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Welfare analysis of smallholder farmers by irrigation systems and factors affecting their production outputs in Nigeria

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ABSTRACT

Sustaining water availability for smallholder farmers in the near future presents a great challenge to agricultural production in Nigeria. This study assessed the smallholder farmers' welfare using assets possession and factors affecting their production outputs in Nigeria. A multistage sampling technique was applied in three agro-ecological zones with primary data collected and analysed using both descriptive and inferential statistics. Results show that the crop water application system practiced across the study area included rainfed system, gravity flow system, motor pump system and bucket system. A large percentage of the motor pump farmers had improved livelihood going by the type of assets they possess. Some of the irrigators were observed to use water unsustainably (not maintaining the existing system for the future generations through misuse and management of the available water resources) especially those using gravity flow system and motor pump systems. This should be discontinued in the face of the climate change affecting the country. Likewise, the use of some agro inputs such as fertilizers need to be controlled since increasing the level of these inputs was found not to translate to increased output for the farmers. Finally, the land tenure system in Nigeria does not promote smallholder farmer's welfare as no farmer had formal title to their lands. This makes it difficult to have sufficient access to credit facilities. The policy is inimical to agricultural development in Nigeria and should be relaxed.

1. Introduction

There are many indications that water is becoming an increasingly scarce resource (Falkenmark, 1997; Wiesmann et al., 2000; Rijsberman, 2006; Molden, 2007; Yokwe, 2009; Jacobs and Fair, 2012) exacerbated by the groundwater depletion (Shah et al., 2008), land degradation in irrigated areas (Khan and Hanjra, 2008), ecosystem degradation (Dudgeon, 2000), water pollution (Tilman et al., 2002), and increasing costs of developing new water sources (Hanjra and Gichuki, 2008). Water scarcity has challenged the sustainability of agriculture, especially in arid and semi-arid regions (Forouzani and Karami, 2011). In addition to the climate change effects (such as temperature rise, erratic rainfall, sand storms, low agricultural yield; drying up of water bodies and flooding), surface and ground water flows are changing due to changes in landuse (examples, deforestation and soil degradation) in Nigeria. In line with irrigation and household welfare linkage (Tekana and

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Oladele, 2011), there are a number of studies in different countries which show that irrigation is the key driver of ensuring household food security and alleviation of rural poverty (Sinyolo et al., 2014; Tesfaye et al., 2008; Bagson and Kuuder, 2013; Haji et al., 2013; Ghosh et al., 2012; Chazovachii, 2012; Hanjra and Qureshi, 2010; Dillo, 2010; Lipton et al., 2003; Rijsberman, 2003; Sullivan and Meigh, 2003). Irrigation water is the most important determinant of increase in agricultural output (Finger and Borer, 2013; Bekchano et al., 2010; Batchelor et al., 1994). Out of the estimated 250,000 million cubic meters (MCM) water resources potential in Nigeria, 190,000 MCM is surface water while only about 60,000 MCM is solely groundwater (AQUASTAT, 2010). This implies that the surface water is the dominant source of irrigation water in the country. Economic development and population increase in Nigeria for instance, is putting great demand on water resources, for both domestic and agricultural uses, thus requiring concerted strategic actions to increase the country's agricultural production. There is physical water scarcity characterized by environmental degradation and declining groundwater resources, economic scarcity characterized by lack of investment in water or insufficient human capacity to satisfy the demand for water. As a result of lack of infrastructure, people fetch water from rivers for domestic and agricultural uses (WHO, 1983; Dougherty and Hall, 1995). While data sets relating to surface water resources, land-cover and areas equipped for irrigation are said to be available (FAO, 2008), the relative contribution of groundwater irrigation to agricultural production is still subjective in Nigeria. However, it should be pointed out that despite the relatively small productivity extent of groundwater irrigation compared to conventional rainfed farming and surface/gravity flow irrigation, especially in the rain forest and guinea savannah region of Nigeria, it represents a unique alternative for management of scarce water resources in support of small scale agricultural production and rural livelihoods.

In Nigeria, rainfall and temperature are the most critical agro-climatic parameters that define the different agro-ecological zones for the purpose of irrigation practices. Irrigation which is artificial application of water to the land or soil is required for crop production, maintenance of landscapes, and re-vegetation of disturbed soils in dry areas and during periods of inadequate rainfall (Snyder and Melo-Abreu, 2005; Williams et al., 1990). Traditionally, sources of irrigation water are surface water withdrawn from rivers, lakes or reservoirs and groundwater extracted from wells and/or springs. In addition, non-conventional sources like treated wastewater, desalinated water or drainage water are also on the increase nowadays in many parts of the world. Nonetheless, successful agriculture is dependent upon farmers having sufficient access to water.

To avoid a global water and food crisis, farmers strive to increase productivity to meet growing demands; communities and industry are also devising ways of efficient water use (Frenken, 2005). Available evidence shows that only very few similar studies (such as Tekana and Oladele, 2011) have been carried out in recent times on either the impact of irrigation systems on farmer's welfare or factors affecting production outputs by the existing irrigation system. This therefore is embarked upon in other to fill this research gap. This paper is part of a research work carried out by the authors on "Livelihood Impacts of Improved On-farm Water Control in sub-Saharan Africa: An Empirical Investigation of Three Modes of Smallholders Agricultural Water Management in NIGERIA in 2011 with the funding support of International Water Management Institute (IWMI), Colombo, Sri Lanka. The main objective is to analyse different modes of agricultural water management of smallholder farming systems in Nigeria and their implications on water resource use, farmers' welfare and production outputs. The results will not only be important for improving the efficiency of irrigation systems but also for improving the livelihoods of people in Nigeria facing severe droughts and socio-environmental problems. The outcome is also expected to guide in discussion on irrigation development strategy most appropriate for smallholder agriculture in Nigeria.

1.1. Overview of irrigation systems

Irrigation is the he artificial application of water as a supplementation of rainwater to land so as to assist in the production of crops. Some of the major types of irrigation systems are: sprinkler method which is a method of application of water similar to rainfall but in this case water is distributed through a system of pipes usually by pumping and then sprayed into the air through spray heads so that it breaks up into small water drops which fall to the ground; surface irrigation system which is a method of application of water down the furrow from siphon tubes or poly-pipe as well as flooding an irrigation basin; and the third, drip irrigation system also known as trickle irrigation is a technique in which water flows through a filter into special drip pipes, with emitters located at different spacing. In drip irrigation method, water is distributed through the emitters directly into the soil near the roots through a special slow-release device.

2. Materials and methods

This section discuses the methodology of the study. First, the study area, followed by the description of survey method, the sampling techniques adopted in the data collection and specific techniques of data analyses employed to validate the objectives of the study while the problems encountered in the course of the data collection are also highlighted.

The study area is Nigeria and the survey sites were selected in three agro-ecological Zones (AEZ), namely: (i) Rain forest zone in the south, (ii) Guinea savannah zone in the middle belt and (iii) Sudan savannah zone in the north (Fig. 1). The specific areas selected within each zone were based on the concentration of vegetable farmers in those localities who are the main users of irrigation systems. The study employed primary data, through the use of a well-structured questionnaire and augmented by scheduled interview and Focus Group Discussion (FGD). Data collection for the study took place between