REGENERATIVE AGRICULTURE IN SENEGAL

Location: Central Senegal's Groundnut Basin

Rodale Institute Regenerative Agriculture Research Center teamed up with farmers' groups and government researchers in Senegal to promote regenerative agriculture to increase food sufficiency, lessen farmers' dependence on external inputs, and improve soil quality.

CHALLENGE

Similar to other countries in the Sahel region, Senegal's indigenous food production is hampered by lack of moisture and sandy soils low in organic matter. Soil erosion and degradation threaten large areas of farm land. In central Senegal's groundnut basin, the low-lying area between the Ferlo and Gambia rivers, the soil's capacity to retain nutrients and moisture has been severely reduced after years of inappropriate agricultural practices, including tillage techniques, monocropping, and chemical input misuse. The few soil nutrients that do exist are often not available to plants due to high soil acidity or diverted by competing weeds. As a result, farm productivity has been steadily declining over much of the region.[1]

RESPONSE

Beginning in 1987, the Rodale Institute Regenerative Agriculture Research Center (RARC) teamed up with farmers groups and government researchers in the country's groundnut basin in an initiative to increase food sufficiency, lessen farmers' dependence on purchased inputs for food production, and improve soil quality. Through networking, education, training, and applied research activities, the initiative promotes regenerative agriculture—organic non-chemical technologies, including cover crops,[2] composting, fattening cattle for improved manure production and household income, intercropping, agro forestry, integrating leguminous plants in cropping systems, and crop rotations to replenish soil carbon matter.[3]

The leguminous plant *Dolichos biflorus* was used in three experimental plots as green manure for onions and tomatoes.[4] For soil conservation, RARC worked with the residents of Tatene Toucouleur and Tatene Serer who built stone barriers along contour lines and created a living barrier by planting leguminous trees and grasses in the abandoned and unproductive fields located between their villages. This allowed soil and plant matter to accumulate and prevented soil and organic debris from being carried away by water runoff, thus allowing the soil structure to rebuild.

As part of the animal-fattening program targeting cattle, goats, sheep, and horses, feed gardens were established in Tatene Toucouleur.[5] Consisting of alternating rows of grasses (*Panicum* and *Andropogon*) and leguminous trees (*Gliricidia* and *Leucaena*), these feed gardens in family compounds provided a food source for animals and also used the household wastewater while enriching the soil with leaf litter.

RARC also promoted multi-integration crops as a risk management strategy for smallholder farmers. Intercropping staple crops such as corn, peanuts, and millet with secondary niche crops like sesame, bisaab (*Hibiscus sabdariffa*, known as roselle in English), and kenaf (*Hibiscus cannabinus*) helps stabilize the farming system against environmental shocks and flux. An intercrop can also act as a physical barrier, slowing the spread of host-specific diseases and pests.[6] Additionally, it helps guarantee food security for farmers' households throughout the year by intercropping species that mature at different times. For example, when used as a border crop to delineate the boundaries between fields, bisaab's sticky petals—rich in vitamins and antibiotic properties and widely used in sauces and beverages—attract beneficial insects that control pests. The post-harvest value-added processing of petals is also an important source of revenue for farmers, especially women.[7]

The Senegalese Institute of Agricultural Research and RARC collaborated with women on vegetable garden trials in the villages of Sinthiane, Tatene Toucouleur, and M'bomboye. The trials focused on the use of soil amendments, composting, out-of-season production, and using plant extracts for pest control. Extracts of neem, tomato stems, and chili peppers applied to okra and cauliflower showed a positive effect in controlling caterpillars.

RESULTS

RARC's regenerative agriculture strategy helped shift the emphasis from a short-term, production-oriented strategy to a long-term, rehabilitative strategy, with farmers prioritizing investing in soil resources and subsequently receiving the long-term benefit of increased crop yields and sustained production. More specifically, the following benefits were noted:

- With farmers keen to find an alternative to chemical fertilizers, organic soil amendments made from locally available materials received great attention. Thousands of farmers have trained with the Rodale team on regenerative technologies to improve soil quality, integrate livestock into crop systems, improve/expand manure quality and composting, and incorporate water-harvesting systems.
- Farmers are fattening cattle, goats, sheep and horses to increase manure availability and household income. A 1995 assessment showed that one successful technique involves feeding stabled cattle a mix of water and 500 grams of millet twice a day—morning and night—resulting in an average daily gain

A women's group who worked with the Rodale Institute, Diouffene, 2003. © Nathan McClintock

Cover crops protect soil from sunlight, wind, and heavy rainfall, improving soil structure, water infiltration, and root penetration. Cover crops also improve soil fertility through increased nutrient retention, while leguminous cover crops add nitrogen from the atmosphere.

"I helped to explain the principles of regenerative agriculture and discussed them on the first day of the workshop. At the end of one session, a farmer raised his hand and said, 'I will never use chemicals in this life again.'"

–Amadou Makhtar Diop, veteran leader of community-based regenerative agriculture in Senegal

of 935 grams. In Baback, the feed mix—wild plant leaves, peanut hulls, and dried cowpea residues—resulted in an average daily gain of 840 grams. Farmers who sold livestock were then able to contribute to a community fund and purchase new livestock. In Ndiamsil, for example, five out of six farmers who fattened livestock sold them, and four of six reimbursed the community fund and bought a second round of cattle to fatten.

- Results from Rodale's on-farm composting trials at N'Gombel and Mboufta show impressive gains. Millet grain yields in plots fertilized with compost were 4.5 times greater (1270 kg/hectare) than unfertilized controls (230 kg/hectare). While the increases in peanuts were less pronounced but still favorable: by 1990, three years after the beginning of the project, plots fertilized with compost yielded 230 kg/hectare more peanuts than plots fertilized with manure, and 1 t/hectare more stover, or ngooñ, a valuable fodder for livestock.[8] At Mboufta, a two-ton application of compost every two years yielded 3.5 times the millet than control.[9] Yields are also more consistent from year to year, thus improving household food security.[10]
- By 1993, in the fields between Tatene Toucouleur and Tatene Serer, the soil level is visibly higher than before, allowing residents to grow crops and graze their animals in post-harvest fields.[11]
- Farmers have reported that the re-popularization of millet-cowpea intercropping has helped reduce the time needed to cultivate their crops. Indeed, because the crops are located in the same field, there is better use of limited land resources and increased weed suppression.[12]
- A three year applied study on a community forage feed bank harvest in Samba Dia suggests that planting—rather than direct seeding—legume tree species results in gains of at least three times greater biomass production.[13]
- Previously underemphasized crops, like sesame and roselle, have attracted outside attention, increasing revenue for farmers. With help from projects like GADEC and ASNAPP (Agribusiness for Sustainable Natural African Plant Products), farmers are seeing profits through exports of organically produced traditional herbs. This helps farmers shift from commodity cash crops such as cotton to traditional species that require low inputs and can be sold into a high-value marketing niche.[14]
- From 2000 to 2004, a project of the Rodale Institute addressed declining soil fertility and food security problems in five peri-urban villages of the Thiès region. By 2002, this resulted in training of 141 people, among which were 118 women. The project helped reach higher yields with regenerative techniques, and also permitted the creation of rotating loans systems to allow villagers, including many women, to buy seeds, goats and sheep.[15]

Compost pits in Ndiamsil, 2003, built by Rodale in the 1990s.
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"Stabling one head of cattle for four months provides sufficient manure for one hectare of cropland."

– Moussa Diagne, a farmer from Ndiamsil

Compost production in Keur Banda, 2003. © Nathan McClintock

· By 2006, the Rodale Institute had trained over 10,000 farmers, technicians and extension agents since the beginning of its work in the Peanut Basin in 1987.[16] Cattle fattening, agroforestry and composting activities have continued over the years, with local partners such as the Association Communautaire pour le Développement de Koumpentoum (ACDK).[17]

FOR MORE INFORMATION

www.oaklandinstitute.org
www.afsafrica.org

Compost production in Keur Banda, 2003. © Nathan McClintock

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ENDNOTES

1 Badiane, Coura. "Senegal's Trade in Groundnuts: Economic, Social, and Environmental Implications." *TED Case Studies*, no. 646 (2001).

2 Newman, Y.C *et al*. "Benefits of Cover Crops for Soil Health." SS AGR 272, Agronomy Department of the University of Florida, IFAS, 2011. http://edis.ifas.ufl.edu/ag277 (accessed September 27, 2014).

3 LaSalle, Timothy and Paul Hepperly. *Regenerative 21st Century Farming: A Solution to Global Warming*. Rodale Institute, 2008. https://grist.files.wordpress.com/2009/06/rodale_research_paper-07_30_08.pdf (accessed September 27, 2014).

4 Rodale Institute. *Rodale's Senegal RARC*. http://www.fadr.msu.ru/rodale/gp/senover.html (accessed September 27, 2014).

5 Hay making, also undertaken in Tatene Toucouleur, provides an additional feed source for cattle.

6 Richards, Paul. "Ecological Change and Politics of African Land Use." *African Studies Review* 26.2 (1983) 1-72.

7 McClintock, Nathan. "New Interest in Old Crops, Tambacounda and Thies regions." *Rodale Institute*, April 13, 2006. http://newfarm.rodaleinstitute.org/international/senegal/0406/index.shtml (accessed September 27, 2014).

8 McClintock, Nathan. "From Dunghills to Compost Pits and Back Again – Only Better." *Rodale Institute*, September 1, 2005. http://newfarm.rodaleinstitute.org/international/senegal/0905/intro3.shtml (accessed September 27, 2014).

9 *Ibid.*

10 Carsky, Robert. *Land and soil quality improvements*. FAO Corporate Document Repository, (undated). http://www.fao.org/docrep/006/y3951e/y3951e05.htm (accessed September 27, 2014).

11 Westley, Karen. "International Information Exchange Network (IIEN)." African Studies Center, University of Pennsylvania, 1993. http://web.archive.org/web/20120513191043/http://www.africa.upenn.edu/Org_Institutes/Rodale_Institute_14582.html (accessed September 27, 2014).

12 *Ibid.*

13 *Ibid.*

14 McClintock, Nathan. "New Interest in Old Crops, Tambacounda and Thies regions." *Op. Cit.*

15 McClintock, Nathan. "A rich slice of sustainability in Senegal." *Rodale Institute*, June 16, 2005. http://www.newfarm.org/international/senegal/060505/index.shtml (accessed November 4, 2014).

16 *Ibid.*

17 *Ibid.;* McClintock, Nathan. "Livestock fattening, Thiawène, Diourbel." *Rodale Institute*, May 11, 2006. http://www.newfarm.org/international/senegal/0506/index.shtml (accessed November 4, 2014); McClintock, Nathan. "From Dunghills to Compost Pits and Back Again – Only Better." *Op. Cit.*

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Embouche program in Thiawene, 2004. © Nathan McClintock