophic crop yield declines citing Regeneration International's claim that in 50 years the "world will literally no longer have enough arable topsoil to feed ourselves," the Forum goes on to state its view of conventional agriculture's culpability in climate change: "Intensive farming also churns up CO_2 naturally stored in soil and releases it into the atmosphere. This contributes to the global warming that is driving climate change." Citing a report from Project Drawdown, the Forum asserts the world's agriculture lands, 'restored' through regenerative agriculture, "could absorb the equivalent of between 2.6 and 13.6 gigatons of CO_2 a year."

While climate change is disproportionately affecting the soils in MENA countries through increasing temperatures, droughts, and desertification, the agricultural sectors in these countries contribute relatively little to greenhouse gas emissions and climate change. The FAO/European Commission study identifies China, Indonesia, the United States of America, Brazil, the European Union and India as the top emitters. The realities for MENA starkly differ.

Although the MENA region comprises about 15 percent of the Earth's land surface, only 6.8 percent of the MENA's land is suitable for farming. The situation is worsening at a rapid pace, as studies suggest that MENA has experienced an aggregate land degradation ranging from 40 to 70 percent. Home to about half a billion people, most countries across the MENA region need to increase domestic agricultural output to feed themselves. Thus, while MENA nations are willing to align themselves in international initiatives for regenerative agriculture that emphasize the reduction of green house gases, the main priorities are water-use efficiency and higher crop yields.

The UAE's Biochar Boom

Biochar is gaining traction in the MENA region as a regenerative agriculture practice to enhance soil structure and improve soil water retention and aggregation. While offering a solution for greater water-use efficiency, biochar's ability to sequester carbon is garnering increased international support from those seeking to reduce atmospheric carbon dioxide (CO_2). As with no-till farming, the ability to sell carbon credits for the use of biochar in so-called 'carbon farming' is helping to drive the business model for biochar's adoption.

Biochar production is a carbon-negative process, i.e. reducing the amount of CO_2 otherwise released into the air from the unstable carbon in decaying plant material. Instead, the material is converted into biocharcoal (or 'biochar') that is a stable form of carbon that can be stored within soils. Biochar is formed when biomass from agricultural or forestry waste is heated to 500 degrees C or above in the absence of oxygen in a controlled process known as pyrolysis to allow the biopolymers to thermally decompose. In addition to biochar, the process produces two types of gases: condensable gases which become bio-oil (also called bio-fuel) and some permanent gases (CO_2, CO, H_2, light hydrocarbons) known as syngas. The resulting bio-oil and syngas can be used to fuel the process, making it self-sustaining.

Aside from its outsized footprint in global agri-trade, the UAE is predisposed to biochar production because of its history as a major hub for oil, natural gas, and petrochemicals production has already prompted the Emirates to take a forward-leaning posture in developing the waste-to-energy biorefining of biomass into bio-oil. Indeed, biomass is the most abundant renewable carbon resource on the planet. The key materials of biomass are the structural parts of plants composed primarily of cellulose, hemicellulose and lignin found in crop residues, purpose grown energy crops (e.g. grasses), forest residues, animal wastes and food wastes – making the production of biochar possible for a variety of agribusinesses globally.

The UAE's biochar industry utilizes a variety of domestically produced feedstocks. The Emirati biochar boom is perhaps best reflected in the 2023 decision by Camelicious – the UAE's iconic camel milk and camel milk dairy products producer – to manufacture biochar from camel dung. Camelicous (The Emirates Factory for the Production of Camel Milk and Its Derivatives), which operates the world's largest and most advanced facility for camel milk production, entered in a strategic partnership with Viqa Investment, an Emirati holding company that manages a group of Emirati firms involved in viscous recycling, metal scrap, and waste recycling, to manufacture the biochar using the modular biochar production plants of German pyrolysis company Carbo-Force. Commenting on the larger significance of the partnership for the UAE's wider use of biochar , Viqa's Chairman & CEO Adem Viqa explained, "Our ultimate goal is to restore arid landscapes, transforming them into fertile, cultivable lands to enhance food security, promote agriculture, and more."

The UAE consistently ranks among the world's top three date exporting countries and consequently tree waste consisting of date palm branches, leaves, stem barks, and fronds represent a potential continual source of biochar. Emirati cultivation of palm trees results in about 20 kg of lignocellulosic waste per tree per year. Dubai's International Center for Biosaline Agriculture (ICBA) conducted some of the earliest studies on Emirati date palm-derived biochar and found that maize planted in sandy soil with the biochar experienced a 29 percent increase in biomass. Subsequent research conducted elsewhere has shown that Emirati date palm leaf biochar functions as an excellent carbon sink. Research has also shown that biochar made from the ghaf tree, the UAE's national tree found in the deserts of Arabia, is also highly efficient in CO_2 adsorption.

The UAE's biochar efforts extend beyond the realm of recycling and waste management. The UK-headquartered, UAE-focused climate tech start-up HyveGeo has entered in the Emirati biochar production ecosystem with an ambitious agenda to transform the UAE's desert areas into farmland capable of producing cereal grains through the use of biochar produced from microalgae. The company began microalgae cultivation as a carbon sequestration business, looking to sell carbon credits. The company claims that its microalgae turns every 1.8 tons of CO_2 into 1 ton of biomass. The HyveGeo cultivates the microalgae and produces the biochar at its pilot facility in Ras Al Khaimah. Currently conducting pot trials on tomatoes and arugula, the company plans to conduct field trials for its biochar formula. The company's long-term ambition is to have 10,000 hectares under microalgae cultivation for the industrial-scale production of biochar.

HyveGeo anticipates selling its formula for $10,000 per hectare which will need to be applied every five years, representing a considerable cost advantage over the current liquid natural clay (LNC) technology developed by the Norwegian firm Desert Control, which can require a yearly application of up to $20,000 per hectare. According to the company, third-party validation confirms that Desert Control's LNC can reduce water consumption up to 50 percent and increase crops yields up to 62 percent. Desert Control began laboratory and field tests in partnership with ICBA in 2018. Overcoming the challenges of operating during the COVID pandemic, ICBA's trials of LNC on watermelon, zucchini, and pearl millet showed positive results. In 2023, Desert Control formed joint venture with the UAE's Marawid Holding (51 percent) called Marawid Desert Control as a fully integrated business for the production, sales, and distribution of LNC in the UAE. The company is also active in Saudi Arabia, as well as Yuma, Arizona.

While the selling of carbon credits has incentivized the development of biochar as a tool of carbon farming, it also helping the biochar industry to expand beyond agriculture into low-carbon construction in the UAE and the other Arab Gulf State members of the Gulf Cooperation Council (GCC). In 2024, the Emirati firm Green Valley Biochar, a leading regional biochar producer, signed a memorandum of understanding (MoU) with German concrete producer Bton to develop a strategic partnership for the supply of biochar the company's expansion into GCC construction markets. Green Valley Biochar makes biochar from locally sourced organic waste including coffee grounds fine-grained charcoal. Bton will use Green Valley-supplied biochar to produce its "climate positive concrete" that will permanently incorporate CO_2 into the concrete and, in the company's words, "help to build a regenerative environment." With its biochar enabling buildings constructed with Bton's concrete to function as a carbon sinks across the GCC region, the MoU envisions Green Valley Biochar operating several new biochar plants to supply sufficient inputs for Bton's climate positive concrete.

Morocco's No-Till Revolution

While certain initiatives to reclaim Morocco's desert areas into farmland – most notably the Sand-to-Green program – use a variety of practices, including biochar, Morocco's major thrust in regenerative agriculture has been the wide diffusion of no-till farming. The effort to develop no-till farming across the country is being led by the Ministry of Agriculture that aims at achieving 1 million hectares of no-till by 2030 and supported by Al Moutmir, Morocco's outstanding organization for extension services to farmers. Based at the Mohammed VI Polytechnic University (UM6P), Al Moutmir's agronomists work collaboratively in the field with farmers in Morocco's rural communities to provide them assistance in appropriately adopting innovative technologies and best practices to transition to sustainable agriculture.

Al Moutmir's no-till farming offer is an agricultural production system of sowing without prior tillage to preserve the soil's microbial life and conserve its water stocks. In the process, the no-till system significantly reduces the levels of CO_2 otherwise released during conventional tillage. The water conservation benefits of no till farming have been scientifically identified for decades. An FAO analysis of no-till farming of maize in Argentina, for example, found a 37 percent increase in the water-use efficiency under no till compared to conventional tillage.

Operatina across 23 of Morocco's provinces, Al Moutmir's no-till program has benefitted over 4,000 farmers and put over more than 32,710 hectares – mostly cereas and pulses – under no-till cultivation. The effort has benefited from Al Moutmir's 1,000 demonstration platforms tracked by all interested parties using digital applications. The platforms revealed an average crop yield increase of 30 percent for no till over conventional till – and at lower cost.

Building on Al Moutmir's success, Morocco's aspiring global sustainable solutions provider InnovX launched a carbon farming company called Tourba (Arabic for soil) that helps farmers and ranchers to adopt conservation agricultural practices like no-till, rational fertilization, and improved grazing management through the monetization of carbon credits. Under this 'carbon farming' framework and working in collaboration with Al Moutmir, the UM6P-headquartered Tourba has transformed farming practices across 25,000 hectares of Moroccan farmland. Operating in Brazil, Nigeria, and Ethiopia as well as Morocco, Tourba aims to transform 6 million hectares of farmland and degraded grassland across Africa and South America through its carbon farming approach by 2030.

Conclusion

The drive to combat desertification, expand available farmland, and increase water-use efficiency – all geared toward higher agricultural output and improved domestic food security – will make regenerative agriculture a permanent feature in Morocco, the UAE, and the rest of the MENA region. The ability to monetize carbon credits for the use of practices, technologies, and products that result in carbon sequestration means that the MENA region will experiment with a variety of approaches until each country discovers the optimal set of approaches to meet its goal. Now is the time for first mover advantage to secure market share. Although biochar presently does not feature in the activities of Al Moutmir and Tourba, the launching of large-scale biochar operations in Morocco by InnovX or another firm in the near future seems almost certain. Similarly, the UAE's agribusiness giant Al Dahra is aiming to put most of its farmlands under no-till by 2030.

While the UAE and Morocco have been the regional leaders in regenerative agriculture, Saudi Arabia has been making important efforts to follow suit. Egypt and, to a lesser extent, Tunisia, are also developing regenerative agriculture initiatives. Successful technologies developed in one country are likely to be marketed to the MENA region as whole. While the arid regions of sub-Saharan Africa are also logical markets, increasing desertification globally due to climate change means that regenerative agriculture technologies developed and deployed in the MENA region could find markets in countries as diverse as Spain, Kazakhstan, and Australia.

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