International Scholars Journals

African Journal of Tropical Agriculture ISSN 2375-091X Vol. 4 (4), pp. 001-007, April, 2016. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Farm input marketing in western Kenya: Challenges and opportunities

Jonas N. Chianu*, Franklin Mairura, Isaac Ekise and Justina N. Chianu

Tropical Soil Biology and Fertility institute of the International Centre for Tropical Agriculture (TSBF-CIAT), c/o World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Accepted 08 February, 2016

Widespread and increasing rural poverty in sub-Saharan Africa has been of great concern to development community. Low use of inputs by farmers, due to market constraints that reduce profitability of input use, is one of the factors responsible for the gap between potential and actual yields. Using questionnaire, this study interviewed 130 agro -input dealers in Kenya to analyze challenges and opportunities in input delivery. Results indicate that there has been a steady annual growth (2 – 22%, with mean of 16%) in their number. Di-ammonium phosphate fertilizer (stocked by 92% respondents) was most commonly stocked, followed by Calcium Ammonium Nitrate fertilizer (84%), Urea (78%), and NPK (40%). Other services provided by agro-dealers are input information (75% respondents), credit (13%), bulk breaking (8%), and spraying (4%). Inputs selling price increased with distance to markets; long distances to market disconnect villages from input supply chain. High transport cost (53%), low demand (30%), lack of market information (21%), lack of storage facilities (13%), and limited business knowledge (12%) were the most important constraints faced by agro-dealers. Policies and institutional frameworks suggested by dealers to streamline input trade were associated. The study concludes with suggestions on how to enhance efficiency of agro-dealers in input delivery.

Key words: Farm input delivery, market constraints, poverty, yield gap, Kenya.

INTRODUCTION

Widespread and increasing rural poverty in sub-Saharan Africa (SSA) has been of great concern to the development community. Compared to other developing regions of the world, the low use of farm inputs by smallholder farmers in SSA is responsible for the gap between potential farmers' yields and actual crop yields at farm level. A comparison of fertilizer consumption trends in SSA and developing countries of Asia shows that while average annual fertilizer consumption increased by 182% in the latter between 1980 – 1989 and 1996–2000, it increased by only 16% in the former (FAOSTAT, 2003). The slow growth in the use of modern agricultural inputs in the farming systems of SSA has resulted in missed opportunities to increase Africa's agricultural production, productivity, and household incomes and welfare. Fertilizer use in SSA is the lowest in the world and is actually less than 10% of the global mean (about 93 kg ha^{-1}) (IFDC, 2006).

This paper examines constraints and challenges limiting the expansion of farm input use by smallholder farmers in Western Kenya by assessing input supply side issues. This is critical in creating conducive atmosphere for agricultural intensification and to enable farmers (especially smallholders) produce for markets and lift them out of poverty. The study surveyed agro-input dealers in order to ascertain why their farm and other services are not reaching many farmers, especially those in remote rural areas. An important element of the study was to assess the main farm services provided by agro-input dealers, the constraints and challenges they face and the policy and institutional frameworks they would want to see implemented in order to enhance the environment for a sustainable expansion of their areas of coverage and the access of smallholder farmers to farm inputs and the other services that they provide. This type

*Corresponding author. Email: j.chianu@cgiar.org. Tel:+(254 20) 7224778. Fax:+(254 20) 7224764/3.

of study has a great potential to contribute in the attainment of the goal of the Comprehensive Africa Agricultural Development Program (CAADP) that calls for a 6% annual growth in agricultural production as a framework for restoring agricultural growth, food security and rural development in Africa and a key step towards attainment of first Millennium Development Goal of halving poverty by 2015.

MATERIALS AND METHODS

Study area

The study was carried out in 13 districts in Western Kenya, a densely populated region of Kenya with high levels of hunger, extreme poverty, and disease. Over 21% of the region's children under five years of age are underweight (malnourished). Adult HIV/AIDS prevalence is estimated at 30% in much of the region, leaving large numbers of orphans. Western Kenya is also characterized by low crop yields and low household cash incomes (Kelly et al., 2003). Potable water, paved roads, electricity, and telephone landlines are all scarce in this region. Most residents are subsistence farmers. However, farm sizes are so small and often in the neighborhood of 0.1 hectares. Farm inputs (such as fertilizer, improved seeds or water pumps) are also very scarce. Rainfall is unpredictable often resulting in low crop and livestock productivity. Many families have difficulty producing enough food to meet their needs. Those who manage to produce a surplus have difficulty finding buyers or getting good prices.

The altitude in the study area ranges from low-medium (1000 to 1300 *m.a.s.l*) in places such as Kasewe in Rachuonyo district, through medium (1270 to 1320 *m.a.s.l*) in places such as Mabole (in Butere district) and Akiites (in Teso district) to high (1500 to 2100 *m.a.s.l*) in places such as Oyani (in Migori district) and Riana (in Kisii district) (Jaetzold and Schmidt, 1982). Average annual rainfall is between 1200 and 2100 mm for Riana area, 1400 and 1600 mm for Oyani area, 1300 and 2000 mm for Mabole area, 900 and 2000 mm for Akiites area, and 1000 and 2200 mm for Kasewe area (Jaetzold and Schmidt, 1982) . Annual mean temperature ranges between 16.2 and 20.5^{O}C for Riana area, 20.5 and 21.7^{O}C for Oyani area, 22 and 27^{O}C for Mabole area, 21 and 22^{O}C for Akiites area, and 20 and 21.5^{O}C for Kasewe area (Jaetzold and Schmidt, 1982).

Survey method

A cross-section survey using structured questionnaire was used to collect data from 130 agro- input dealers randomly selected from 40 markets from 13 districts. Data collection was done between the months of February and November 2005.

Parameters investigated

Among others, the main variables on which data were collected were the agro-inputs sold, quantity of different inputs (different types of fertilizers, seeds, farm tools, etc.) stocked, prices at which different inputs were sold, distances from where different inputs were sourced, additional farm services offered to farmers, constraints and challenges faced by the agro- input dealers, and the policies and institutional frameworks which the agro-input dealers would like to see implemented in order to enhance their efficiency and areas of coverage in timely provision of farm services to the smallholder farmers, including those in far rural areas.

Data entry and analysis

Microsoft Excel was used for data entry. Online distance calculator (ODC), based on the World Geodetic System WGS84 (DMA, 1991) ellipsoid, was used to estimate distances between input selling and purchasing points. Data was analyzed using SPSS version 11.5 (SPSS, 2002). The World Geodetic System reference coordinate frames were established more than a decade ago to facilitate mapping, charting, positioning and navigation applications.

RESULTS AND DISCUSSION

Trends in the number of agro-input dealers in Western Kenya

The services of agro-input dealers are critical to farmers' access to affordable quantities of appropriate farm inputs in their local environments. Between 2003 and 2005, the increase in number of agro-input dealers ranged from 2% (for seed treatment chemicals) to 22% (mineral fertilizers) with a mean of 16% across agro-inputs (Table 1). The difference in the magnitude of percent increase (between 2003 and 2005) in the number of agro- input dealers selling different inputs reflects the demand for different agro-input in the farming systems of Western Kenya. Although many farmers were yet to be reached with the various farm services of the agro-input dealers, the trend in the growth of the number of agro-input dealers is encouraging, especially considering the current sub-Saharan Africa wide low level of infrastructure development in support of good network of private agro-input dealers and the usual period of slow, gradual growth before experiencing a period of relatively dramatic and rapid growth that characterize a typical technology adoption process (Surrey, 1997). For instance, the kilometers of paved roads per million people in selected African countries are 59 for DR-Congo, 66 for Ethiopia, 94 for Uganda, 114 for Tanzania, 141 for Mozambique, 230 for Nigeria, 494 for Ghana, 637 for Guinea, 1402 for South Africa, 1586 for Zimbabwe compared to 20,987 for USA, 12,673 for France and 9,102 for Japan and with 1,064 for Brazil, 1,004 for India and 803 for China (Encyclopedia Britannica, 2003) (Table 1).

Farm inputs stocked

Altogether, the agro-input dealers surveyed sold about 2357 bags (or about 118 tons) of mineral fertilizers annually (Table 2). The corresponding figure for improved seeds was about 10 tons. The average for the liquid agro-chemicals ranges from about 490 litres (for herbi-cides) to about 1600 litres (for seed treatment chemicals) (Table 2).

Table 2 clearly shows the low demand that agro-input dealers ranked second to high cost of transport among the constraints and challenges that they face in trying to provide inputs to smallholder farmers. Coupled with the

Table 1. Number of agro-input dealers selling different farm inputs in Western Kenya: 2003 - 2005.

Agro-input	Number of input dealers[#]			% Increase (2003-2005)
	2003	2004	2005	
Mineral fertilizers	245	276	299	22
Insecticides	314	351	372	19
Farm Machinery	69	78	82	19
Herbicides	61	67	72	18
Fungicide	234	255	275	18
Improved seeds	176	189	198	13
Storage chemical	244	263	271	11
Seed treatment chemicals	43	43	44	2
Total across inputs (*not mutually exclusive*)	1498	1643	1742	16

[#]Responses was collated for different input brands within each agro-input category. Hence, for some inputs, the number of dealers is more than the sample size because of the grouping together of similar inputs.

Table 2. Mean quantity of different farm inputs sold by agro-input dealers in Western Kenya: 2003 – 2005.

Agro-input	Quantity	n*
Mineral fertilizers (bags)	2357.0	383
Improved seeds (kg)	10144.0	186
Fungicide (litres)	416.5	299
Insecticides (litres)	671.0	273
Storage chemicals (litres)	868.0	223
Herbicides (litres)	491.2	69
Seed treatment chemicals (litres)	1616.0	46
Machinery (units of different tools)[#]	236.3	17
Other farm implements (units of different tools)[&]	187.7	17

*Each input category included several specific input brands; hence n was larger than number of agro-input dealers

[#]Machinery here includes: tractors, sprayers, and spare parts.

[&]Other farm implements here include: long hoes, short hoes and cutlasses

usually high prices of most agro-inputs, these constrain the development of efficient farm input distribution systems and are fed into by farmers' inability to sell their farm surplus produce at high prices, especially immediately after harvest. This situation contributes to poor land stewardship, accelerated land degradation, decline in household welfare, and negatively affects farmer investments in farm inputs and returns to agricultural production (Bashaasha, 2001). To break the cycle of high input price, low input demand, the need to stimulate a huge increase in input demand is critical. This requires reduction in input prices (through economies of size, new institutional arrangements, etc.) at the farm-level, credit availability to farmers for the purchase of agro-inputs, and attractive prices for farm produce (Table 2).

Other farm services that input dealers provide to farmers in Western Kenya

Only 2 – 11% of the agro-input dealers surveyed provided other services to small-scale farmers. Farm services most commonly provided by the farm input dealers were information [especially related to agrochemicals (24% of respondents) and improved varieties of seeds (22%)]. The least important farm services that dealers provided farmers included credit and spraying services. Twenty-seven agro-input dealers (or 18% of the respondents) provided farmers with credit services. However, only three agro-input dealers (about 2% of all respondents) provided farmers with spraying services. It is little surprising that only few agro-input dealers provided credit to

Table 3. Number of farmers who benefited (according to dealers) from different other farm services given by agro-input dealers in Western Kenya.

Other agro-input service	Number of farmers that benefited from service*	
	Female	Male
Input packaging	3100 (2)	15000 (2)
Soil suitability information	796 (7)	3650 (7)
Soil fertility information	787 (7)	3645 (7)
Seed variety information	656 (13)	2656 (12)
Agrochemicals information	735 (14)	2328 (13)
Credit facilities	255 (12)	298 (12)
Spraying[&]	30 (3)	75 (3)

*Values in parenthesis are effective sample sizes of agro-input dealers who offered serviced
[&]Free and at cost

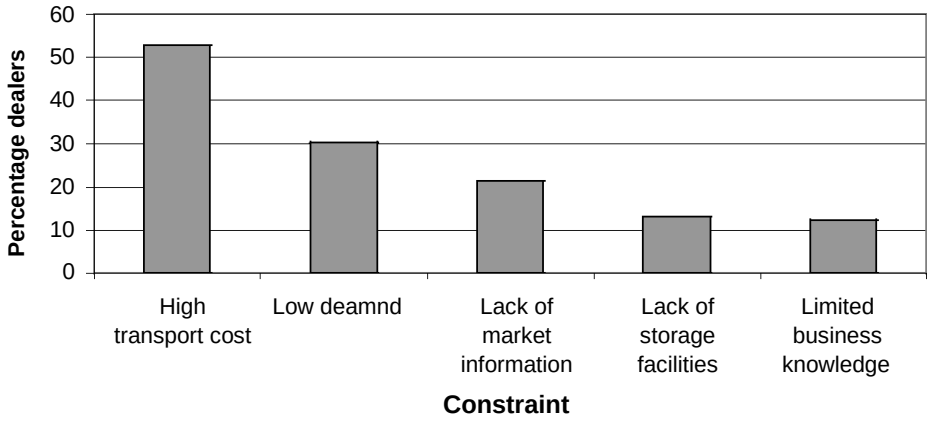

Figure 1. Business constraints faced by agro-input dealers in Western Kenya.

smallholder farmers since many of the traders themselves lacked access to financial resources beyond their own savings and income (Yanggen et al., 1998). This is critical especially considering that farm inputs such as fertilizer are expensive to market (high storage and transport costs) and to purchase and underscore the fact that both the input-dealers and farmers lack access to critical service markets (especially credit markets). This is a typical example of how the private sector growth is constrained by a weak enabling environment.

It is critical that credit guarantees are used to link farm input manufacturing companies with agro-input dealers. Successful instances of smallholder farmer adoption of technologies (e.g., in Malawi) have demonstrated the importance of credit as an important enabling factor.

The above information was gender disaggregated to provide a better understanding of the distribution of farm services by input dealers. Agro-input buyers (mostly farmers) benefited through input packaging. Data from the agro-input dealers show that of about 18100 customers (farmers) that benefited from this service, about 83% were male farmers. Although only a few of the surveyed agro-input dealers gave an estimate of the farmers that benefited from their other farm services, it is striking that in 100% of the cases, more male farmers than female farmers benefited from the farm services of agro-input dealers (Table 3). This was the case for both free farm services (e.g., some aspects of the spraying services) and the services that were paid for. This is generally expected because, compared to their male counterparts female farmers are less likely to have contact with agro-input dealers due to their more limited financial resources than male farmers.

Business incentives and constraints

The agro-input dealers surveyed generally lacked business support and faced about five major business constraints including high transport cost (mostly due to poor infrastructure), low demand, lack of market information, lack of storage facilities, and limited business skill and knowledge (Figure 1). The high cost of transport must have been due to the long average distance covered (and many hours' drive away) by agro-input dealers to source their goods. This shows how infrastructural cha-

Table 4. Mean distances (Km) traveled by agro-input dealers to acquire selected farm inputs.

Input	Distance (Km)
Improved seeds	112.6 (97)
Storage chemicals	99.7 (22)
Farm machineries	92.8 (350)
Other agro-chemicals (herbicides, pesticides, etc.)	86.3 (71)
Mineral fertilizers	79.5 (182)

Values in parenthesis refer to the number of sourcing distance included in determining the statistics in the table.

Table 5. Correlation between distance from where traders sourced farm inputs and the selling price.

Input	Correlation
Murate of potash	1.000**
Improved millet seeds	1.000**
Tractor	1.000**
Thiram	0.574*
NPK fertilizers	0.543
Improved sorghum seeds	0.209
Urea fertilizer	0.19
Improved seeds of common bean	0.174
Improved maize varieties	0.014

Source: Computed from survey data, 2005

llenges undermine farmers' access to necessary farm inputs, food security, and impede growth. Poor domestic infrastructure (in much of Africa) and limited access to agricultural credit (including seasonal credit) also undermine the effect and equitable participation of many African countries in world trade. Africa's road density was less than India's in 1960 (Sanchez, 2005). All these explain why the farm gate prices of inputs are generally high and why many smallholder farmers use few purchased inputs. The result of a recent study on fertilizer supply chains suggests that lowest fertilizer prices occur in areas where the retail outlet is developed (Chemonics, 2007). Kelly et al. (2003) earlier identified the serious deficiencies in roads, education, market information systems, and supportive institutions as the major limitations that need to be addressed by governments to expand farm input use, increase agricultural productivity and improve the livelihoods of smallholder farm families in SSA. Recently (June 2006), an Africa Fertilizer Summit declared that the Africa Union Member States should, among others, take specific actions to improve farmer access to market information. This is in line with the Comprehensive Africa Agriculture Development Programme (CAADP)'s Pillar II agenda, which seeks to improve Africa's infrastructure and trade-related capacities for market access.

In western Kenya, the distance from agro-input marketing points to paved roads ranged from 0 (where market is next to a paved road) to 3 km. However, the distance (km) that agro-input dealers had to travel to source the farm inputs sold ranged from 20 km to over 300 km, indicating a more or less inaccessible distance. For specific farm inputs, the mean agro-input sourcing distance ranged from about 80 km (inorganic fertilizers) to 113 km (improved seed varieties) (Table 4). All these, coupled with the poor state of most of the road and market infrastructure in Western Kenya, explain the high cost of transport that ranked highest among the business constraints facing agro-input dealers in the area. It also explains the lack of access to timely and affordable farm inputs by most of the smallholder farmers. Under these situations, the inputs may be available but still far from the reach of the farmers because of high prices caused by many factors including "excessive" profit margins being asked for by agro-input dealers. All these again underscores the need to improve the existing rural infrastructure, and build and develop new ones in most parts of SSA, a prerequisite for increasing the access of rural farmers to farm inputs at affordable prices and for increasing agricultural productivity, farm incomes, and general improvements in the livelihoods of the people Table 4.

Our analysis shows a positive correlation between the price at which agro-input dealers were willing to sell farm inputs and input sourcing distances. However, the magnitude of the correlation coefficient varied with agro-inputs. For instance, the sourcing distances and selling prices of Muriate of Potash (MoP), improved millet seeds, and tractors had a perfect correlation. Other correlations range from 0.014 (for improved varieties of maize) to 0.574 (for Thiram) (Table 5). This result shows that increasing the networks and percent coverage by the main distributors of different agro-inputs are important ways of getting farm inputs closer to the poor and has a great potential to reduce the unit price at which farm inputs are sold to the resource limited farmers in rural communities of SSA. This is an important step towards developing rural small-scale agro-input dealers. The question then is 'how to provide the necessary incentives (e.g., tax incentives) for the main agro-input distributors to increase the networks through which they supply agro-inputs to the

retailers that ultimately sell to the smallholder farmers in distant and far flung rural communities'. Both policy support and infrastructural development are critical issues that must be addressed (Table 5).

Frameworks agro-input dealers would want to see implemented

Sustainable expansion of the areas of coverage by agro-input dealers for increased access of smallholder farmers to farm inputs is critical. How to arrive at this desirable situation was assessed from the point of view of the agro-input dealers. They were asked about the policy and institutional frameworks they would want to see implemented to enhance the environment for a sustainable expansion of their areas of coverage and the access of smallholder farmers to farm inputs. The most important areas where agro-input dealers would want to see improvements were training on agro-input business (29%); enhanced access to credit and loans to enable them purchase more goods (21%); agricultural extension, research, and infrastructure development (15%); tax incentives and reduction (14%); illegal trade and adulteration (13%); and input supply management (8%). These would provide some incentives for them to take the risk implied in supplying farm inputs to many farmers in remote rural communities. The major institutions that agro-input dealers felt should intervene to remove their business constraints were the government (48%) (Facilitate access to credit and loans, tax reduction, and input quality control) and the Universities and research institutions (26%) (Provide various training support). Overall, it is important to note that the government is extremely important when it comes to price (including farm input price) reduction mechanisms.

We also examined the relationship between all the policy-related interventions (training of farmers, agro-input dealers, agricultural extension personnel; giving credit to farmers and agro-input dealers; price and tax reduction; curbing illegal trade and licensing; supply management; provision of agricultural extension services; supporting market research; etc.) and all the institution-related interventions (market cleanliness; customer care, agro-vet services in market, Government framework and institutions such as the Ministry of Agriculture and KEPHIS; Formation of cooperatives; Financial institutions, etc.) proposed by the agro-input dealers using multivariate correspondence analysis. However, it is important to note that the division is our own creation aimed at increasing our understanding of the data. Correspondence analysis helps to find a dimensional representation of the dependence between categories of variables in a two-way contingency table (Hair et al., 1995). Multivariate correspondence analysis was conducted to relate the areas of policy interventions suggested by the agro-input dealers and institutions that they felt were in the best position to handle the situation.

As expected, the result shows that both the policy-related interventions and the institution-related interventions were significantly correlated (Pearson Chi- Square-208. 504, *df* = 100, p = 0.000). The agro-input dealers who proposed training and credit and loans as a means to improve agro-input marketing also proposed govern-ment departments as the expected main actor. Government was also the main organization that was suggested to deal with illegal trading and adulteration of agro- inputs and improve marketing efficiency. The agro-input dealers who proposed the need to improve trans-portation, suggested road improvement policies, and they were also associated with those who proposed extension policies and chemical distribution institutions and im-proved supply policies.

Agro- input dealers who proposed tax reduction and the curbing of illegal agro-input trade and adulteration proposed Kenya Revenue Authority as the best institution that could deal with the situation. Government role is important in promoting the expansion of input use (Kelly at al., 2003). The first dimension (horizontal axis) of the solution is related to road improvement and the curbing of illegal input trading and adulteration with contributions from extension and the university. The second axis (vertical axis) is related to training policies and favorable loan policies with government and Kenya Revenue Authority intervention as indicated by contribution of points to inertia of dimensions, which are equivalent to the interpretation of loadings in a principal component analysis (PCA) for numeric data reduction. The suggestions of input dealers were found to be in tandem with those proposed by Kelly et al. (2003), including the need of government to invest in rural infrastructure (roads, markets, storage facilities, etc), education, agriculture research and extension and market information systems. Government, training, and loan provision were closely related as policies and institutions.

Conclusions and way forward

The study shows that although the number of agro-inputs dealers in Western Kenya has been growing, the growth is still a far cry from what is required to ensure that smallholder farmers, especially those in far away rural communities, have adequate access to agro-inputs. Besides, apart from limited business incentives, most of the agro-input dealers in the study area face numerous other problems (e.g., infrastructural challenges, low demand) in their businesses that hamper efficient agro-input supply to smallholder rural farm households. Most of the agro-input dealers still travel long distances to source different agro-inputs – a situation that has continued to result in high farm- level (or farm gate) prices for farm inputs. The problem of high unit price of agro- inputs is compounded by the fact that credit services were rarely provided to smallholder farmers by the agro- input dealers who themselves lack adequate working capital

for increased stocking of agro-inputs. Besides, only very few agro-input dealers (2 – 11%) were in a position to provide small-scale farmers with other services (especially input-related information).

The fact that agro-input dealers faced numerous constraints (high transport costs, low demand, lack of market, limited market information, lack of storage facilities, and limited skills and knowledge) is particularly worrisome because most of these are serious problems of infrastructure that require strong political will to address. This shows the void preventing the private sector from fully taking up farm input supply functions, in spite of the on-going market liberalization aimed at de-emphasizing government control of businesses and encouragement of the private sector to take over such business undertakings for increased efficiency. Policy and institutional environment conducive to private agro-inputs dealer operations and investment are, therefore, of paramount importance to efficient agro-input market development in Western Kenya and similar environments in SSA. A similar measure is also needed on limited business skill and knowledge, especially considering that knowledge reduces risk and increases rewards.

As a way forward, government policy and institutional intervention (in areas such as: reducing the risks that the private sector face in rural markets, improving road and other infrastructure, developing and extending credit and loans to agro- input dealers and their networks) are critical in stimulating the input supply sector and in effectively ushering in sustainable green revolution in Africa.

ACKNOWLEDGEMENTS

We acknowledge the agro-input dealers for giving us their attention during data collection.

REFERENCES

Bashaasha B (2001). The evolution and characteristics of farming systems in Uganda. Department of Agricultural Economics, Makerere University. A resource paper for the Policies for Improved Land Management in Uganda Project. A collaborative project of: International Food Policy Research Institute, German Center for International Development, Makerere University, Agricultural Policy Secretariat, and National Agricultural Research Organization.

Chemonics International and International Center for Soil Fertility and Agricultural Development (IFDC) (2007). A six-country survey of fertilizer supply and costs in Africa. Fertilizer Supply and Costs in Africa. June 21.

DMA TR (1991). Department of Defense World Geodetic System 1984, Its Definition and Relationships with Local Geodetic System, 2nd Ed.

FAOSTAT (Food and Agricultural Organization Statistical Database)(2003). http://apps.fao.org/page/collections?subset=agriculture.

Hair JF, Anderson RE, Tatham RL, Black WC (1995). Multivariate data analysis, 4th edn. Upper Saddle River, NJ: Prentice Hall

IFDC (2006). (International Center for Soil Fertility and Agriculture) Report, 31: 1.

Jaetzold R, Schmidt H (1982). Farm management handbook of Kenya - Natural conditions and farm management information – Part A West Kenya (Nyanza and Western, Provinces). Ministry of Agriculture, Kenya, in Cooperation with the German Agricultural Team (GAT) of the German Agency for Technical Cooperation (GTZ). 2: 397.

Kelly V, Adesina AA, Gordon A (2003). Expanding access to agricultural inputs in Africa: a review of recent market development experience. Food Pol. 28: 379-404.

Sanchez P (2005). Implementing the Hunger Task Force Recommendations in Africa. PowerPoint presentation. Hayes Memorial Lecture, University of Minnesota, 25 May.

SPSS (Statistical Package for Social Sciences) (2002). Statistical Package for Social Sciences Release 11.0. Prentice Hall: Chicago.

Surrey DW (1997). Diffusion theory and instructional technology. Paper presented at the Annual Conference of the Association for Educational Communications and Technology (AECT), Albuquerque, New Mexico, February 12–15 (available at www.gsu.edu/wwwitr/docs/diffusion/)

Yanggen D, Kelly V, Reardon T, Naseem A (1998). Incentives for fertilizer use in sub-Saharan Africa: A review of empirical evidence on fertilizer response and profitability. MSU International Development Working Paper Departments of Agricultural Economics and Economics, Michigan State University, East Lansing, Michigan 48824, p. 70.