

March, 2018



Water Smart Agriculture (WaSA)- Brief

Addressing needs and opportunities for small holder farming

Key Messages

1. Optimization of rainfall and stored soil water underpins WaSA contribution to the broader goals of Climate Smart Agriculture (CSA). Soils provide for a huge water storage reservoir - a fact that is generally underappreciated.
2. Minimizing water evaporation from soil and other non-plant surfaces is essential for improving WaSA efficiency (more crop per drop).
3. Conservation agriculture and other WaSA practices minimize soil disturbance, surface runoff, erosion and water pollution, and promotes use of cover crops and residues, as well as crop rotations.
4. Farm-scale adaption of WaSA requires policy enabling environments and coordinated decision-making. We highlight the need for convergence of practices through creation of a shared vision of the development pathway by key stakeholders: public, private, as well as civil society partners.
5. WaSA practices are context dependent. There is no single “silver bullet” innovation, nor a fixed recipe that applies everywhere. This demands that decision makers, primarily farm families, need to understand their choices in water use, soil and crop management, and appreciate their implications.
6. Crop and soil management practices that increase soil organic matter (SOM) generally improve water use efficiency. SOM improves soil stability thereby reducing erosion, increasing water infiltration. SOM also increases soil porosity, while increasing soil water storage and deep soil recharge.
7. Water smart agriculture demands that water quality —safe water— be a priority for producers and consumers.

What is Water Smart Agriculture?

Water Smart Agriculture (WaSA) is the convergence of diverse best water-use practices in concert with enhanced soil, crop and ecosystem management for resilient, sustainable, and efficient agriculture, toward the betterment of family farmers' livelihoods.

In this definition, 'resilience' includes both economic resilience and production resilience from shocks, including those that are climate-related, such as by droughts and floods.

The concept of WaSA was developed to assist (small holder) farmers to both identify and apply 'best fit' water management practices that improve water accessibility, availability and use, specific to their socioeconomic, technical, and agro-ecological environments, while acknowledging the central role of soils in supporting crops, livestock and our general livelihood.

Overview of WaSA

Given that approximately 70% of water abstracted globally is used for agriculture and that water is increasingly more scarce due to diverse demands by other sectors, it is imperative water be used more thoughtfully. Therefore, whether rain-fed or irrigated, optimization of rainfall and stored water for sustainable, resilient, agricultural production underpins WaSA.

WaSA practices target the optimization of both green water and blue water resources, primarily through reducing water evaporation from the soil. Green water includes rainfall that enters the soil either to be intercepted by vegetation and evapo-transpired back into the atmosphere, or often evaporated. Blue water is the rainfall that enters lakes, rivers and groundwater (see Figure 1).

Green water enters the soil from precipitation, and directly provides water for plant uptake and for biological processes of 'healthy' soils. Green water supplies enables rainfed agriculture, which provides about 60% of all agricultural output on 80% of global agricultural lands. Precipitation also feeds Blue water sources which are used for irrigation and for public and industrial water uses. Societal tensions for access to Blue water are increasing, on a global scale. Use of Blue water resources by smallholders through small ponds and shallow tube wells provides opportunities for sustainable intensification of production. Improved agronomic and water management practices increase water use efficiencies for both Green and Blue waters —'more crop per drop'.

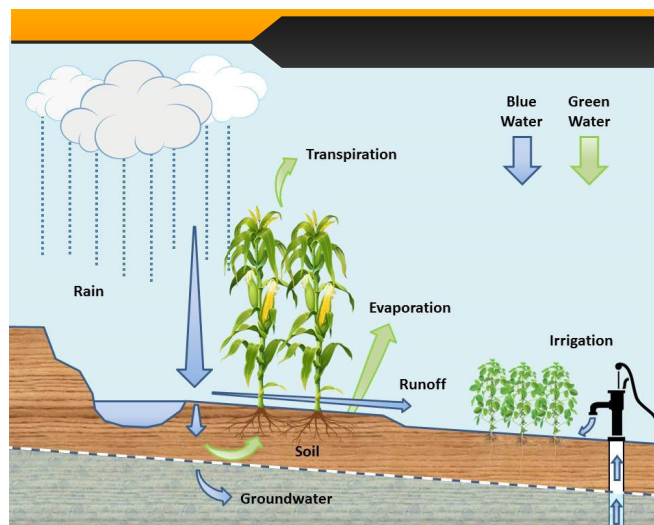
How is WaSA different from Climate Smart Agriculture?

According to the FAO definition, Climate Smart Agriculture (CSA) is defined as "agriculture that sustainably increases productivity, enhances resilience through adaptation, reduces greenhouse gas emissions (mitigation) where possible, and enhance achievement of national food security and development goals". WaSA theory and practice complements CSA goals, addressing the specific challenges surrounding water availability, access, and use, for both rain-fed and irrigated systems. Therefore, WaSA and CSA are regarded as companion concepts with similar objectives, with WaSA being focused primarily on soil and water management.

Benefits of WaSA include:

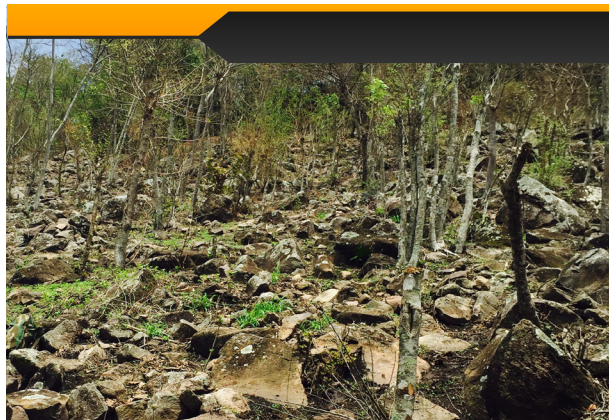
- Focus on 'water issues' first helps ensure that investments in other inputs are more secure
- Enhanced resilience and reduced risks, thus improving productivity, food security, income, and overall ecosystem health.

Figure 1.
The sources of Green and Blue water. Adapted from
Rockstrom and Falkenmark 2015



What Can Farmers Do?

Soil Smart:



Eroded hillside in Nicaragua. Photo credit: Eric Kueneman, 2015.

- Reduce tillage and keep soils covered to reduce runoff and erosion, and improve soil infiltration
- Monitor soil organic matter (SOM) and choose practices that sustain and increase SOM, such as by mulching, incorporating plant residues and manures into the soil, use of cover crops, perennial grasses and legumes
- Ensure that other soil related factors are not limiting (e.g., soil fertility, soil pH, soil structure, plant nutrients availability)
- Correct compaction when and where it occurs. For example, deep rooted crops such as pigeon pea and alfalfa can penetrate compacted layers.
- Use terraces, soil contour bunds, and perennial crops on sloping lands.

Crop Smart:

- Select and rotate crops appropriate for water availability and sustainable economic viability
- Control weeds, diseases, and insect pests through best practices; for example, crop rotations can lessen many pest and disease problems.
- Implement judicious and safe fertilizer-use practices - using the right product, at the right rates, times and places. Improved fertilizer-use efficiency practices reduce fertilizer losses by leaching, runoff and greenhouse gas emissions, and increase productivity.
- Add cover crops in the rotation when practical to increase SOM, soil nitrogen, and reduce pests.

Irrigation Smart:

- Avoid soil evaporation, including as a way to prevent residual salts accumulating on surface soils;
- Consider energy efficient, low-cost technologies such as low-pressure drip systems, axial flow pumps and lay-flat plastic pipe
- Invest in small dams and ponds, including for community use
- For small-holders, consider efficient drip irrigation systems, especially for high-value horticultural crops
- Consider land leveling that can greatly improve water use efficiency
- Avoid using water contaminated with human pathogens, especially for vegetables.



*Solar pump from tube wells for horticulture.
Source: iDE Water Smart Tech.*

Challenges to WaSA Adoption

- Highly weathered, low SOM tropical soils have low water and nutrient holding capacities. Therefore, WaSA practices in the tropics must consider elevating SOM. These processes take time and can be easily reversed if not done consistently. Minimizing tillage, maintaining soil coverage through cover crops, crop residues and mulching practices increase SOM and are pillars of conservation agriculture approaches.
- Many of the important water, crop and soil management WaSA practices are knowledge intensive, yet smallholders have limited access to innovative options. Wide-scale adoption by millions of smallholder farm families requires

investment in training and extension towards their water-secure livelihood, including through field demonstrations and farmer field schools.

- Partnerships among the public extension, NGOs and the private sector can be very powerful in exposing and enabling farm families to adopt innovations, but both coordination and shared visions are prerequisites. Development change-adoption generally requires a convergence of diverse partners working in the same place at the same time. Scaling-up WaSA practices requires partnerships.
- It has been documented that low yields in semi-arid tropical agricultural systems can be explained by both on-farm blue and green water losses, caused by surface water runoff and nonproductive soil evaporation. It suggests that water limitations for such small-holders farming systems can be largely reduced and crop yields significantly raised, by improved soil and agronomic practices that increase soil plant cover and reduce soil erosion.
- Often specialized equipment such as: no-till planters, tube wells, solar-powered pumps, axial-flow shallow lifting pumps, flat-lay hose pipe, and drip systems are relatively expensive and unavailable, and training for use and maintenance is absent. However, train-the-trainers' workshops and empowering farmers to become trained 'service providers' are ways to share information that effect adoption. It also requires a shared vision, stakeholder cooperation, and effective use of resources.
- WaSA approaches are widely available and have been proven effective. Yet, continued research and extension is needed to optimize scaling-up and adoption of proven knowledge intensive innovations for small-holders across a wide range of agricultural systems, climates and geographies. Much advocacy is still needed to harness public and private funding for this purpose.

Water-Wise Women

Historically, women farmers have been excluded from many agriculture support and water management projects. Women in many low-resource settings are tasked with collecting water for household purposes, animal husbandry chores, and the cultivation of horticultural crops, making them intimately aware of households' intersecting demands for water. WaSA provides an excellent opportunity to build on women's knowledge and existing water-related responsibilities and in so doing, address gender inequality. For example, irrigation activities that prioritize women have proven successful. More attention is warranted in order to effectively engage women in training and extension activities.



Permanent mulched beds with drip irrigation for horticulture conservation agriculture in Cambodia Photo: Manuel Reyes, Hort. Innovation Laboratory.

Take home messaging

Unequivocally, adoption of good soil and water use practices are key food and environmental security solutions. WaSA is a water-centric approach to a holistic methodology that sustainably optimizes agricultural production systems, embracing efficient and effective crop, soil, water, pest, and livestock management practices.

There are numerous policy barriers that impinge on wide adoption of many WaSA innovations. The diverse policy and strategy barriers to adoption generally have local specificity. Governments at all levels, and their partners, jointly need to characterize innovation and policy domains for effective scaling up adoption of WaSA.

Most components of WaSA are knowledge intensive, and therefore will typically not be adopted through field demonstrations only. Therefore, agricultural extension approaches need to be adjusted to this reality to adequately enable farmer learning and discovery. Much more investment in training and extension programs is crucial to reach targeted smallholder farmers, as their need is often underappreciated and underfunded.

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Further Reading

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