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Dynamics of maize production practices in urban open field agriculture in Zimbabwe

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Abstract

A research to assess the maize production practices and dynamics in open field cultivation was carried out in Gweru City. One hundred and eighty three interviewer administered questionnaires to active open field cultivators were used to collect data over three consecutive seasons 2011/2012, 2012/2013 and 2013/2014.Results show that manual power is used by 73% of the respondents in land preparation, 25 and 2%use motorized and draft animal power respectively. Trend analysis on power used for land preparation indicates an increase of 5% in motorized power whilst manual power use, decreased by 9% for the same period. Planting is carried out manually by all open field cultivators; 97% using family labour and 7% using hired labour. Sixty five percent, of cultivators use the basal fertilizer, 7% use ammonium nitrate, and 28% do not use any type of fertilizer on their maize crop. Crop maintenance is limited to weeding; all cultivators weed their fields mechanically using hoes. Only 3% indicated using agro-chemicals for pest control, and 17% used scarecrows to deal with bird and animal problems. Average maize yields from open field cultivation vary between 0.8 – 4 t/ha. Seventy six percent of cultivators consume all their produce, 20% sell part thereof to fellow residents and only 3% sell to outside and official markets such as the Grain Marketing Board (GMB). It can be concluded that the maize production practices of urban open field cultivators are dynamic and they follow some trends in relation to power sources and utilisation of their produce.

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Introduction

Maize is the most widely grown grain crop in both the rural and urban areas of Zimbabwe. It can be said that for the urban populace, the growing of maize, a staple crop is the main motivator for engaging in open field cultivation; other crops being only incidental. Open field cultivation is that component of urban agriculture (UA) that concentrates on the use of vacant plots in and around suburban areas for the production of field crops (Tshuma and Mashoko, 2010). Most of the times these plots belong to the municipality and the cultivators have no legal claims to them except only those developed by societal norms (Halloram and Magid, 2013). Open field cultivation differs from urban gardening not only in the location of the fields where it is practiced, but also in its seasonality and the types of crops grown. In Zimbabwe, urban gardening focuses on horticultural crops especially vegetables that are grown throughout the year under irrigation. The plots for urban gardening are usually in the gardener's back/front yard or very close to his/her homestead, usually across the road. The plots for open field cultivation on the other hand are located on the outskates surrounding residential areas, usually more than half a kilometer from the cultivator's homestead. Open cultivation focuses on field crops especially maize, that are grown under rain-fed conditions.

There has been considerable growth in urban farming in Zimbabwe as evidenced by the evolution of its perception from being trivial (Mbiba, 1995) to being mainstream (Tshuma and Mashoko, 2010). The highlight of this growth is the increased participation by the urban populace in open field cultivation. This increase was most notable in the period between 2007 and 2009 when Zimbabwe experienced a notable decline in the performance of its economy (World Bank, 2013). The connection between urban poverty and increased participation in UA by urban dwellers is well documented (Drakakis-Smith *et al.*, 1995; Bryld, 2003; Zezza and Tasciotti, 2010). AU is touted, among other benefits, to improve urban food security and improve the nutritional status of urban dwellers especially children (Crush *et al.*, 2011; Indraprahasta, 2013), but these benefits can only be realized if the level of productivity of urban cultivators is congruent with the demands placed on it.

The productivity of crop production systems is dependent on a number of factors, chief among them being the availability of water, hybrid seed, agro-chemicals and farm power (Clarke, 2000). This study sought to profile the maize production dynamics and practices in urban open field cultivation. The objectives of the study were to identify current and developing trends in yields, crop management practices, and the usage of farm power sources for land preparation in urban open field maize production. The availability of water and the use of hybrid maize seed were considered as hygiene factors. This was because production is completely under rain-fed conditions and the use of hybrid seed in urban areas is ubiquitous due to repackaging which makes it practically available at any price.

The knowledge made available by this study is of importance to individuals and organizations involved in the promotion of UA as well as service providers that target urban farmers. In addition, the study adds to the volume of knowledge that can inform policy formulation in urban planning.

Materials and methods

Study site

The city of Gweru covers about 26 113 Ha of the Sanyati catchment area. Gweru city lies in natural region III of Zimbabwe and receives an average rainfall of 600mm bordered by a minimum of 400 and a maximum of 850mm. The area receives most of its rainfall between November and March in a 6 months rainfall season stretching from October to April. It straddles across three soil types namely black basalt, red loams and gravel. An estimated 1-3% of the 158 233 population practices open field cultivation.

Data collection

In the first season (2011/12) an initial sample of 183 respondents was selected for data collection and was

tracked over three seasons. Tracking was possible due to the fact that cultivators would still come back to till their traditionally "owned" pieces of land even if they changed place of residence. All the respondents were active open field cultivators who owned fields in Mkoba, Senga, Ivene, Southdowns and Riverside. Of the initial 183 respondents only 178 and 163 participated in the 2012/13 and 2013/14 seasons respectively. In each season questionnaires were administered between December and February. This period was selected because it roughly coincides with the middle of the rainy season when the cultivators are most actively carrying out field operations. The questionnaire asked respondents about methods used in land preparation, crop management, yields and subsequent use of the produce.

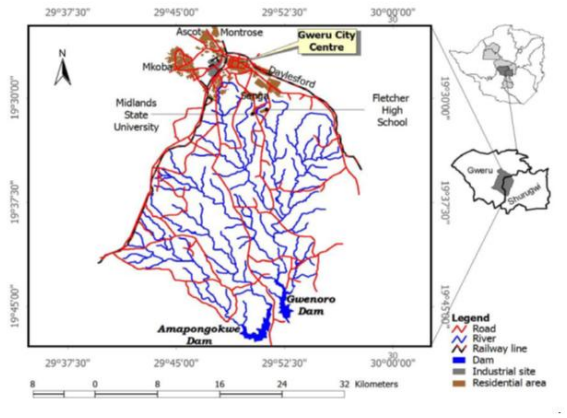

Fig. 1. Map of Gweru city in Zimbabwe.

Results and discussion

Sources of power for land preparation

On average over the three seasons the primary source of power for land preparation was manual power which provided 73.7% of all power for land preparation. Draft animal power (DAP) contributed 1.3% whilst motorized power provided 24.7% (Table 1). The trend can be attributed to the fact that open spaces are usually sub-divided into smaller fields and self-allocated to many farmers. The sizes thereof do not warranty an economically feasible use of motorized and draft animal power. These finding can be supported by who identified high reliance of manual power as characteristic of the majority of agricultural production in Sub-Saharan Africa. Although Bishop-Sambrook (2005) was referring to the general sub-Saharan Africa the situation of urban open cultivation can be the same. The low use of DAP is to be expected given that the keeping of cattle and donkeys in Zimbabwean urban residential areas is very rare. Those that utilized DAP relied on the services provided by peri-urban farmers who traditional have been allowed to keep such livestock on their plots.

Table 1. Sources of power used in open field cultivation.

Source of power	Percentage of power source usage
Manual	73
Draught Animal	2
Motorised	25

Trends in power source usage for land preparation

Motorized power contributed 26% of the power for land preparation in the 2013/14 season, there is an observable trend toward its increased use over the previous 2 seasons. In the 2011/12 season its contribution was 21% which increased to 24% in the 2012/13 season. An opposite trend is however observable in the contribution on manual power to land preparation; in the 2011/12 season its contribution was 79% which decreased to 72% in the 2012/13 season and finally to 70% in the current season (Table 2). There thus seems to be a gradual movement away from manual power toward motorized mechanization of land preparation in urban open field cultivation.

Table 2. Changes in power source usage over three seasons.

Power Source	Percentage of power source usage per season		
	2011/12	2012/13	2013/14
Manual	79	72	70
Draught animal	0	0	4
Motorised	21	24	26

Reasons for increased use of motorized power

The use of the tractor drawn plough for land preparation seems to stem from, not only its ability to reduce family labour, but also in the provision of a quality service at a fair price. Of those that utilized motorized power for land preparation, 64%

considered the price charged fair, and of the 36% not satisfied, 50% were disgruntled not by the price, but rather by the service being provided later than agreed.

The late provision of the service might be an indication that there are few providers and that the demand is overwhelming them. A more compelling theory however, might be that motorized cultivators, those who prefer to use motorized power, only start requesting for the service over a very narrow window period; 86% of these cultivators prepare their fields in October and November. Interestingly, this is very similar to manual cultivators (those relying on manual power) of which 86% also prepare their fields during the same time. The reason cited by the majority (80%) of motorized cultivators for preparing their fields at this time of the year is that the tractor will be available. The objective reality of this assertion is however, questionable since the service providers are either locals residing in the same suburb or on nearby peri-urban plots who can be contacted quite easily. It is most likely that, like their manual power utilizing counterparts (91%), motorized cultivators rely on adequate rainfall having fallen to start preparing their fields. Service providers only actively start marketing their services at this time because that is the only time when their service is required, making it appear as if tractors are only available at that time. It is the fact that open field cultivation is rain-fed agriculture that deters farmers from preparing their fields earlier. The risk is simply too great. Thus, the determinant of when land preparation commences is not the type of power utilized but rather, how cultivators assess the coming season, which assessment is heavily influenced by the commencement of effective rainfall.

Another compelling explanation as to the increased use of motorized power for land preparation is that it reduces drudgery (Clarke, 2000; Bishop-Sambrook, 2005). However, this seems to be not the case in urban open field cultivation. It seems that if cultivators are interested in reducing drudgery, it is the drudgery of their own family members in particular and not of manually performing agricultural operations in general. The findings of this study indicate that, associated with the increase in the use of motorized power for land preparation, is a possible increase in the use of hired labour for land preparation. In the 2011/12 and 2012/13 seasons none of the respondents indicated that that they employed hired labour for land preparation, but in the 2013/14 season 11% indicated having utilized purely hired labour for land preparation. In the meantime the use of purely family labour for land preparation decreased from 75% in 2011/12 season through 60% in the 2012/13 to 48% in the 2013/14 season.

An economic perspective on farm mechanization postulates that it is the "profit maximization" motive that leads to increased mechanization of agricultural operations (Clarke, 2000). Modifying such a perspective to the subsistence farming context, one would postulate that mechanization would be motivated by the desire to reduce household operating costs. Urban open field cultivation can be categorized, according to Vittuari and Segre (2010), as subsistence farming. Thus, if mechanization of urban open field cultivation was motivated by economics, then one would expect the majority of cultivators using motorized power to indicate reductions in household operating costs due to open field cultivation. This indeed is the case, of those that use motorized power; 86% indicated that they did not buy any mealie meal for their households because they harvested enough maize to cater for all their families' requirements for the whole year.

Planting and crop management

Planting

All planting is carried out manually; 97% using family labour and 7% using hired labour. The majority of cultivators (96%), open the planting station and drop seed in separate operations. This is congruent with the finding of this study that on average 2.75 people work per field making such division of labour possible: two open planting stations with the other following dropping and covering the seed. In addition, the 2.75 people per field might be the major

disincentive to the use of the planting line to produce straight rows, only 17% of cultivators use the planting line. When using a planting line an average of 4 people is required: 2 to hold the line, 1 to open the planting stations and the other to follow dropping and covering seed. Of course, it is possible to do the operation using 3 people but the operation would become more time consuming than not utilizing the planting line. Also, other than the aesthetic effect there might be no perceived benefit to using a planting line since all crop maintenance operations are carried out manually, virtually eliminating the need for fixed row spacing.

Crop maintenance

Crop maintenance is largely limited to weeding: all cultivators weed their fields mechanically using hoes: none utilise herbicides. Only 3% indicated using agro-chemicals for pest control, and 17% used scarecrows to deal with bird and animal problems.

The majority, 65%, of cultivators use the basal fertilizer Compound D (N_7 P_{14} K_7) whilst only 7% use ammonium nitrate, and 28% do not use any type of fertilizer on their maize crop.

When cultivators were queried about their reluctance to use herbicides and pesticides; 46% cited that they were expensive, 36% that they has not been trained in their use, 14% that they had not considered them as an option and 4% perceived them as too dangerous to use. These results are very much similar to those reported as being cited by communal farmers for not employing pesticides and herbicides in maize production (Muzenda *et al.*, 2004). It would thus seem that the production of maize in urban areas is heavily influenced by the practices the cultivators were exposed to in the rural/communal set-up: 93% of the cultivators indicated having a rural background. Also, because of the lack of extension services to urban cultivators, this communal farming based system for maize production is persistent even with new entrants without a rural background because the main source of farming knowledge to these entrants are the current cultivators. Though extension services are officially available to all farmers including urban farmers, the activities of Agritex in urban areas seem to be concentrated on officially recognized programmes NGO funded initiatives (Sammie *et al.*, 2014).

Yields and utilization of produce from open field cultivation

Yields from open field cultivation ranged from 0.9 – 3t/ha in the 2011/12 season, 0.65 – 3.8t/ha in the 2012/13 season and from 0.8 – 4.4t/ha in the 2013/14 season (Table 3). In the 2011/12 season 50% of the cultivators had yields less than 1t/ha, 30% yields of between 1 – 2t/ha, 15% yields between 2 – 4t/ha whilst only 5% had yields greater than 4t/ha. In the 2012/13 season 53% of cultivators had yields below 1t/ha, 34% yields between 1 – 2t/ha, 10% yields between 2 – 4t/ha and 3% yields greater than 4t/ha. The 2013/14 season saw 41% of cultivators achieving yields of less than 1t/ha, 34% yields between 1 – 2t/ha, 18% yields between 2 – 4t/ha and 7% yields greater than 4t/ha. On average yields were 1.1t/ha, 1.8t/ha and 3.1t/ha for the 2011/12, 2012/13, 2013/14 seasons respectively.

Table 3. Maize yields obtained by open field cultivators.

	Percentage of cultivators obtaining yields			
Season	**Less than 1t/ha**	**1 – 2t/ha**	**2 – 4t/ha**	**Greater than 4t/ha**
2011/12	50	35	15	0
2012/13	53	36	11	0
2013/14	41	34	18	7

Overall, 76% of cultivators consume all their produce, 20% sell part thereof to fellow residents in their suburb and only 3% sell to outside markets such as the Grain Marketing Board (GMB). It should be noted that some cultivators also own farms near the city as a result of the government of Zimbabwe's land redistribution programme (Sachikonye, 2003). In this study 5% of the respondents indicated owning such farms. These cultivators primarily reside in the city such that, in some cases, operations subsequent to harvesting such as shelling, bagging and storage are done in the city. The result is that produce from both the farm and urban open fields is mixed together

leaving no distinction as to its origin. It is this phenomenon that most likely explains the presence of cultivators that can harvest enough produce to sell to the GMB.

Conclusion and recommendations

It can thus be concluded that there is an increase in the use of motorized power at the expense of manual power in land preparation. Crop management practices in urban open field cultivation basically have not developed a unique trend of their own but are basically a reflection of contemporary communal crop management practices. In addition, there is a general increase in the yields of maize to appreciably satisfy household maize requirements however, this increase has not resulted in a sellable surplus to commercial buyers such as millers and the GMB. There exists a potential for increased maize production in urban open field cultivation if cultivators, in addition to the widespread use of basal fertilizer, also employ the use of top dressing fertilizers such as ammonium nitrate.

In addition further research must be carried out to quantify the spatial spread and distribution of urban open field cultivation around the major towns and cities of Zimbabwe. Such knowledge will better inform policy reforms with regards to the legitimization of open field cultivation and the minimization of negative impacts of urban agriculture especially agrochemical pollution and siltation of water supply sources.

References

Bishop-Sambrook C. 2005. Contribution of farm power to smallholder livelihoods in sub-Saharan Africa. Agricultural and Food Engineering Technical Report (FAO). Rome

Bryld E. 2003. Potentials, problems, and policy implications for urban agriculture in developing countries. Agriculture and human values, **20**(1), 79-86.

Clarke LJ. 2000. Strategies for agricultural development: The roles of the private sector and the government. FAO, Italy, Rome. Available at http://www.fao.org/fileadmin/user_upload/ags/publications/agr_mech_strat.pdf

Crush J, Frayne B, McLachlan M. 2011. Rapid Urbanization and the Nutrition Transition in Southern Africa. African Food Security Urban Network (AFSUN).

Drakakis-Smith D, Bowyer-Bower T, Tevera D. 1995. Urban poverty and urban agriculture: An overview of the linkages in Harare. Habitat International, **19(2),** 183-193.

Halloran A, Magid J. 2013. Planning the unplanned: incorporating agriculture as an urban land use into the Dar es Salaam master plan and beyond. Environment and Urbanization. DOI: 10.1177/0956247813500903.

Indraprahasta GS. 2013. The potential of urban agriculture development in Jakarta. Procedia Environmental Sciences, **17**, 11-19.

Mbiba B. 1995. Urban agriculture in Zimbabwe: implications for urban management and poverty. Avebury.

Muzenda S, Mashingaidze AB, Riches C, Ellis-Jones J, Chivinge OA. 2004. Weed management options for seasonal wetlands (vleis) in semi-arid areas of Masvingo Province, Zimbabwe. In Integrated Approaches to Higher Maize Productivity in the New Millennium: Proceedings of the Seventh Eastern and Southern Africa Regional Maize Conference, Nairobi, Kenya, 5-11 February 2002 (p. 113). CIMMYT.

Sachikonye LM. 2003. From 'growth with equity'to 'fast-track'reform: Zimbabwe's land question. Review of African Political Economy, **30(96),** 227-240.

Sammie B, Gwazane M, Nyamutowa C. 2014. Percespectives on the effectiveness of NGO initiatives in urban agriculture in Zimbabwe. International Journal of Scientific Research Vol **3(2),** pp5-6.

Tshuma DT, Mashoko D. 2010. Urban farming, its relevance, sustainability and policy implications: A case study of Gweru and Masvingo urban areas. Journal of Sustainable Development in Africa, **12**(3).

Vittuari M, Segre A. 2010**.** Structural change in republika srpska–small farms between subsistence orientation and modernization. APSTRACT: Applied Studies in Agribusiness and Commerce, 4.

World Bank. 2013. Zimbabwe Overview. Accessed at http://www.worldbank.org/en/country/zimbabwe/overview

Zezza A, Tasciotti L. 2010**.** Urban agriculture, poverty, and food security: empirical evidence from a sample of developing countries. Food Policy, **35(4),** 265-273.