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Assessment of farmers' knowledge on fertilizer usage for peri-urban vegetable production in the Sunyani Municipality, Ghana



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ABSTRACT

How to optimize fertilizer application (i.e. by choosing the best fertilizer types, dosage, time of application, and application methods) to sustain and increase crop production and quality in intensively cropped weathered soils in Ghana is understudied. The purpose of the study was to assess farmers' knowledge on fertilizer usage for intensive vegetable production in peri-urban areas in Ghana where production and marketing of vegetables cause significant export of nutrients from farms. Data were collected from 180 peri-urban vegetable growers in Abesim and Yawhima in the Sunyani Municipality using purposive and snowball sampling methods. The study showed that vegetable production constituted 65% and 70% of the total annual income of farmers in Abesim and Yawhima, respectively. Ninety-seven percent of the farmers used mineral fertilizers to improve soil fertility, but the use of organic manures such as poultry dung was very low even though it was available. Limited knowledge on fertilizer use and management among the farmers and high market prices of mineral fertilizers constrained their usage. Intensifying education on fertilizer use and management through agricultural extension services, the media, and at the point of sales are recommended to improve sustainable use of fertilizers for peri-urban vegetable production.

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1. Introduction

Peri-urban agriculture is an important agronomic practice in many developing countries. Peri-urban agriculture is distinguished from urban or intra-urban agriculture in that the former takes place within the inner city while the latter takes place in urban periphery (Mougeot, 2000; de Zeeuw, 2004). Peri-urban interface refers to areas within a radius of 40 km from the inner city (Phillips et al., 1999). Peri-urban agriculture involves growing, processing, and distributing diverse food and non-food products. It also entails using human and material resources, products, and services found in and around the urban area. Production is usually heterogeneous, capital intensive, and involves growing of perishable crops (Potutan et al., 2000).

Peri-urban agriculture plays an important role in addressing food insecurity problems in urban areas in many developing countries (Mougeot, 2000; Cofie, 2009; Lynch et al., 2013). This

no doubt, contributes toward meeting the UN Millennium Development Goal 1—to reduce the number of people suffering from hunger by half between 1990 and 2015 (Cofie et al., 2005; United Nations, 2013). In Sub-Saharan Africa (SSA), urban and peri-urban agriculture employ about 11 million people (FAO, 2001). In addition, peri-urban agriculture contributes to poverty alleviation and improves the livelihood of poor income households living in urban peripheries (FAO, 2007).

In Ghana, the situation is not different from elsewhere in SSA; rapid urbanization of cities and their peripheries due to high rate of rural–urban migration and natural growth have led to increased demand for food (Maxwell et al., 1998; Frimpong, 2013; Osei-Asare and Eghan, 2013). While most of the staple food crops like tuber and root crops, cereals, and grains are supplied from the rural areas to urban centers, perishable food products like vegetables often decay and/or lose their market value when transported over longer distances. As a result, large proportions of vegetables consumed in urban centers in Ghana are produced around the cities to keep their freshness and quality (Abaidoo et al., 2009). In bigger cities such as Accra, high demand for fresh exotic and indigenous vegetables has led to vegetable farming within the inner city. Production

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usually occurs in open spaces, along river-banks and water catchments as well as non-built-up areas reserved for future use (Egyir and Ackah-Nyamike, 2006). However, such production has been constrained by land scarcity due to rapid infrastructural development. Peri-urban vegetable production offers employment to farming households and labor around city peripheries. It also provides a major source of economic sustenance to native and migrant population in peri-urban areas in Ghana (RUAFA, 2005).

A major challenge facing agricultural production in Ghana is low soil fertility due to the fact that most soils were developed from weathered parent materials and also because of long period of leaching of nutrients, especially nitrogen and phosphorus (Ministry of Food and Agriculture [MoFA], 1998). Over the years, problems of low soil fertility in peri-urban agriculture have been exacerbated by land scarcity due to rapid urbanization leading to reduced length of fallow (Henao and Baanante, 1999; Kimetu et al., 2004; McGregor et al., 2011). Organic manure and mineral fertilizers (nitrogen, phosphorus, and potassium [NPK]) are applied to replenish soil fertility in order to improve productivity. Mineral fertilizers, unlike organic manures, are easier to apply and their nutrient content is more predictable, but their use is limited among smallholder farmers due to high cost (Bailey, 2002; FAO, 2005; van Veenhuizen and Danso, 2007). Organic manures used by farmers include animal manure, waste water, human urine, green manure, compost, and fecal sludge (Mainoo et al., 2008; Olowolafe, 2008; Akpan-Iodiok et al., 2012; Karak and Bhattacharyya, 2012). These sources, unlike mineral fertilizers, are less expensive and more accessible to farmers (Agyarko and Adomako, 2007; Seidu, 2009). For instance, studies conducted in northern and southern Ghana found high use of human excreta as fertilizer for the production of sorghum and maize, respectively (Cofie et al., 2005, 2010).

The benefits of using inputs like fertilizers in vegetable production cannot be over-emphasized, but inappropriate use and poor management can lead to environmental pollution and health complications (Smith et al., 1999; Camargo and Alonso, 2006; Obuobie et al., 2006). Fertilizer use and management with the dual purpose of securing crop production and limiting the adverse effects on health and environment have been understudied in Ghana. The purpose of this study was to investigate the knowledge about fertilizer management among vegetable growers in peri-urban areas in Sunyani Municipality. The objectives were to (1) examine the different types of organic manures and mineral fertilizers used by the farmers, (2) assess the factors that affect the choice of fertilizer types, and (3) investigate the management options used to reduce the potential environmental and health effects of fertilizers. In this study, the term “fertilizer(s)” without an adjective refers to both organic manures and mineral fertilizers. We hope that findings of this study will help to improve sustainable use of fertilizers in peri-urban vegetable production in Ghana and elsewhere in the world.

2. Methodology

2.1. Description of the study area

The study was carried out in Sunyani Municipality of the Brong Ahafo Region of Ghana. The municipality is located between latitudes 7°20'N and 7°05'N and longitudes 2°30'W and 2°10'W (Anane, 2013). Sunyani Municipality falls within the wet semi-equatorial climatic region characterized by double maxima rainfall regimes (Owusu and Waylen, 2012). The mean annual rainfall is between 1250 mm and 1400 mm (Mote, 1998). It has a mean monthly temperature between 23 °C and 33 °C. Soils in the municipality are formed from Precambrian Birimian rocks and are associated with extensive masses of granite. The environmental

conditions in the municipality are suitable for agriculture and timber production (Sunyani Municipal Assembly, 2008). The study was conducted in two peri-urban areas: Abesim and Yawhima (Fig. 1). These were chosen because they are the major vegetable producing communities in the municipality (Boateng, 2009). Vegetables produced in these communities are generally sold in Sunyani, the municipal capital.

Abesim has a population of about 16,441, and about 8583 for Yawhima (Ghana Statistical Service, 2012). About 52% of the population in Abesim is female and 48% male, while in Yawhima, 48% is female and 52% is male. The dominant type of occupation in Abesim and Yawhima is agriculture. It employs about 60% of the active working age group, while 40% are engaged in teaching, dress-making or tailoring, and small-scale businesses. Agriculture is mostly done on small-scale basis, and it involves the production of traditional root and tuber crops (cassava and yam), plantain, maize, and livestock rearing (Sunyani Municipal Assembly, 2008). Over the years, growing of high valued crops such as indigenous and exotic vegetables has become a prominent economic activity among farmers in both communities. Exotic vegetables such as lettuce (*Lactuca sativa*), carrot (*Daucus carota*), green pepper (*Capsicum annum*), and cabbage (*Brassica oleracea var. capitata*) cultivated in Abesim and Yawhima are mostly produced to supply the market and restaurants in Sunyani and other cities in Ghana (MoFA, 2013). Indigenous vegetables like tomato (*Lycopersicon esculentum*), onion (*Allium cepa*), eggplant (*Solanum melongena*), and okra (*Abelmoschus esculentus*) are produced for both household consumption and also to supply the local and the urban markets.

2.2. Data collection

Primary data were collected from vegetable farmers in Abesim and Yawhima between July and September 2014. The field study was designed as quantitative and qualitative research. The respondents were selected using purposive and snowball sampling techniques. Purposive sampling is a deliberate choice of respondents due to the quality they possess (Tongco, 2007). With this method, the study focused only on vegetable growers. Snowball sampling involves gathering research respondents through identification of initial subjects who in turn help to identify other actors whose characteristics are suitable for the research (Atkinson and Flint, 2004). These techniques were chosen because they have been successfully used in previous studies on farmers' perception about farm and fertilizer management practices (Agyarko and Adomako, 2007; Oyesola and Obabire, 2011). With these methods, the Assemblyman and a key vegetable grower in the study communities were consulted. These people had in-depth knowledge and were familiar with vegetable farmers in their communities. They aided the researchers to identify other vegetable farmers.

Semi-structured questionnaires made up of closed and open-ended questions were administered to the respondents. The closed and open-ended questions constituted quantitative and qualitative data, respectively. The questionnaires were structured into the following themes: background data of respondents, land tenure system and vegetable production practices, existence of farmer/vegetable farmer organizations, input (fertilizer) utilization, the potential effects of fertilizers, and management practices. A total of 180 respondents were interviewed from Abesim and Yawhima (90 from each community). Additional information was obtained through expert interviews with personnel from the office of the Ministry of Food and Agriculture in Sunyani.

The quantitative data were analyzed with the aid of a Statistical Package for the Social Sciences (SPSS) version 20.1. The processed data were then exported to Microsoft Excel to generate frequency tables and graphs. The relationship between independent variables (socio-economic characteristics of respondents) and

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