

Resources endowment, income distribution and needs for technologies among peri-urban smallholders in the Gambia

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One reason of the modest adoption of improved technologies by smallholder farmers is that the majority of them are resource constrained. Structural constraints at the households level and institutional weaknesses have often prevented most of the farmers from joining the economic development process. This study analyses the production resources in relation with the income and the needs for improved technologies of the peri-urban farm households in The Gambia. The results are compelling. The majority of the production resources are owned by small fraction of the smallholders. As a consequence, their income is higher and mostly derived from agriculture, while the poor-resource households rely on a relatively wide variety of activities to compensate their low income. The poor-resource households have also the greatest need for improved technologies, although many would also need some kind of subsidies to uptake them. There is a clear need for more agricultural research, expertise and policy-making to transcend the traditional global understanding of smallholder farmers, and consider their heterogeneity in terms of production resources.

Keywords. Peri-urban agriculture, production resources, income, technology needs, the Gambia.

Dotation en ressources, distribution de revenus et besoins technologiques des exploitations agricoles peri-urbaines en Gambie. La contrainte en ressources productives constitue une des raisons de l'adoption modeste des technologies améliorées par les exploitants agricoles. En effet, des contraintes structurelles au niveau des exploitants et les faiblesses institutionnelles ont souvent empêché les agriculteurs de joindre le processus de développement économique. La présente étude met en exergue les relations entre les ressources de production, le revenu et les besoins en technologies dans les ménages agricoles peri-urbains en Gambie. Les résultats sont déterminants et indiquent que la majorité des ressources productives est détenue par une minorité des exploitants agricoles. Par conséquent, les revenus de cette minorité sont plus élevés et proviennent essentiellement de l'agriculture. En revanche, les exploitants pauvres en ressources tirent leurs revenus d'une multitude d'activités pour compenser la faiblesse de leurs revenus agricoles. En outre, ce groupe a les besoins en technologies les plus élevés, mais beaucoup auront également besoins d'une assistance supplémentaire pour les adopter. Il y a donc un besoin clair de plus de recherche agricole, d'expertise et de décision politique pour dépasser la compréhension globalisante des exploitants agricoles, et prendre en compte leur hétérogénéité en termes de ressources productives.

Mots-clés. Agriculture peri-urbaine, ressources productives, revenus, besoins technologiques, Gambie.

1. INTRODUCTION

During the past three decades, the urban population of developing countries has tripled (Rabinovitch, Schmetzer, 1997). One of the consequences of this rapid urban population growth is the increasing pressure of the peri-urban space for agriculture. In this context, traditional roles of rural and urban areas are changing. Rural areas traditionally devoted to produce food and

animal products for both urban and rural areas, are facing high exodus of manpower. Because of the low remuneration of agricultural and livestock production in the rural areas, most of the youth leave for hypothetical more incentive jobs in the urban areas.

At the same time, economic recession affecting developing countries limits job opportunities and income sources in the over-crowded cities. Consequently, the possibilities to find a steady employment in most

sub-Saharan African countries are constrained. A major part of the population, which has immigrated to cities, is then living in peri-urban areas. Deriving sufficient income from non-agricultural sources to sustain their livelihood is however problematic.

Peri-urban agriculture has emerged as a major economic activity during the 1980s (Tricaud, 1987; Rakodi, 1988; Yeung, 1988). In Central and West Africa, for instance, this represents the occupation of people of lower socio-economic status, because of difficult economic conditions in the cities (Hartvelt, Gross, 1992; Manshard, 1992), and lack of qualification to undertake non-agricultural employments. Those people are involved in agriculture first for food and secondly to earn some extra income. A large literature has shown the potentials of this agriculture in contributing to poverty alleviation and improving food security of city-dwellers in many West Africa countries. The Gambia is not an exception in this respect.

Despite the lack of data, the dynamic of peri-urban agriculture is observable within the Greater Banjul Areas (GBA) and surroundings. This includes rising of livestock and growing of vegetables and field crops. Peri-urban agriculture in The Gambia also includes women cooperative gardens, which receive technical and financial support from various donors. Those gardens are initially oriented towards vegetables production and are being implementing vegetable-livestock integrated systems with the support of the International Trypanotolerance Centre (Fall, Akinbamijo, 2000). The export of horticultural produce has also received considerable attention from the government and development agencies and is a prominent element of the state's export diversification program (The Gambia, 1993). However, it is strictly under the control of a few private companies and individuals who operate in the peri-urban zones of Banjul (Little, 2000). Last but not least, the third form of peri-urban agriculture that is currently marginalized, involves individual farm households producing a variety of goods. The characteristics of the latter form in the GBA and surroundings, its potentials and its implications for policy remain unexplored.

Because policies have often failed to nurture peri-urban agriculture or understand how it works, its economic potential remains largely untapped. Yet, the recent research interest and emerging literature on peri-urban agriculture has shown great economic potentials (Egziabher *et al.*, 1994; UNDP, 1996; Binns, Lynch, 1998), in terms of contribution to food security and poverty alleviation. Thus far, studies carried out in some developing countries, have generally focused on issues such as supply of food from rural to urban areas (Lynch, 1994), the functioning of urban markets for food staples (Bryceson, 1993) and land use and food marketing (Briggs, 1990, 1991).

Relatively little attention has been paid to know who these producers are and what they produce. There is no doubt that information about the resources available for a farm household is critical input for success of development policy. Such knowledge assures efficient allocation of the limited resources from the governments or other donors. In addition, the assets that individuals, households, or communities control are critical for their capacity to cope with vulnerability and to establish secure livelihoods. People living in the peri-urban areas are often partly farmers, partly laborers, and partly nonfarmers – and always consumers. As such, they may gain or lose in different dimensions at the same time, so that the net impact of technological change on households can remain ambiguous.

Farmers will obtain own-farm benefits from research and policy only if they adopt them. Even if a technology is proved profitable, two conditions are necessary and sufficient for farmers to adopt it. Firstly, the technology must correspond to the farmers' needs, which is the necessary condition. Secondly, the technology must be affordable, that is the input required by the technology must be available and accessible in terms of cost. In other words, the technology and policy must be appropriate and profitable with respect to the farming conditions.

In this respect, the functional-operational linkage with the research clientele should be improved to make research more demand-driven and to ensure continued research focus on priority constraints (Weijenberg *et al.*, 1993). This has been the motivation of the present study. Improved knowledge on smallholder farm households in general and particularly those in the peri-urban areas will help fostering economic development of this part of population that struggle to improve their livelihood. The overall objective is to contribute in seeking potential paths of development of the peri-urban agriculture in the Gambia. Specifically, the study aims at (1) typifying smallholder farm households, and (2) analyzing implications for income generation and demand for improved technology.

2. RESEARCH DESIGN

Data were collected in four locations (Penyam, Kitty, Kabekel, Siffor) of Kombo for 501 farms households, from May to June 2001. In the settlements of Kombo, numerous households rely on agriculture production for their livelihood (Faye, 2001). The household was defined as all members living in the house at time of interview including those persons who had stayed for more than one year and who shared meals. Most of them devoted themselves to food production on a half-time basis and the other engaged in non-agricultural income earnings activities in the cities.

Different but complementary research methods were used to complete this study. Two questionnaires were developed. The first one, designed as an informal survey checklist, was used to collect qualitative data on production and marketing contexts, constraints, and opportunities of agricultural production in the selected villages, in the frame of focus group discussions. Then a formal questionnaire survey was carried out from May to June 2001 to collect quantitative data. The survey covered in detail crop and livestock production, household income, household land and labor endowment and production objectives, etc. A recall period of 12 months was adopted to overcome the problem of seasonality of farm production into account.

3. DATA ANALYSIS

A simple classification function (Klecka, 1981) was applied based on the theory of maximum group differences while minimizing variation within groups. First, a K-means analysis was applied to detect group membership of the farm households. The principle is as follows: let n be the number of farmers whom p variables x_{ij} (for $i = 1, 2, \dots, n; j = 1, 2, \dots, p$) are collected from, the K-means clustering consists of allocating each observation to one K groups or clusters to minimize the within-cluster sum of squares:

$$\sum_{k=1}^K \sum_{i \in S_k} \sum_{j=1}^p \left(x_{ij} - \bar{x}_{kj} \right)^2, \quad (1)$$

where S_k is the set of farmers in the k^{th} cluster and \bar{x}_{kj} the mean for the variable j over cluster k .

Secondly, a canonical discriminant function (equation 2) was derived to apprehend the nature of group differences. It has the following mathematical form:

$$f_{kn} = u_0 + u_1 X_{1kn} + u_2 X_{2kn} + \dots + u_p X_{pkn}, \quad (2)$$

where f_{kn} is the value (score) on the canonical discriminant function for case m in the group k ; X_{ikn} represents the value on discriminating variable X_i for case n in group k ; and u_i are coefficients that produce the desired characteristics in the function. The coefficients for each function are derived so that group means on the function are as different as possible. Non-parametric Wilcoxon tests are applied to test the differences between the K groups formed.

The above methods were supplemented with descriptive statistics based on means and standard deviation. Comparison tests on means of resource,

income, and independence tests for activities patterns and needs for agricultural technology, were also carried out.

4. RESULTS

4.1. Farming systems, products and production objectives

The farming system in the peri-urban areas of the Gambia is characterized by diversity in crop and livestock production. Crop production systems comprise cereals, vegetables and fruit trees. The most common fruits are mango and orange, while the common vegetables are cabbage, okra, pepper and garden eggs. The most frequently produced cereal is rice, grown by 80.4% of the population. Groundnut, the main country cash crop, is grown by 49% of the surveyed households. Farm households often practice mixed productions. The combination of rice, millet and groundnut is predominant (24% of the sample), followed by the combination of rice and millet (17%). Farming equipment remains traditional hand-tools, though some farmers own draft animal and apply few chemical fertilizer, when available, as well as organic fertilizer.

Livestock production is also characterized by the diversification of species. Most of the households with livestock (29.8% of the sample) are mainly engaged in goats' husbandry. This translates into about 150 farm households involved in livestock production, out of which 56.6% own poultry, 50% cattle and 30% sheep. The combination of cattle and goats ownership is commonly practiced by 20% of the livestock owners sub-sample. All species are reared in an extensive manner, except for poultry where cases of semi-intensive management were observed.

4.2. Typology of peri-urban smallholders farm households

Results from discriminant function analysis indicate that 99.6% of the original grouped cases using K-Means Cluster analysis were correctly classified. Two cases failed to belong to their initial class allocated through the K-Means clustering method. Group membership classification indicated that 3.19% of the cases belong to a group that can be referred as to medium resource farms, and 96.81% to poor-resource farms. Peri-urban smallholder farm households can then be discriminated into two unequal groups according to their endowment of land, labor, cattle, sheep, goats, pigs and poultry.

Test of significance of the discriminant function provided the Eigenvalue of 3.266 with a canonical correlation of 0.875. These test statistics suggest that the estimated function significantly discriminates

smallholders on the basis of their resource endowment. Results of tests of equality of group means and standardized discriminant coefficients are summarized in **table 1**. Except the means of poultry owned by each group, the results indicate high significant differences (at 1% level) of resources endowment between the two groups for the size of household, land cultivated, the number of cattle, pigs and sheep. Likewise, the average number of goats per household is significantly different at 5% level between the two groups. On the other hand, there was no significant difference between both groups for the number of poultry.

The overall test of the discriminant function yielded Wilks' Lambda of 0.234 (Chi-square = 720.235 with $df = 5$). The standardized canonical discriminant function coefficients shows the variables that contribute to well discriminate between smallholder farm households. Cattle number has highly and positively contributed to discriminate cases into the two groups.

Table 1. Results of tests of equality of group means and standardized discriminant coefficients — *Test d'égalité des moyennes de groupes et coefficients discriminants standardisés.*

Variable	Wilks' lambda	F	Df1/Df2	Coefficients ¹	Significance
Household size	0.866	77.06	1/499	0.271	0.000
Land cultivated	0.923	41.59	1/499	0.144	0.000
Cattle	0.273	1326.07	1/499	1.002	0.000
Goats	0.992	4.139	1/499	-0.127	0.042
Pigs	0.973	13.79	1/499	0.223	0.000
Sheep	0.910	49.21	1/499	-	0.000
Poultry	1.000	0.025	1/499	-	0.875

¹ Standardized canonical discriminant function coefficients — *Coefficients standardisés de la fonction canonique de discrimination* ; Df is degree of freedom (not included in the function) — *Df est le degré de liberté (non inclu dans la fonction)* ; F is the Fischer statistic — *F est la statistique de Fisher.*

Table 2. Structure of resources endowment of smallholder farm households — *Structure de la dotation en ressources des exploitants agricoles.*

Group	Statistics	Cattle	Cult. land	Goats	Sheep	Hh. size	Pigs	Poultry
Medium	N	18	18	18	18	18	18	18
	Mean	59.78	12.78	3.39	2.72	27.39	0.94	2.22
	St. Error	7.50	3.77	1.26	1.09	4.96	0.94	2.22
Poor	N	483	483	483	483	483	483	483
	Mean	0.85	5.19	1.77	0.31	11.22	0.07	2.52
	St. Error	0.15	0.18	0.15	0.05	0.31	0.03	0.36
Total	N	501	501	501	501	501	501	501
	Mean	2.96	5.46	1.83	0.40	11.80	0.10	2.51
	St. Error	0.58	0.23	0.15	0.06	0.37	0.04	0.35

Cult.land = cultivated land — *terre cultivée* ; Hh. size = Household size — *taille du ménage* ; N = number of cases — *nombre d'observations.*

Variables such as the household size, the number of pigs and the size of the cultivated land are positively related to belonging to the medium resource farms household group. The more the farm household owns those resources, the higher the probability that he belongs to medium resource group. On the other hand, the more the household owns goats, the lower the probability that he belongs to the medium resource households. Finally, the ownership of sheep and poultry does not discriminate among farm households.

Table 2 shows the descriptive statistics of the two resource-based types of smallholder farm households. On average, a medium farm household owns 60 heads of cattle, 13 ha of cultivated land, and 3 goats. Its household size averaged 27 persons. On the other hand, a poor-resource farm household owns on average 1 head of cattle, 5 ha of cultivated land, and 2 goats. The average household size for this group is 11 individuals. Raising poultry and sheep did not significantly contribute to differentiating resource-based households categories. In general, the average resources own among the medium resource group of farm households are above the overall average of the sample. The averages among the poor-resource farms are below the overall sample average.

4.3. Income-generating options for the peri-urban smallholders

This dichotomy among the peri-urban farms households is translated into a huge income inequality. It is worth noting that the extensive diversification of farm and off-farm activities contributes considerably to the smallholders' income generation in the peri-urban areas of the Gambia. The production, transportation and marketing of fruits are significant income generating business, as well as satisfying the basic needs of the households. About 70 to 90% of these products were sold along roadsides. Most of the medium resource farms households were involved in such production

and were the most beneficiaries of incomes from the fruit sub-sector. Secondary income-generating options in the peri-urban area were milk and small ruminants sales, and in a least measure large ruminants sales.

Table 3 presents an estimation of farm households income derived from peri-urban agriculture. The results suggest that income earnings are related to the farm resource endowment; the wealthier the farm household, the higher the income that is derived from farming. The agricultural gross income averages Dalasi 10,523.33 (US\$701.55) and Dalasi 3,637.47 (US\$242.49), for the medium resource and poor-resource farm household, respectively.

Peri-urban farm households have a multiplicity of income sources. In the medium farm group, agriculture income accounts on average for 90% of the total household income. This is generated through selling fruits, milk and livestock, especially small ruminants. On the other hand, total income for the poor-resource farm group is derived from up to four categories of sources, namely wage income or allowances from petty jobs in the nearby towns, farm income, particularly from selling groundnut and horticultural products, business income (including petty trade) and remittances from relatives working in towns or abroad. The share of agriculture in those households' incomes was estimated to be about 50%.

4.4. Household resource endowment and the types of activities of the head

Smallholder producers in the peri-urban area of the Gambia are involved in many activities (**Table 4**). Poor-resource farm households rely on a relatively wide range of activities for their income. Many of them (32%) are only involved in crop production. Another important sub-group (31%) combines crop production with off-farm activities. These off-farm activities include carpentry, tailoring, local bakery and care taking. Finally, a third sub-group of poor-resource farms (23%) are practicing mixed crop-livestock farming. In contrary, the medium farm households are

Table 3. Estimation of peri-urban smallholder farm households' income (Dalasi per year) – *Estimation du revenu des exploitants agricoles peri-urbains (Dalasi par an)*.

Resource-based	Member-ship	N	Mean	Standard error	95% confidence for means	
					Lower bound	Upper bound
Medium	18	10,523.33	2,242.44	5,792.20	15,254.46	
Poor	483	3,637.47	2,487.14	-1,249.50	8,524.45	
Overall	501	3,884.87	2,399.66	-829.78	8,599.52	

US\$1= GD15.

involved in a limited number of activities. Many (61%) are involved in integrated crop-livestock production, and 28% in crop farming and off-farm activities.

Statistically, the test of independence between the types of activities the farm household's head is involved in and the type of resource-based farms suggest that both are highly related. The medium resource farm households are mainly practicing integrated crop-livestock production, while the poor-resource farm households are concentrated in crop production. In addition, the latter group are involved in a wider range of activities than the former.

4.5. Potentials and constraints for adopting improved technology

The implications of the farm households' resources and consequently its income on its potentials to uptake improved agricultural technologies are investigated in this section. From the farmer perspectives, the needs for improved technologies are an important step towards adoption. Based on this, the objective is to test whether the resource-based discrimination adds information to better understand the farm household's needs for improved agricultural technologies. Four groups of technologies were recorded: livestock feeding for meat and milk production, crossbreeding for milk production, soil fertility management and draft power for crop production. These technologies are related to the production objectives, which are grouped into

Table 4. Income-generating activities and smallholders resource-based group membership – *Activités génératrices de revenus par type d'exploitant agricole*.

Activities	Group membership	
	Medium resource farms	Poor-resource farms
Crop farming and off-farm activities	5	149
Off-farm activities	0	9
Crop farming and other on-farm activities	0	20
Crop farming and civil employment	1	38
Civil employment	0	1
Crop and livestock production	11	110
Livestock production	0	1
Crop production	1	153
Not stated	0	2

Test of independence: chi-square = 15.814 — *Test d'indépendance* : $\chi^2 = 15,814$; $df = 8$ — $df = 8$; Asymptotic Significance (2-sided) = 0,045 — *Signification asymptotique* = 0,045.

increase meat and milk production, and increase crop production.

Table 5 summarizes the results of the test of combination between resource-based groups of farm households and needs for improved technologies. The results show an obvious potential for technology transfer among the survey population. However, it is worth noting that a huge number of poor-resource farms (89%) did not show up any needs for improved technologies, whereas all medium resource farmers did. One of the explanations given during the survey was the inability for those farmers to pay for any technology. Unless the technology is subsidized, they did not find the usefulness of needing something that is known unaffordable. Nonetheless, with the valid observations, the results indicate that the most needy group belongs to the poor-resource.

Indeed, out of the expressed needs for feeding technology to increase meat production, 71% come from the poor-resource farm household group. Similarly, needs for improved technologies to increase milk production (feeding and crossbreeding technologies) and to increase crop production (draft power and soil fertility) are in majority requested by the poor-resource households. Proportionally, livestock production technologies are shown to be more attractive than that of crops. In particular, the needs for technologies to increase meat production are high (66%), followed by crops (19%) and milk production (15%).

5. DISCUSSION

Farming in the peri-urban areas constitutes for the low socio-economic status people in the Gambia an opportunity to improve their live standard. Those farmers have access to markets in the cities where agricultural produce can be easily sold as compared to their counterparts in remote locations of the country where transport and market infrastructures are often

lacking. However, the debate on peri-urban agriculture often simplifies the diversity of conditions under which farm households operate and therefore fails to understand who the farmers are. The concept of low economic status attached to the peri-urban farmers has led to general development approaches that ignore the heterogeneity of this population.

This study shows that smallholder farm households must not be considered as a unique entity if development policy for peri-urban agriculture is to alleviate poverty in this class of the population. Indeed, this category of farm households differs from each other in their livelihood. By definition, the households' livelihood comprises the capabilities, assets (including both material and social resources) and activities required for means of living (Ashley, Carney, 1999).

The survival strategies developed by the so-called smallholder farm household in the peri-urban of the Gambia are related to the productive resource endowment. One of the complex issues raised by this study is the huge heterogeneous pattern of the resource distribution among the farm households. A small fraction of the population owns almost the totality of the resources. This inequality in term of resources endowment is translated into a low agricultural income for the poor-resource farm household's heads. Similar results were reported for Kampala households in Uganda (Bigsten, Kayizzi-Mugerwa, 1992). To compensate for the low agricultural income, poor-resource farm households are involved in more diversified economic activities.

Inequality in resources allocation and subsequently in income also has implications on the needs for improved technologies. The study revealed that although both resource-based groups of farm households have expressed needs for technologies, the poor-resource group has proportionally shown the highest potential demand. This is likely because of their willingness to close the gap between them and the medium resource people, and get their family out of poverty. However,

Table 5. Group membership, production objectives and revealed needs for technologies — *Types d'exploitants, objectifs de production et besoins révélés en technologies.*

Technologies for	Meat production (Feeding strategy)	Milk production (Feeding strategy and improved breeds)	Crop production (Draft power and soil fertility)
Medium group^a	14	1	3
% within group	77.8	5.6	16.7
% within objectives	29.2	9.1	21.4
Poor group^b	34	10	11
% within group	7.0	2.1	2.3
% within objectives	70.8	90.9	78.6
Total valid N^c	48	11	14

^a cluster number of wealthy group total count is 18 — *le nombre total dans le groupe moyennement riche est 18*; ^b cluster number of poor group total count is 483 out of which 55 cases were valid observations — *le nombre total dans le groupe pauvre est de 483, dont 55 ont exprimé leurs besoins en technologies*; ^c then total valid observations are 73 — *d'où le nombre total ayant exprimé leur besoin, en technologies est de 73.*

the most attractive technology appeared to be feeding strategies for meat production, which is referred as to fattening technology for both medium and poor-resource groups, because of evident demand for meat in the nearby cities. As opposed to the results in the rural Gambia (Barton, Bennison 1997), peri-urban farmers are oriented towards productivity increase. Access to the market and the reduction of grazing areas are the major reasons why the peri-urban farmers are willing to invest in feeding strategies.

Therefore, there is need for distinguishing features and drawing attention on the farm household level characteristics of smallholders farming systems in developing countries when evaluating opportunities for improvement (Swallow, 1997; McDermott *et al.*, 1999). Research and extension interventions should be targeted and it appears important to know the target population. Early study in the rural Gambia by Agyemang *et al.* (1997) showed that livestock owners behavior toward technologies for livestock production was related to their socio-economic status.

Looking at the expressed needs for improved technology, a priority seems to be given to the short-term technology by farm households. Among these short-term technologies are the feeding strategies for meat and milk. Farmers' awareness about the short-term effectiveness of these technologies has likely been determinant. This rational behavior of smallholder farm in the peri-urban of The Gambia is consistent with the evolving economic environment. It should not be interpreted as if farmers are pursuing only short-run production objectives, but rather as a way to strengthen their production basis before embarking in any long term and risky technology. As argued by Holden *et al.* (1993) a viable technology from the farmer perspective is the one that can contribute to secure income in the short term and increase the family welfare.

Finally, this study shows that even if farm households' resources were taken into account, there is still an important problem to deal with. The majority of peri-urban farm households will likely be left out of the development process, because they simply cannot afford for improved technology unless special support is provided. This category of farm households belongs to poor-resource group. This raises a question on how to alleviate poverty in developing countries in general and in the peri-urban areas in particular, when 85% of the population are poor-resource people. Although there is no definite answer to that question, it seems that one possibility is to put in place strategies for resources accumulation. This is relatively easier in the case of livestock than land. Experiences have shown land redistribution policy also end up with more social and political problems than expected. On the other hand, small ruminants have been successfully used in some African countries to build stock for

rural population. One reason of the modest adoption of improved technologies by smallholder farmers is that the majority of them are resource constrained. Structural constraints at the households level and institutional weaknesses have often prevented most of the farmers from joining the economic development process. Policies and institutions need therefore to focus on investing in resourceless people for poverty alleviation and sustainable resources accumulation and use (Ruben *et al.*, 2003).

6. CONCLUSION

It is clear that a bold vision is now needed incorporating a comprehensive and realistic assessment of the production conditions at the farm households with a view to design appropriate policy and technology for improving the economic contribution of the peri-urban agriculture. This requires a new approach, which draws on the past experiences that have often increased the inequality among farm households. The exclusive promotion of few cooperative gardens and private enterprises exporting horticultural produce, has left the majority of the peri-urban households on their own.

There is a clear need for more agricultural research, expertise and policy-making to transcend the traditional global understanding of smallholder farmers, and consider their heterogeneity in terms of productive resources. The motivations of the producers must therefore be closely examined in relation with the available resources in order to design and implement meaningful research and development policies. These and other issues related to agricultural production in and around cities require further careful consideration, leading to the formulation of appropriate and specific policy recommendations.

This study shows that differences in production resources are translated into differences in income. This in turn is reflected in the smallholders' needs for improved technologies. As a consequence of the poor resource endowment, majority of the farm households feel unable to cope with any technology, and are likely to be left aside of the development paths. In addition, when the farmer is in a position to uptake any technologies, short-term technologies are relatively more attractive than long term ones.

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