Research Application Summary

Investigating viability of premium influenced land use structure in production of quality indigenous vegetable

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Abstract

Raised bed gardening is a form of land use structure that is becoming popular among home vegetable growers especially in parts of the world with greater population densities or less tillable land. Raised bed plots coined as Premium Influenced Land Use structures (PILAU) and conventional plots were established on the farms of ten representative farmers selected from Vihiga and Jinja sites of Kenya and Uganda, respectively. Each PILAU was further divided into three micro-plots totalling to 30 micro-plots. Indigenous and exotic vegetables were planted in each of the micro-plot and maintained by the defined agronomic practices, each vegetable being replicated six times. Weekly monitoring of the PILAU plots was done and agronomic performance parameters measured (vigour and robust, plant height, branching, yield and leaf density) and similarly for the conventional plots. PILAU treatment had a significant effect ($p<0.001$) on the height, leafy density, yield and disease incidences of the vegetables. Vegetables grown in raised beds also showed high morphological characteristics in terms of branching, leafy density and vigor compared to those that were grown conventional plots. They were also 'leafier' and yielded more compared to the ones that were grown in conventional plot. An observational survey was conducted to establish plant diversity of smallholder farms and land use practices, with regard to vegetable farming, in Vihiga and Jinja for 76 house holds. Generally, farmers apportioned their land into reference points as near portion, medium portion and far portion, depending on the proximity of the portion to the homestead. The near house portion reported high crop diversity with a frequency of 49 which was equivalent to 50.7%. The mid-farm portion ranked second in crop diversity with a frequency of 288 (29.8%). The far-farm portion had the lowest crop diversity with a frequency

of 188 which equated to 19.5%. Farmers should therefore be encouraged to improve the potential of the near house portion.

Key words: conventional farming, intensive cultivation, mineral macro and micronutrient density, raised bed planting system, underutilised indigenous leafy vegetables

Résumé

Le jardinage composé des structures d'étalage surélevé est une forme de l'utilisation des terres qui est devenue populaire parmi les cultivateurs de légumes à domicile en particulier dans certaines parties du monde, avec des une grande densité de population, ou avec moins des terres labourables. Les parcelles des étalages surélevés inventées comme premières structures d'influence d'aménagement du territoire (PILAU) et les parcelles conventionnelles ont été établis sur des fermes de dix agriculteurs représentatifs choisis dans le site de Vihiga au Kenya et dans le site de Jinja en Ouganda. Chaque PILAU a été divisée en trois parcelles totalisant jusqu'à 30 micro parcelles. Les légumes indigènes et exotiques ont été plantés dans chacun des micro parcelles et entretenues par les pratiques agronomiques définies, chaque légume a été reproduit six fois. Un suivi hebdomadaire des parcelles PILAU a été fait et les paramètres de performance agronomique mesurés (la vigueur et l'état robuste, la hauteur de la plante, les branches, le rendement et la densité du feuillage) et de même pour les parcelles conventionnelles. Le traitement PILAU a eu un effet significatif ($p < 0,001$) sur la hauteur, la densité de verdure, le rendement et l'incidence de la maladie des légumes. Les légumes cultivés dans les étalages surélevées ont également montré de hautes caractéristiques morphologiques en termes de ramification, de la densité des feuilles et de la vigueur par rapport à ceux qui ont été cultivés dans des parcelles conventionnelles. Ils avaient aussi «beaucoup de feuilles» et avaient donné plus de production par rapport à ceux qui ont été cultivées dans la parcelle conventionnelle. Une enquête d'observation a été menée afin d'établir la diversité végétale des petites exploitations et des pratiques d'utilisation des terres, en ce qui concerne la culture des légumes à Vihiga et à Jinja pour 76 ménages. En général, les agriculteurs avaient réparti leurs terres en référents points, comme la portion la plus proche, la portion moyenne et la portion lointaine, en fonction de la proximité de la portion de la propriété familiale. La portion se trouvant près de la maison avait la diversité des cultures rapportées avec une fréquence élevée de 49, ce qui équivaut à 50,7%. La portion médiane de la ferme classée deuxième dans

la diversité des cultures, avec une fréquence de 288 (29,8%). La partie extrême de la ferme avait la plus faible diversité des cultures avec une fréquence de 188 ce qui équivaut à 19,5%. Les agriculteurs devraient donc être encouragés à améliorer le potentiel de la portion qui se trouve près de la maison.

Mots clés: agriculture traditionnelle, la culture intensive, macro minéral et la densité en micronutriments, le système de plantation sur d'étalages surélevés, légumes de feuilles indigènes sous utilisés

Background

Raised bed gardening is a form of land use structure that is becoming popular among home vegetable growers especially in parts of the world with high population densities or less tillable land (Sayre *et al.,* 1997). This is because they are ideal for maximizing use of land as they concentrate more crops per unit piece of land compared to long single row gardens. As such they can be used to increase production of crops especially vegetables. However, information regarding use of raised bed in the production of indigenous vegetables in several African countries is still scanty. Raised bed gardening in this study has been presented as a premium land use structure. The research context of premium value is an all-embracing term that is a summation of premium status along the vegetable value chain that ultimately culminates in a vegetable type being established in the market and contributing to income security and livelihood of the farmers. The overall objective of this study was to investigate the viability of premium influenced land use structures in line with a premium implied cropping for a prospective premium product development. This was achieved by identifying the prevailing land use in a smallholder cultivation system and introducing and evaluating the benefits of a raised bed (Premium Influenced Land Use structure) as a land use practice.

Literature Summary

Intensive planting in raised beds results in higher yields per square foot which is often twice the yield from conventional single row gardening (Fahong Wang *et al*., 2011). Additionally, a higher percentage of the available growing space is used, providing less room for weeds to grow, and ensuring water use efficiency. Furthermore, raised beds gardens warm up easily increasing temperatures that provide energy essential for the process of germination thus permitting faster germination of plants (Fahong Wang *et al*., 2011).

Indigenous vegetables are important as a source of food base of the people, particularly those in marginal and tribal areas, as they are most vulnerable to food shortages and famines. Several studies have indicated that the ALVs contain micronutrient levels as high as or even higher than those found in most exotic LVs (Steyn *et al*., 2001; Odhav *et al*., 2007) However, they remain underutilized due to the following factors; lack of sufficient empirical data to link dietary diversity and biodiversity, poor image of traditional foods, poor production practices, lack of partnerships and networking, low capacity within institutions, poor policies and lack of policy implementation structures, undeveloped value chains and markets and low research priority (IDRC,t 2006).

Study Description

The study was conducted in Vihiga and Jinja Districts of Kenya and Uganda, respectively, as target sites for the Lake Victoria Basin. Observations were done on 76 households to identify various land use practices. Farmers characterized their land into reference points of near portion, medium portion and far portion on the consideration of how close the portion was to the homestead. The near portion was an area found near the homestead, medium portion was the mid part and far portion was a piece of land located at the end of the land. An 'onion' design was adopted to refer to these reference points. Crops grown in these reference points were identified and recorded. Data were analyzed using SPSS version 14 and frequency of crop occurrence drawn in tables. The near farm portion had a high plant diversity followed by the mid farm portion. The far farm house portion had the least diversity.

A total number of 40 smallholder farmers were identified for the study, 20 from Vihiga (Kenya) and 20 from Jinja in Uganda. For each study location, the 20 farmers were put into groups of five. In each group, one representative farmer was selected; thus 10 representative farmers were selected (5 from Vihiga and 5 from Jinja). Raised bed plots (PILUAs), of a circular staircase-like design, were established on the 10 farms. Each raised bed plot was further divided into 3 micro-plots totalling to 30 micro-plots. Exotic and indigenous vegetables of different varieties were then planted in each of the micro-plot using manure, each variety being replicated six times. A comparison to determine their micronutrient content between the indigenous and exotic vegetables was then done. Weekly monitoring of the plots was done to determine growth of the vegetables. The following leafy area measurements were taken; vigour and

robust, plant height, branching and leaf density. Yield was also determined. The same procedure was done to the control. The control plots were the farmers' conventional way of planting indigenous vegetables. Planting was done in two seasons. Season 1 was the long rain season covering the months of April, May, June and July while season 2 was the short rain season covering the months of September, October November and December. The PILAU plots were the treatment factor in this study. Using Genstat version 14, a split split-plot design was adopted as an analysis method.

Research Application

Almost 60% of total fruits and vegetables are supplied by home gardens (piece of land located near the homestead) in Nepal (Gautman *et al.*, 2009). Indirectly, the benefits of home gardens are through savings due to reduce purchases and increased income from sales. The results obtained in this study similarly showed a high percentage of plant diversity in the near house portion of the farm (Table 1). Farmers should therefore be encouraged to improve the potential of the near house portion of land by fertilizing the soils because of the high plant diversity which is also linked to dietary diversity. This could be help reduce malnutrition especially among smallholder women farmers and their children, but also increase income for such households.

Table 1. Plant diversity of the Near, Mid and Far farm portions of land structures in Jinja and Vihiga.

House reference points	Occurrence of plant diversity	Percent occurrence of plant diversity
Near house portion	490	50.7
Mid house portion	288	29.8
Far house portion	188	19.5

Vegetable crops under the PILAU plots had a high performance level in terms of their morphological characteristics and yield (Table 2). This is because more plants were concentrated per square unit area ensuring water and nutrient utilization efficiency and providing less space for weed growth. They also showed high resistance to diseases compared to those that were grown in the conventional plots. Similar results have been reported by Fahong Wang *et al.* (2011) in winter wheat *(Triticum aestivum* L.) to raised bed planting in Northern China.

Use of raised bed for vegetable growth is therefore ideal in areas where land sizes are small like urban centres. They can be used to promote urban farming.

Table 2. Comparison of PILAU and Conventional vegetable planting (pooled data for for two locations, Jinja and Vihiga).

Parameter	PILAU*	Conventional plot
Disease incidence@	2.9	2.2
Leaf density#	2.6	2.2
Height (cm)	14.8	10.8
Yield (kg/ha)	42,254	27,772

Note:
@Disease incidence was scored on a scale of 1 to 3, whereby 1 = high disease incidence, 2 = medium diseased and 3 = low disease incidence;
#Leaf density was scored as 1 = many narrow light green coloured leaves, 2 = medium (light to dark green coloured leaves), 3 = many broad dark green leaves.
*PILAU – Premium influenced land use.

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