AGWATER SOLUTIONS
Improved livelihoods for smallholder farmers

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This briefing note summarizes the preliminary case study findings for discussion and comment

SHALLOW GROUNDWATER IN GHANA

Based on a report by Regassa E. Namara, Joseph Awuni and Lesley Hope

Shallow groundwater irrigation has the potential to provide profits to smallholder farmers. Reaching that potential requires greater knowledge about groundwater availability, improved policy and strategic support, and specialized extension services.

The Opportunity

Groundwater use for agriculture is limited to just 5% of the total groundwater used in Ghana, this could be increased significantly with greater information and policy support. In general, the investment cost of developing shallow groundwater (SGW) for irrigation is relatively low, and farmers can achieve good returns for vegetable crops such as tomatoes and peppers.

In sub Saharan Africa, groundwater irrigation gets little public policy attention. This is partly due to lack of information to provide guidance on where and how to utilize the resource. In Ghana there is no specific policy on groundwater use for agriculture, and the National Water Policy states that the potential for increasing groundwater use is faced with challenges including saline intrusion and insufficient yields.

Despite this, smallholder farmers in the Volta, Upper East, Upper West, and the Greater Accra regions already make use of shallow wells, but the numbers are currently low. To realize the opportunity, several limitations need to be overcome. Many of these are the typical difficulties faced by smallholder farmers, e.g., market access, land tenure, lack of credit, pests and diseases.

Access to groundwater improves irrigation

Other constraints are specific to SGW use, such as: the significant labour requirements for annual well-digging; high energy costs; limited access to affordable well-drilling, water lifting equipment, and technical advice on SGW irrigation; and the lack of an explicit policy and strategy on groundwater use in agriculture due, in part, to the limited knowledge on the resource.

The Research

This study was designed to identify the types of groundwater irrigation systems in Ghana and to analyze the economics, socio-economic impacts, constraints and opportunities. The results provide evidence for which groundwater systems should be supported and how. Data was collected from communities in Upper East (UE), Upper West (UW), Ashanti (A), Greater Accra (GA), and Volta (V) regions. The study, which built on an earlier survey by the International Water Management Institute in UE, was conducted in two steps, a census survey in selected communities, and random sample survey in the sub-set of communities and farm-households practicing shallow groundwater irrigation. The census survey covered 12,620 households (Table 1) and was followed by in-depth interviews with 494 randomly selected farmers in Ashanti, Greater Accra, and Volta.

Table 1. Surveyed households irrigation with SGW

	Region					
	GA	UE	UW	V	A	Total
Number of HH Interviewed	2,244	1,424	1,891	3,525	3,536	12,620
Groundwater users:	**527**	**381**	**858**	**2,172**	**119**	**4,057**
Bucket users	460	NA	NA	1,201	94	1,755
Petrol/Diesel pump users	67	NA	NA	97	25	189
Electric pump users	0	NA	NA	874	0	874

NA: Data not available

Main Findings

The census survey found that 32% of agricultural households already utilize SGW for irrigation (Table 1).

Farmers perceive groundwater as the most reliable resource, followed by rivers, while small reservoirs are seen as the least reliable. Electric pumps provide the most reliable water supply, followed by diesel/petrol pumps and buckets. Most farmers believe they do not need permission to use water resources, particularly groundwater, a view which contrasts with the country's water law, under which water resources belong to the State. Many farmers only make partial use of their irrigable land. The reasons for this are lack of finances to buy equipment, followed by inadequate water availability and high labor costs. There are also some location-specific constraints such as: water quality, access to electricity and flooding, mainly in coastal areas; and access to water in UE. Land tenure is also an issue for investing in more permanent groundwater structures, with 90% of land rental contracts lasting only one year.

The investment costs of developing SGW for irrigation are generally low, but vary by system type and location. Table 2 gives a breakdown of the relevant costs from UE. Riverine systems involved the largest investment as motorized pumps are required. Permanent wells are a close second in UE (GH¢120-150). Investment costs are significantly more for tube-well irrigation (GH¢1,543 in Volta and GH¢1,836 in Greater Accra).

Table 2. Average investment costs of SGW Irrigation

	Riverine Seasonal	In-field Seasonal	Permanent	
			Lined	Unlined
Mean depth in meters	5.6	5.9	12.2	10.4
Labor: drilling & lining (man-days/meter)	0.94	0.94	4.2	4.3
Total labor costs (GH¢ per meter)	10.5	36.6	102.7	89.4
Material costs (GH¢ per meter)	3.37	2.02	3.4	2.3
Total material costs (GH¢)	18.9	39.2	41.8	23.9
Total construction costs (GH¢)	29.4	23.0	144.5	113.4
Cost of lifting device (GH¢)	131.4	3.0	5.5	6.8
Total investment (GH¢)	**160.8**	**26.0**	**150.0**	**120.0**

Motor pumps provide the most reliable access to groundwater.

Tomato and pepper are the two major crops grown in UE where 87% of the SGW irrigated area studied was planted with tomatoes in the dry season. In Volta and Greater Accra, various vegetables cover 98% of the SGW irrigated area. In UE, the gross margin of tomato production is positive for in-field and riverine systems, and the profit becomes significantly larger if the opportunity cost of labor is deducted (Table 3). Tube-well irrigators in Volta and Greater Accra realized significantly greater profits per hectare, approaching US$4500/ha and US$2200/ha in the wet and dry seasons, respectively.

Table 3. Profitability analysis for tomatoes under SGW irrigation in UE

	In-field seasonal	Riverine seasonal	Permanent
Gross income (GH¢[1])	859.0	1478.0	348.0
Total variable cost	601.7	702.4	524.6
Fixed cost (GH¢)	7.9	48.2	48.7
Total cost (GH¢)	609.6	750.6	573.3
Gross Margin (GM)	**257.4**	**775.6**	**-176.6**
GM excluding labor costs	**554.9**	**967.2**	**274.6**

1US$=GH¢ 1.5. Calculations are on per acre basis.

In UE, dry season irrigation using SGW has created additional labour demand estimated at 359,511 person days. The total contribution of SGW irrigation to the economy of the 35 communities in the White Volta basin is about US$1.2 million. In UE, almost 99% of the farmers interviewed experienced some period of food shortages in the 12 months prior to the survey, but the number of food insecure months varied according to the type of irrigation practiced (Figure 1). However, dietary diversity was lower for small dam and permanent shallow well irrigators than rain-fed farmers. Thus, while access to irrigation in UE reduced food insecurity, it did not eliminate it.

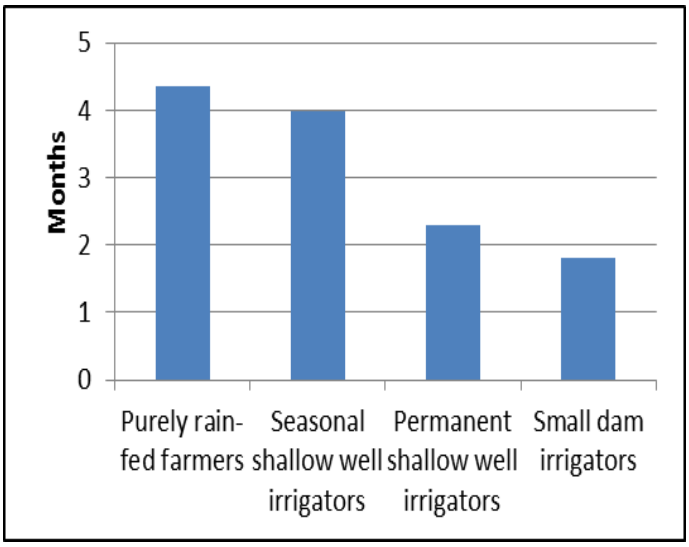

Figure 1. Average number of food insecure months

Solutions

- Improve knowledge of groundwater availability and use;
- Develop easily accessible and interpretable ground-water maps;
- Formulate an explicit groundwater irrigation policy and strategy;
- Provide specialist extension services that cover specific groundwater irrigation issues;
- Align the country's rural energy policy to the special needs of groundwater irrigated agriculture;
- Provide agronomic and on-farm water management research support.

Potential Impact

- **Poverty reduction and enhanced food security** for smallholder farmers. SGW irrigators have lower incidences of poverty than purely rainfed farmers; and the survey data suggests that access to SGW may contribute to poverty reduction.
- **Job creation**, particularly for the young during the dry season with important implications for rural-urban and north-south distress migration in Ghana.
- **Rural development:** The total value addition of shallow groundwater irrigation is estimated to be about US$1.2 million over a period of just 3 to 4 months.

Simple technology helps make the most of shallow groundwater.

Questions for Discussion

- How can groundwater policy be most effectively influenced?
- Which organizations could be responsible for ground water mapping?
- How can ectension services be supported to provide SGW irrigation specific advice?
- How can the rural energy policy be streamlined to best serve the energy needs of the groundwater irrigation sector?