

Optimized Shrub-intercropping System (OSS): Bio-Irrigation for Climate Adaptation in the West African Sahel

LOCATION:

Senegal, West Africa

DATES: November 2018 – June 2023

FUNDING:

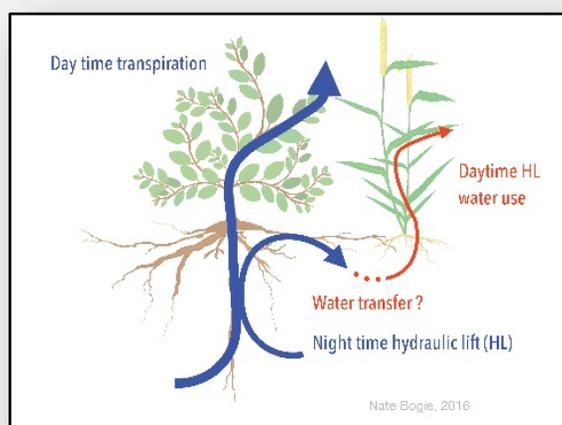
- U. of Georgia, Peanut Innovation Lab: \$349,937
- Michigan State U., Legume Innovation Lab: \$114,651

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Optimized Shrub-intercropping (OSS):

The OSS is an innovative management system that has been developed and validated in over 20 years of research by a team of Senegalese, French, and U.S. scientists, led by Ohio State's Richard Dick of the School of Environment and Natural Resources. The system is based on two readily available native shrubs that co-exist with crops throughout the Sahel, *Guiera senegalensis* and *Piliostigma reticulatum*. However their densities are low, and although farmers recognize the value of shrubs, they typically coppice them in the spring to clear fields and unfortunately burn the residue, depriving the nutrient-poor Sahelian soils of desperately needed organic inputs. Our research, funded by the National Science Foundation and USAID, has shown that increasing the shrub density from current levels <200-35 shrub/ha to ~1500 shrubs/ha combined with annual incorporation of coppiced shrub biomass results in: improved soil quality, carbon (C) sequestration, reduced days to harvest by up to 15 days, increased nutrient and water availability, and significantly increased yields – up to three-fold (27+ peer reviewed articles). A truly remarkable finding is that the shrubs “bio-irrigate” crops via hydraulic lift at night, which combined with improved soil quality, significantly reduces crop water stress during in-season drought. Hydraulic lift occurs when shrubs move water from the wet deep sub-soil up through their root systems and deposit it in the dry upper soil layers at night when the stomata close and photosynthesis stops allowing neighboring crops to uptake the water through their shallow root systems – bio-irrigation.



Project Activities:

Although OSS has shown profound results on long-term research plots, these projects are the first time the OSS is being piloted under farmer-managed conditions. Thirty farming households in Senegal have established twoside-by-side comparison plots, one with OSS and one with the traditional management system of removing and burning the shrubs.



Participant farmer planting shrubs in her plots.

- 1) We will pilot test OSS - increased shrub density from about 300 to 1,500 and annual incorporation of shrub residue - with 30 farm households growing peanut in rotation with millet and double cropping cowpea.
- 2) Socio-economic, women's empowerment, and agronomic monitoring of the households will take place
- 3) Component research will be conducted to screen peanut and cowpea varieties best adapted for OSS.
- 4) Nutritional analyses will be conducted on cowpea crops to determine if crops grown under OSS have higher nutrients than those grown in the traditional system.
- 5) OSS field days and outreach and awareness campaigns will be conducted.
- 5) One PhD and seven MS students will be trained as change agents on the forefront of OSS scaling.

Expected Project Outcomes:

Improved food and nutrition security, agroecosystem sustainability and resilience for participant households; OSS barriers to adoption identified; fine-tuned OSS management recommendations for future scaling; OSS Symposium; and peer reviewed published journal articles