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Smallholder Irrigation Productivity for Sustainable Intensification: Water Balances for High Value Crops in Northern Ghana

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Abstract

Sustainable intensification for smallholder farming systems in sub-humid and semi-arid zones of West Africa critically hinges not only on agronomy and crop varieties but also the management of on-farm water in rain-fed and dry seasons to enhance crop and livestock productivities. Long-term dry spell analysis was carried out using INSTAT+ v3.37 while CROPWAT v8.0 model was used to estimate supplementary irrigation for wet season crops and irrigation requirement for dry season irrigated high value crops.

The results showed that although average annual rainfall amounts across the northern regions exceeds 1,000 mm/year, there is a 60–80 % chance of a dry spell exceeding seven days and 30–40 % chance of a dry spell exceeding 10 days. On the other hand, longer dry spells of 14 and 21 days do occur but are much less frequent. Dry spells ultimately result in yield decrease unless water management strategies are practised to increase infiltration. Shorter dry spells (7–10 days) can be overcome by infield water harvesting and increasing water holding capacity of the soils; however, supplementary irrigation is to be considered for longer dry spells (14–21 days).

In addition, dry season irrigation – of between 50–75 % required by crops – results in best productivity (kg yield m⁻³ water applied), attaining 70–90 % of potential yield if well-scheduled, especially for high value crops such as tomato, onion, and pepper. To maximise incomes per unit water in dry season irrigation, farmers need good scheduling advice and devices. This also benefits sustainable intensification. Hence, we recommend assisting farmers to improve water management to fully meet objectives of sustainable intensification.

Keywords: Dryspell mitigation, rainfed agriculture, West Africa, yield response