POLICY BRIEF

SOIL WATER MANAGEMENT FOR SUSTAINABLE AGRICULTURAL PRODUCTION IN A DRIER CARIBBEAN

Exposure to a high degree of climate risk is a characteristic feature of rain fed agriculture in the Caribbean; as such, soil water (green water) management[1] has a vital role to play in improving global food security and building resilience for adaptation to climate change in the agriculture sector.

Currently, the Region is spending more than USD$ 3.5 billion annually to import our food! This is unsustainable and must be reversed sooner than later, in keeping with the Liliendaal Declaration on Agriculture and Food Security which commits CARICOM Governments to "*pursue a strategic approach to transforming the agriculture sector into an internationally competitive sector with increased capacity to contribute to the sustained economic development of the Region, the economic livelihood of entrepreneurs, the rural sector and to food and nutrition security*."

Framing the Issue

Climate change will increase rainfall variability and average temperatures, affecting both the supply and demand side of the irrigation equation. Most projections for the Caribbean can be summarised in the quote below:

> *The Caribbean is expected to become significantly drier under climate change, up to 30% drier in the annual mean. Drying will be most significant between May and November, when the region is normally at its wettest. This will likely significantly reduce available water by reducing both surface flows and water available for groundwater recharge. For those countries which are already facing issues of water insecurity, this is likely to increase the severity of their water resource problems. For those which currently have sufficient water resources, the decline in rainfall may introduce new water resources issues to be contended with (Taylor, et al, 2011, pp.32, 42).*

In a Region where rainfall is KING- as water is the limiting factor for plant growth- this could have grievous implications for crop production, given the fact that over 50% of agricultural operations rely solely on rainfall.

[1] Because climate change will influence temperature and rainfall patterns, there will be direct impacts on soil moisture.

The potential bio-physical risks[2] posed by climate change (especially evapo-transpiration) to soil moisture[3] are identified as:

- Reduced infiltration resulting from modified rainfall intensities;
- Longer dry periods resulting from altered temporal distribution of rainfall;
- Depleted soil moisture arising from higher evaporative demand;
- Soil erosion resulting from modified rainfall intensities and duration; and
- Reduced soil quality (including water holding capacity and nutrient status) resulting from modified rainfall and temperature.

Consequences of a Drier Caribbean

Climate change and climate variability will result in agricultural droughts and associated soil water deficiency which in turn, can lead to crop failure and high livestock mortality rates, and ultimately threaten food security in the Region.

Many Caribbean countries have experienced significant water shortages and agricultural losses due to 2009-2010 drought (Farrell, Trotman and Cox, 2010) Several farmers were faced with extremely high temperatures that gave rise to an increase in evapo-transpiration rates, lower effective application of water, smaller size crops and lower yields generally.

The ripple effect was a serious threat to citizens' livelihoods and the countries' socio-economic development. For example, the Guyana Government had to spend US$ 1.3 million on relief (including planting materials, fertilizers for cash crop and portable water tanks to service communities in desperate need) to bring relief to farmers of Region 2 in February, 2010. In addition, US$ 16,000 to secure water for farmers in Region 5 that is a predominantly agricultural area. Other Caribbean states were impacted by the drought: Dominica's banana production lessened by 43% from the previous year, thereby reducing the country's foreign exchange earnings, while in St. Vincent and the Grenadines, agricultural production was 20% lower than average (Farrell et al, 2010).

[2] International Water Management Institute. 2009. Flexible Water Storage Options and Adaptation to Climate Change. Colombo, Sri Lanka: International Water Management Institute (IWMI). 5p. (IWMI Water Policy Brief 31).

[3] The soil moisture regime, determined by changes in soil water content with time, is the main single factor conditioning moisture availability, plant growth and crop production. It is mainly conditioned by soil properties affecting the capacity and possibilities of infiltration, retention and drainage of rainwater, and the limitations to root growth under the particular rainfall characteristics.
http://www.tucson.ars.ag.gov/isco/isco15/pdf/Pla%20Sentis%20I_Water%20management%20under%20changing.pdf

Time to Act

Unarguably, investments in preparedness and drought mitigation are more cost effective than post-impact assistance or relief programmes: the traditional crisis management approach. Moreover, climate change is one factor that will influence good management practices that will fashion innovative on-farm water management.

Gravity Drip System in Jamaica

The Caribbean Agricultural Research and Development Institute (CARDI) has already embarked on research into the development of crop varieties capable of producing under various adverse conditions due to climate change such as droughts, floods and saline conditions, in addition to soil related studies that aim to improve soil organic matter and carbon sequestration as a means of mitigate climate risks. In addition, CARDI, in partnership with the Caribbean Institute of Meteorology and Hydrology (CIMH), the World Meteorological Organization (WMO) and National Meteorological and Hydrological Services (NMHSs) of Caribbean Member States, is working to improve agricultural productivity in the Caribbean through improved dissemination and application of weather and climate information. The latter has been made possible through a Caribbean Agro-Meteorology Initiative (CAMI) project.

Nonetheless, the magnitude of project impacts as a result of a drier Caribbean climate necessitates actions at the national level. To this end, several techniques can be applied to increase the water available for crop production in the Caribbean. These must be integrated into the National Agriculture Climate Change Mitigation and Adaptation Strategy and include:

- Explore investment in the production of mulch (plastic and organic) and compost by converting urban and industrial wastes into useful farm products;

- Increase irrigation efficiency to get **"more crop per drop"**, using micro-irrigation, especially sub-surface drip irrigation, as a modern innovation to enhance water-use efficiency;

- Encourage schedule irrigation and soil erosion control measures;
- Promote the use shade tolerant plants;
- Promote and invest in water harvesting and storage (reservoirs, tanks);

- Invest in and rationalize research that could aim to develop new crop genotypes resistant to stresses and related to climate variability, such as crops or varieties which are drought resistant, heat tolerant, and more water-use efficient.

- Provide climate information services to support adaptive management of water and production activities, as a way to manage residual risk with incomplete water control; for example, rural integrated early warning systems that will provide reliable information to farmers and support timelier and better coordinated response to droughts;

- Promote intercropping;

- Strengthen local extension services and other methods of agricultural innovation;

- Prioritize conservation tillage, in-field water conservation, mulching and composting activities in areas dependent on rain fed agriculture;

- Build local understanding of water retention and moisture conservation practices in order to identify a range of measures that can improve soil moisture on a large scale, and institutionalize such understanding in local training centres and vocational schools.

- Invest in waste water recycling technology;

- Harmonise the work of Regional centres engaged in observation and planning, improve prognosis, provide early warning, and training to enhance the impact of drought monitoring in the Region; and

- Improve soil structure to conserving water in the root zone by application of nano-enhanced materials (for example, zeolites) to enhance water-infiltration rate and decrease losses by surface runoff.

Above all, capacity building among technocrats as it relates to water management and climate change should be given high priority in each country.

Our vulnerability due to the variability of rainfall can affect our viability if our water management systems are not enhanced.

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