

Installation of Drip Irrigation at CSIR-Crops Research Institute, Ghana

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Abstract

The Council for Scientific and Industrial Research-Crop Research Institute (CSIR-CRI) sourced financial assistance from the Alliance for a Green Revolution in Africa (AGRA), to expand the irrigation facilities on the research fields with the main aim of ensuring continued irrigation of research trial fields all-year round. The overall objective of the project was to enhance the crop improvement and technology development capacity of the Crops Research Institute to promote food security and improve livelihoods of smallholder farmers and processors in Ghana. Sprinkler and drip irrigation systems were proposed for installation on the research fields at CSIR-CRI. The fund provided by AGRA was earmarked for land preparation towards the installation of both the drip and sprinkler irrigation systems and for the installation of the drip irrigation system.

Keywords: Irrigation, installation, research fields, procurement, drip irrigation, AGRA

Introduction

The Crops Research Institute (CRI) is one of the 13 institutes of the Council for Scientific and Industrial Research of Ghana. It is mandated to develop and disseminate environmentally sound technologies, comprising improved high yielding, good quality, pest and disease resistance varieties and improved crop management and post harvest practices. The research fields of CSIR-CRI cover a total area of 157 ha with two (2) dams. Supplementary irrigation is currently being applied to a section (6ha) of the fields. The Institute sourced financial assistance from Alliance for Green Revolution in Africa (AGRA), to expand the existing irrigation facilities at the Fumesua station with the aim of ensuring continuous irrigation of research fields all –year-round. The overall objective of the project was to enhance crop improvement and technology development capacity of the Crops Research Institute to enhance food security and livelihoods of smallholders in Ghana. The specific objectives of the project were to:

- Acquire and install irrigation facilities for the experimental fields of the Crops Research Institute at Fumesua and;
- Establish irrigation/demonstration plots and ensure continued supplementary irrigation of trial fields all –year-round.

Methodology and description of key activities

The following activities were done towards the installation of the drip irrigation system.

Hydrological survey and Irrigation water quality analysis: There are two man-made water reservoirs on the station labelled ‘A’ and ‘B’ for the purpose of this report with capacities 36,896 m³ and 6,868 m³ respectively. Reservoir ‘A’ can be found along the main entrance to the Fumesua station while reservoir ‘B’ can be found along the road from the station to village called ‘Paakoso’ The surface area for each reservoir is about 1.2ha. The catchment run off is estimated at 14m³/s for each reservoir. The Water Research Institute of the CSIR was contracted to conduct quality analysis of the water in the two reservoirs. Results from the analysis indicated that the water in the dams were good for irrigation purposes i.e. it will not pose problems for the soils and crops but not suitable for drinking without some purification.

Soil Analysis and characterization: The Soil Research Institute of the CSIR was contracted to conduct a soil survey and analysis to describe and characterize the soils on the research field.

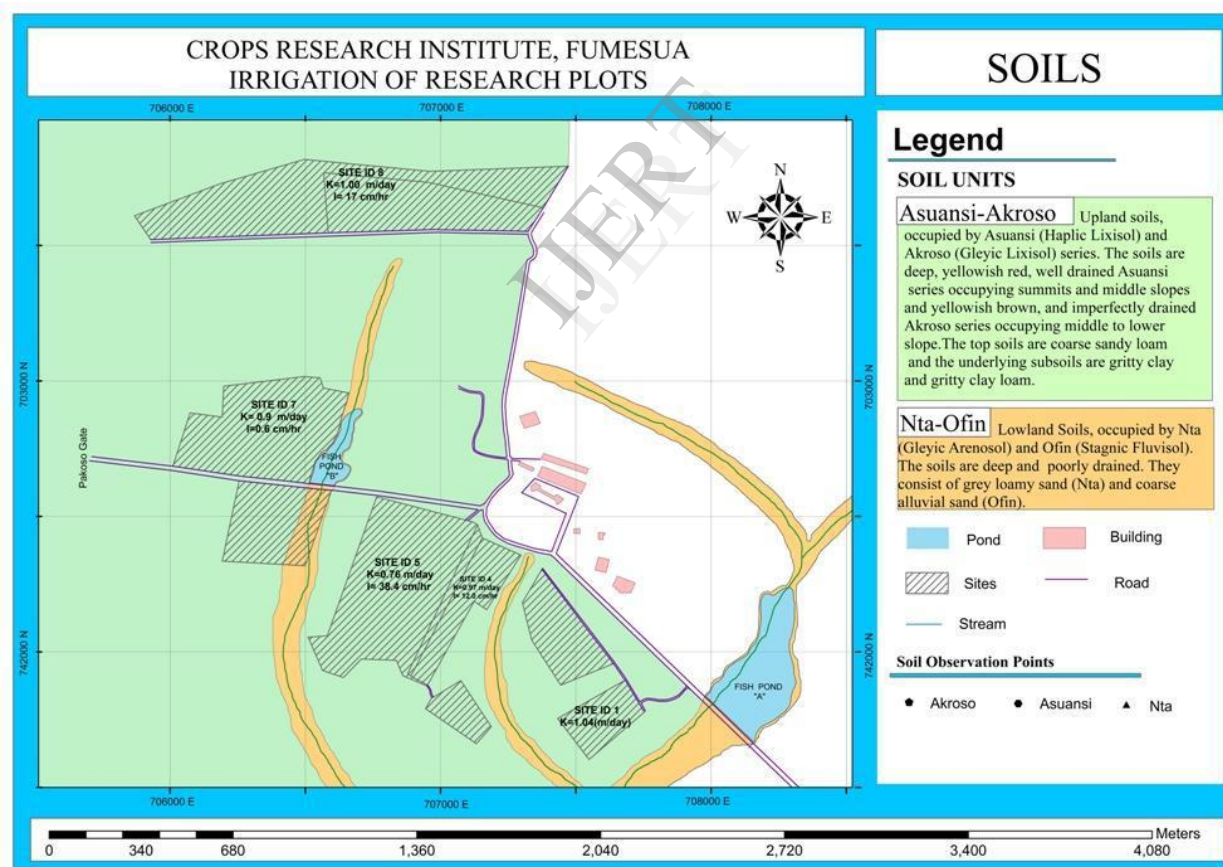


Fig 1: Soil map of research fields at Fumesua, Kumasi

Results from the analysis identified the soil types in the research fields. These are:

- Sandy loam at the top with a depth of 20cm and a gritty texture. The top soil is dark brown sandy loam that dries up rapidly and can crust up when dry.
- The subsoil is heavy textured at a depth of 25 to 30cm and has higher moisture holding capacity. The soil is mainly sandy loam with an infiltration rate of 40mm/hr. The moisture holding capacity is 115mm/m and the total available moisture in root zone is estimated at 57.5mm.

Topographical Survey: The Ghana Irrigation Development Authority (GIDA) was contracted to conduct a topographical Survey to map out the experimental plots and prepared the Bill of Quantities for the Drip Irrigation system. A complete design of the layout for the drip irrigation was carried out along with its corresponding Bill of quantities. The Bill of quantities was used in the preparation of the tender document for the procurement and installation of the drip irrigation system.

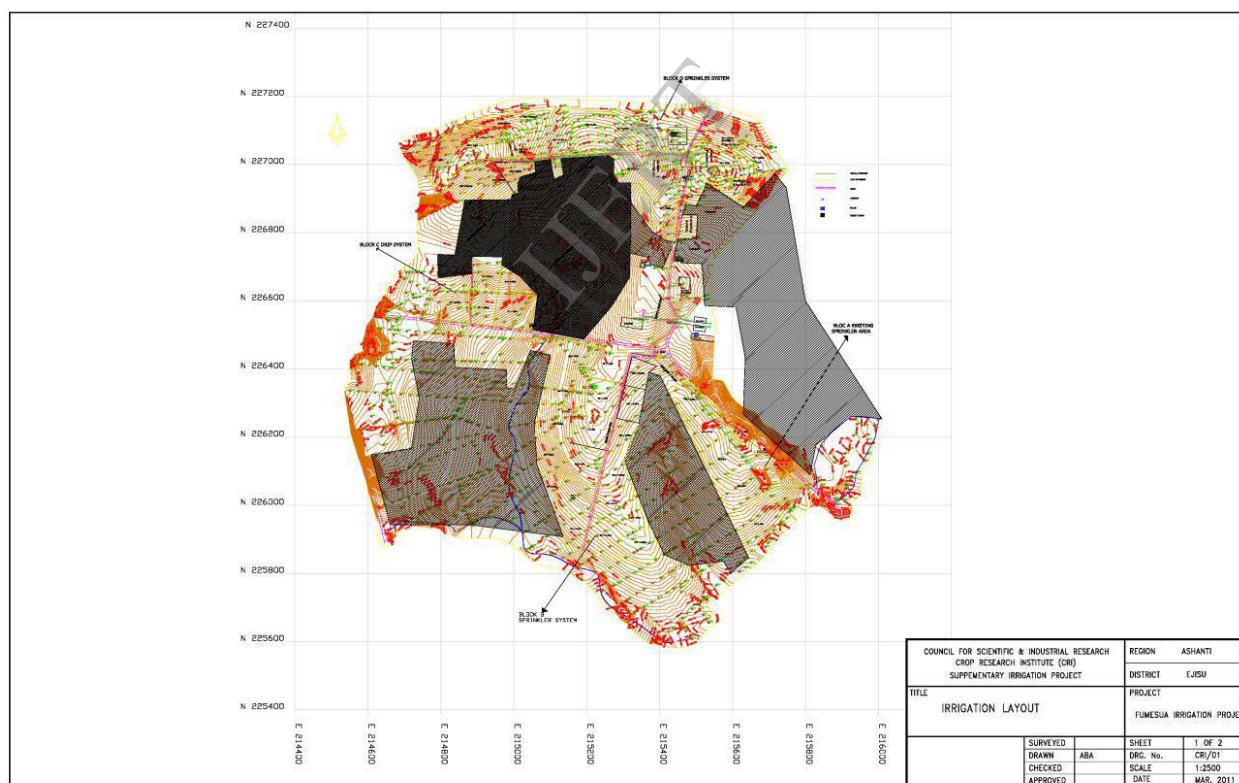


Fig 2: Topographic map of the CSIR-Crops Research Institute

Field Layout, Research Plot Demarcation and Irrigation Design: In order to carry out the work required to design the CRI irrigation system, Dr. Muktar Hannibal of Agricon International, Ontario, Canada, was consulted to help develop a layout for the demarcation of the research

fields into plots and also provide an irrigation design. The consultant used information gathered by his staff and from the research scientists of CSIR-CRI. Using a questionnaire, the Consultant solicited for information from the Research scientists on their land requirements under the irrigation system. The Consultant worked closely with the Irrigation Committee at all stages of the work. The Consultant also met with the Research scientists on two occasions to explain to them the concept of the design, to answer any queries about the information collected and to make sure that scientists' requirements were fully taken into consideration. The Consultant also paid a number of visits to the research fields to validate topographic survey data and determine the boundaries of the land that could be included in the design. Data were collected on many of these visits for the design. After the initial layout, a validation of the design was done on the field. Plot size: plot sizes in Block A have been laid out in 1 ha field as shown in the map (Fig. 2). It is assumed that each field can be divided into 0.5 ha plots for experimental crops. The sizes of the plots are therefore taken at 100 m x 50 m along the least possible slope.

Preparation of tender document and call to tender: Tender documents were prepared by the Procurement office of the CSIR in accordance with the procurement policies of Ghana. It was advertised in the newspapers for calls to tender.

Evaluation of bidding documents and Award of contract: After careful evaluation of the bidding documents, the contract was awarded to Dizengoff Ghana limited to supply and install the drip irrigation system at Fumesua.

Land preparation towards the installation of the drip irrigation system: Tender document for the civil works associated with the installation of the drip irrigation system was prepared and advertised by the procurement office of the CSIR. The Irrigation Committee evaluated the financial and technical suitability of the Bill of Quantities submitted by the three companies: Kenteks Enterprise, Kevinola Enterprise Ltd and Reagvin Ventures. Generally, the Bill of Quantities submitted by the tenders was not financially feasible looking at the resources available for the project implementation. It was therefore suggested that other means be sought in executing the civil component of the project for the installation of the drip irrigation system. Recommendations were made by the irrigation committee to use hired and local labour to perform the land preparation activities towards the installation of the drip irrigation. It was also suggested that a traxcavator be hired to fell the trees. A survey team from the CSIR-Building and Road Research Institute was consulted to map out an additional forest area to be cleared for the

installation of the drip area after which a traxcavator was hired to perform the task of tree felling. The wood was cut into smaller pieces and dispose off. The area was then ploughed, harrowed and levelled. This process was repeated until a leveled field was attained for the installation of the drip irrigation system.

Supply and Installation: A pump house was built by DWA Dizengoff at the site to house the pumping machine and the accessories. This was done as part of the contract to provide a pumping station for the drip irrigation system Installation of pump and accessories. The contractor, DWA Dizengoff Ghana Ltd supplied and installed the pump and its accessories (constituting the pumping station) as per the Bill of Quantities requested. A 7.5HP pump was installed with a discharge of 30m³/h and a pressure head of 60m. An excavator was used to trench the fields for the laying of the main pipelines. The 160mm diameter polyethylene (PE) main pipelines were laid at a depth of 1m along the fields at a distance of 190m from the pump house, coupled with a Tee coupler and extended infield again at a depth of 1m and a distance of 37m to make provision for an infield head. The 16mm PE pipe was again extended across field at a distance of 120m to make provision for another head. Three pumping heads with filters were installed by the contractor on the fields. The first pump head was coupled to two lateral lines, 63m in diameter and extending 44m infield in opposite directions. This pump head was installed with two valves to control each lateral line. The lateral lines were saddled and connected to Y-couplers at spacing of 50cm between saddles. The drip lines were connected to the Y-couplers at spacing of 67cm between drip lines. Drip heads (drippers) were installed on the drip lines at spacing of 30 cm to a distance of 55m infield. The second field pump head was coupled to four lateral lines (two on each side), 63m in diameter and extending 37m infield in opposite direction. The lateral lines were saddled and connected to Y-couplers at spacing of 50cm between saddles. The drip lines were connected to the Y-couplers at spacing of 67cm between drip lines. Drip heads (drippers) were installed on the drip lines at spacing of 30 cm to a distance of 64m infield. The third pump head was coupled to four lateral lines (two on each side), 63m in diameter and extending 33m infield in opposite direction. The lateral lines were saddled and connected to Y-couplers at spacing of 50cm between saddles. The drip lines were connected to the Y-couplers at spacing of 67cm between drip lines. Drip heads (drippers) were installed on the drip lines at spacing of 30 cm to a distance of 74m infield. The application rate of the dripper is 5mm/h at a working pressure of 4m.

Conclusion

The supply and installation of the drip irrigation system at CSIR-Crops Research Institute is complete and ready for all-year-round irrigation. Demonstration of the irrigation facility has been made. It is hoped that the irrigation facility will enhance the crop improvement and technology development capacity of the Institute to boost food security and livelihoods of smallholders in Ghana.

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