NIRP Research for Policy Series 3

Market gardening, urban development and income generation on the Jos Plateau, Nigeria

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Colophon

NIRP Research for Policy Series

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Preface

This text is based on the results of a research project conducted jointly by researchers from Israel, Nigeria and the Netherlands in the period August 1993 - July 1996. It deals with the question whether there are ways to improve small-scale market gardening in and around the city of Jos (Central Nigeria) so that its productivity and income generating capacity can be increased. The relevance of this question extends to many other urban areas in sub-Saharan Africa.

The project was funded by the Netherlands-Israel Development Research Programme (NIRP), which aims to encourage development-related research focused on socio-economic and cultural change. Being policy-oriented in nature, NIRP aims to make the results of research accessible to anyone interested in solving the problems investigated. The target groups for such knowledge include policy makers, representatives of non-governmental and donor organisations, and the scientific community. With this aim in mind, the Publication Board has launched the NIRP Research for Policy Series as a channel for the publication of “user-friendly” summaries of more than 30 scientific reports.

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I. General information

I.1 Framework of the study

Market gardening in Jos-Bukuru metropolis in Central Nigeria has expanded considerably since the 1960s in response to urban growth and the concomitant increased demand for fruits and vegetables. The chance to increase personal incomes well beyond the subsistence level stimulated the urban middle class and the more affluent inhabitants, as well as migrant settlers and seasonal itinerant farmers, to engage in market gardening.

Urban farming is not a new phenomenon, however. As in other fast-growing urban areas in sub-Saharan Africa, an increasing number of people have taken up farming in response to the deteriorating food crisis. Unable to afford sufficient quantities of food for their family needs, the urban poor are resorting increasingly to cultivating small patches in their compounds and – often illegally – open unbuilt areas or unroofed buildings still under construction. Such subsistence-oriented urban farmers can also be found along the Delimi River and its tributaries. Some of them are unemployed migrants from rural areas, who were forced back into farming through lack of jobs. It should be realised that both subsistence and commercial gardening are components of the same urban farming system.

This study addresses the operational problems and potential of small-scale dry-season (irrigated) market gardening in the urban and peri-urban areas of Jos-Bukuru metropolis. Urbanisation not only provided a stimulus to urban market gardening, but also had negative impacts. Urban expansion has resulted in complex changes in the rural-urban fringe zones, bringing about instability, dislocations and shifting land uses. Adjoining villages have been engulfed, dispossessing the rural agricultural population of good farmland and causing insecure land tenure.

A major concern of this study was how to balance the positive and negative effects of urban growth, particularly in the interest of small-scale market gardeners. The major question was how their farming activities could be continued and improved and their income increased. To discover how the constraints to small-scale market gardening could be tackled, a

pilot gardening improvement project was set up in Korot village, about 32 km south-east of Jos city.

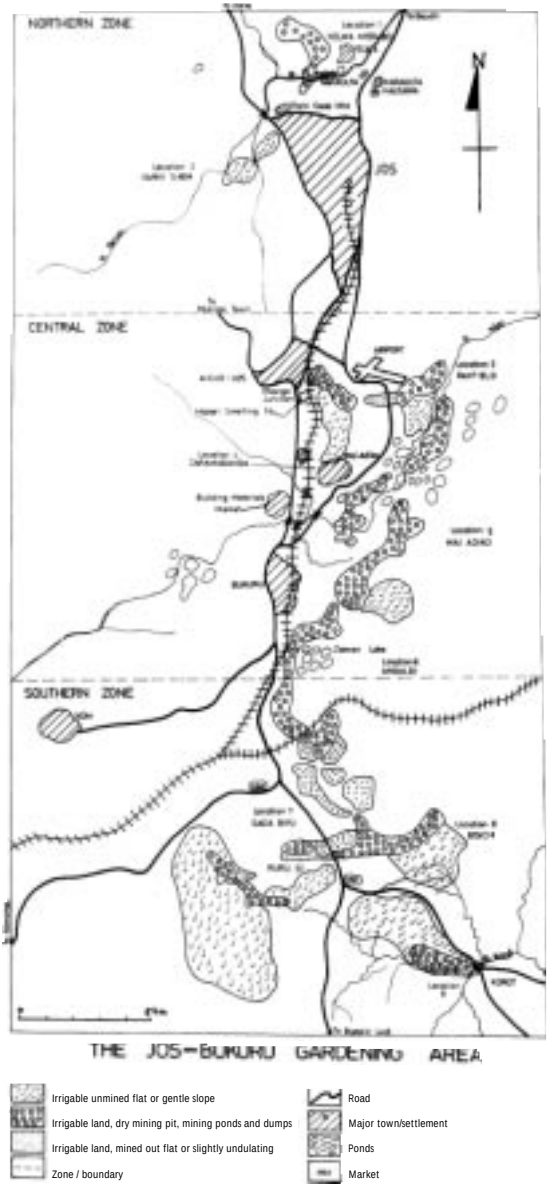
The study area extends from the relatively highly urbanised fringes of the Jos-Bukuru metropolitan area to parts that are not quite affected by the urban sprawl, at distances of about 40 km from the Jos city centre (Figure 1). It covers about 1,000 km^2. This area was divided into three zones. These are, from north to south: the Northern zone, the Central zone and the Southern Zone (Figure 1). Jos is the administrative capital city of Plateau State and the centre of a previously important tin mining region. With an altitude of over 1,250 m and a mean annual temperature of 22°C, the region's climatic conditions, together with its suitable *fadama*[1] soils and available irrigation water, favour the production of fruit and vegetables of the Mediterranean type. The metropolitan area, located in the north of the study area, has over 600,000 inhabitants and provides a well-developed market for such crops as carrots, lettuce, cabbage and cauliflower.

I.2 Objectives and research questions

The main objective of this study was to find ways of achieving sustained production and income generation for small-scale commercial gardeners who operate in a situation of urban growth-related opportunities and constraints. This included the following sub-objectives:

- to determine the operational measures and policies needed to ensure stable land for market gardening and secure land and water-use rights for the farmers;
- to evolve an appropriate model of farmers' organisation and cooperation, capable of enhancing the ability of small-scale market gardeners to tackle their operational constraints;
- to determine how to improve transport, distribution and marketing systems for gardening produce in order to increase the gardeners' income;
- to test, through the Korot gardening improvement project, how the various constraints to small-scale market gardening could be dealt with;
- to assess what experiences from Israel and the Netherlands might be adapted to the Nigerian situation.

[1] The West-African term *fadama* can best be described as an irrigable floodplain of a small stream.



THE JOS-BUKURU GARDENING AREA

Figure 1 The Jos-Bukuri gardening area

These objectives were translated into the following research questions:

- How much land and water is used for market gardening in the Jos-Bukuru metropolitan area and how much potential exists?
- What are the demographic and social characteristics of small-scale market gardeners and what organisational structures do they already possess?
- What is the productive capacity of small-scale market gardeners, taking into account the relative advantages of each gardening zone in and around the urban area?
- How is the produce of market gardeners in the Jos-Bukuru area marketed and transported to the main consumer areas and what improvements are possible here?
- What institutional support is essential for gardeners to consolidate and modernise their operations and to increase productivity at minimal costs?
- What have been the results and effects of the market gardening improvement project in Korot village?

I.3 Hypotheses and methodology

With regard to the potential of small-scale market gardening, it was hypothesised that site and situation aspects such as soil conditions, irrigation potential, access to wholesaling facilities and urban infrastructure in general, influence the location and success of market gardening activities.

It was further hypothesised that joint action by market gardeners in marketing, disseminating new crops and techniques and securing suitable production space is the most important mechanism for improving the performance and income-generating potential of small-scale market gardening.

Institutional support, which can be enforced through this joint action, was also assumed to be essential for achieving consolidation and modernisation.

It was assumed that through these mechanisms – site and situation aspects, joint action and institutional support – small-scale gardeners would be able to benefit from urban expansion instead of being at the mercy of it.

Several methodologies were adopted for learning about the market gardeners, their gardens and their on and off-farm activities. Satellite imagery and geographical information systems (GIS) were used for the identification and mapping of the currently used and potential gardening land (*fadama*) and the adjoining irrigated and irrigable land.

Socio-demographic and economic surveys were carried out in nine *fadama* locations, making up 20% of the 48 *fadama* patches identified in the

study area. Interviews were conducted with 273 gardeners, of whom 146 were dry-season gardeners and 127 rainy-season farmers. The total number of dry-season (or irrigation) farmers in the study area was estimated at 2,300, while the number of rainy-season (or rain-fed) farmers was estimated at about 2,000. About 70% of the dry-season farmers were also involved in rain-fed farming. One survey was carried out of the market gardeners' rain-fed farming activities and two surveys were conducted of their dry-season operations.

Marketing surveys were carried out in the main market of each of the three administrative zones, as well as in a purposively chosen retail market in the city of Jos.

Focus group discussion (FGD) was employed for discussions among male and female gardeners of different age classes. Subjects discussed included their farming practices, marketing systems, constraints and local solutions. This method also brought out the gardeners' local knowledge and technology base.

Participant observation of eleven gardeners facilitated the monitoring of both gardening and off-garden activities and the gardeners' behaviour. Attention was paid to their social life and networking, household circumstances, aspects of gardening labour, food and feeding habits, health, spending patterns and quality of life.

These methods were supplemented by in-depth one-to-one interviews with selected gardeners. The interviewees included experienced gardeners (male and female, settler, indigenous and migrant), as well as transport contractors, middlemen, wholesalers and retailers. Responsible officials of the three local authorities, of the Plateau State Agricultural Development Program (PADP), and of the Jos Metropolitan Development Board (JMDB) were also selected as key informants.

A participatory community approach and methodology were adopted to analyse the social organisations and farmers' associations, interactions, networking and dynamics of the communities in selected *fadama* irrigated market gardening locations. These locations differ from one another in urban pressure, the availability of water and land tenure. For the purposes of comparison, a similar analysis was carried out among small-scale market gardeners in the peri-urban area of Kaduna city, about 300 km north-west of Jos.

A participatory approach was also used to analyse the farmer association in Korot, where the *fadama* gardening improvement experiment was implemented. A pre and post evaluation design was adopted to evaluate the short-time effects of this project, as the time

available for research was considered too short for a long-term impact evaluation. Process evaluation was used to monitor the execution and effectiveness of the project components.

Field visits to the Netherlands and Israel, consultations with other scholars and practitioners, library search and literature reviews put the results of this study in a broader perspective. These supplementary data facilitated a comparative analysis of market gardening transformation, marketing strategies and options for solutions.

I.4 Theoretical orientation

From the theoretical standpoint, this study deals with three main issues: the spatial aspects of urban land use, the prerequisites for sustained market gardening and the problems of communal management.

I.4.1 The changing urban-rural fringe: spatial impacts

Thinkers and model builders have been interested in the use of the urban-rural area since the beginning of the 19th century. In 1826, the geographer Heinrich von Thünen developed his famous ring model of land use, which may still be applicable to the African peri-urban space, though with some reservations. In this model, the level of economic rent declines progressively with increasing distance from the city. Horvarth (1969) also found this in Addis Ababa, where the land-use rings surrounding the city closely resembled those of the original "isolated state" as presented by Von Thünen for European cities in the early 19th century. Many other studies also suggest that some form of peri-urban land-use zoning is universal.

Sinclair (1967), however, argued that on the urban fringe of modern cities the situation is reversed. He introduced the concept of "Value for Agriculture", which refers to undeveloped land and stands for the part of the rent which is derived solely from agriculture. Sinclair stated that the agricultural rent, or value for agriculture, tends to be lowest close to the fringe of modern cities and slopes upward away from the city fringe (Figure 2a). He implies, though, that in non-modern areas, agricultural land values may still fall away from the city fringe, as in Von Thünen's original model. One of the reasons for the modern reversal is the inability of farming to compete with residential, commercial or other land uses. Among other reasons for this, Sinclair mentions the decline of transport costs and the prevalent expectation of continuing urban sprawl, which will inevitably result in a further retreat of farming from the urban fringe.

Sinclair's model was further refined by Boal (1970), who introduced the notion of "speculative value" of undeveloped land, to show the impact of

land-use control by the government (Figure 2b). That public policy may play an important role in the actual appearance of the city fringe is shown, for instance, by the Green Belt policy of the British government. Although this policy was unable to fully eliminate the pressured area, it managed largely to push it back.

More recent research has shown that the urban fringe is not a simple zone in which the value for agriculture (or economic rent) declines uni-directionally. It is rather a complex zone where the impact on farming can be both positive and negative and where the most intensive horticulture may exist near the most extensive grazing lands or vacant land (van den Berg, 1984).

The impact of changing land values on the value for agriculture is a core issue in the assessment of the agricultural prospects under urban impact, but land costs are only one of the factors that must be considered. In fact, land prices reflect the combined product of numerous forces such as site characteristics (including resource quality), accessibility, location in relation to service provision, industrial or residential activity and their associated pollution and competition for space, as well as locational advantages (or disadvantages) for human interaction. All these are taken into consideration in an attempt to provide a new value for agriculture model based on the Jos-Bukuru evidence (see Section III.1.1).

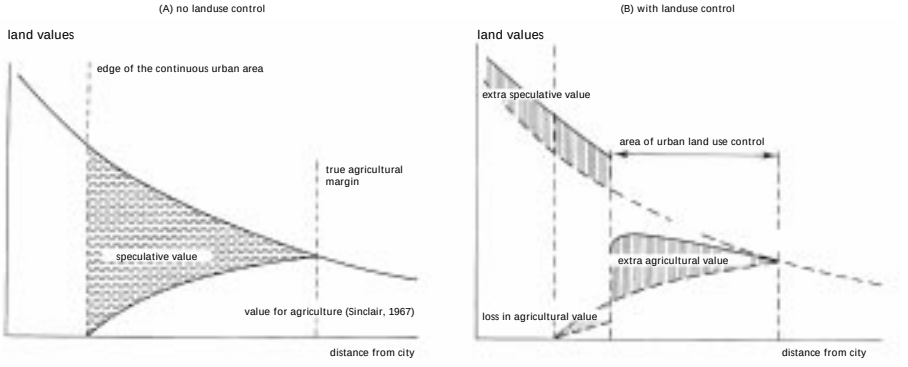


Figure 2 Sinclair's and Boal's models of urban land use

I.4.2 Tenure practices, rural organisations and the theory of the commons

Secure tenure and rights to use land and water are crucial for irrigated market gardening. Large and reliable water supplies are needed, as well as high investments. Migrant farmers usually have no guaranteed land rights,

so their motivation to invest in long-term intensive gardening is bound to be low. Regulation of land and water rights may remove this constraint and encourage investment, thus helping to extend the area under cultivation.

The need to establish a system of rights to use natural resources is common, in fact, to most rural societies. Its function is to allocate the most basic needs of the agrarian communities and to achieve an equitable distribution of the means of production, where pressure on land and resources does not allow them to be open to all without restriction. Where local government is ineffective, the community has to assume such a function.

In this respect, it is important to realise that, in the African context, a dual land tenure system is widespread. Customary communal land tenure coexists and often overlaps and conflicts with the official legal tenure system. Traditional rights may be allocated on the basis of kinship or residence, but can be overruled by official laws and regulations – largely at the farmers' expense. This dual system also exists in Nigeria's cities.

Although communal tenure is often a response to functional needs, most forms of communal management of resources have been discontinued in the process of modernisation. An explanation for this is provided by the arguments raised by Hardin (1968) in his famous article 'The tragedy of the commons'.[2] When common resources come under pressure, group members tend to pursue their own selfish needs, even when their behaviour hurts the group to which they belong. In the case of communal grazing lands, for example, each herder knows that if he adds a single animal to the commons above the level of optimal carrying capacity, the community of users will be hurt. But his self-interest leads him to pursue the strategy anyway, because, by adding one animal, his gain is "one", while the community's loss is only a fraction of "one".

Because of such conflicts between private interest and the interest of the group to which the individual belongs, it may be expected that associations on the Jos Plateau, managed by traditional communal rules and manpower, will not function well under a modern system. The more so, because urban farmers are ethnically and socially a very heterogeneous group with few common interests and highly diverse needs and prospects. However, they all need some mutual help and some communal arrangements, especially for marketing and water regulation. Cooperation, although difficult to accomplish, could increase the farmers' share of income. Village associations,

[2] Although originally referring to a model based on common land, Hardin's arguments have a very wide applicability in many other aspects of human activities. Land tenure and cooperation are two of them.

built around a specific purpose, might be promising. A possible option would be to promote partial cooperation, e.g. peasants retain private rights over the holdings they operate, but cooperate in matters which provide economies of scale (e.g. tractor services, fertiliser purchases and access to credit, information and official support). A variant of these are the informal "banks". Although they are not genuine cooperatives or traditional communal institutions, these informal banks or *essussu*[3] clubs provide an example of such a grassroots organisation. The way they function and their role in communal credit provision suggest that cooperation can exist, and even flourish, in the transitional economy of present-day Africa. For this reason, their functions and operations are of great interest.

I.4.3 Prerequisites for sustained income generation

This study assumes that three major forces affect the performance of the market gardening industry and its income-generating capacity, i.e. governmental policy and support, mobilisation and organisation, and the diffusion of new technologies and innovations. These forces also affect the spatial appearance of market gardening and can therefore not be considered in isolation from the spatial dimension outlined above.

Governmental policy and support

In industrialised countries, local and other governmental agencies are a highly important external force affecting economic activity. They are expected to supply information, regulate marketing, impose law and security and provide economic and physical infrastructure. In the urban areas of developing countries, however, many of these elements are lacking, as the government is often too weak to impose laws and regulations. In practice, the authorities are often indifferent or even hostile to the urban farmer, whose activities are considered to interfere with zoning regulations or viewed as a sanitary hazard, damaging to health, or ecologically undesirable (Mbiba, 1995; van den Berg, 1982). In most instances, market gardeners receive very little support.

Mobilisation and organisation

A major driving force behind the cooperative movements in Israel and the Netherlands was the desire to reduce dependence on intermediaries and to reap the benefits of marketing. One would expect this to be even more relevant to market gardeners in developing countries, where middlemen

[3] Also spelled as *esusu* or *isusu*.

play an important role in the marketing system. These middlemen provide vital services to the farmers, but also hold a superior position over them. The farmer is kept in a dependent position with no control whatsoever over marketing.

Technology and diffusion of innovation
In most African countries, human interaction for the demonstration and transmission of technological and scientific knowledge is still insufficient. Formal institutions of education and training to improve human resources are lacking and other forms of human interaction, such as long-distance transmission (literature, radio, telephone, fax and Internet) are often not operational. In a situation where diffusion is based on direct contact rather than on more sophisticated transition systems, the adoption of new technologies tends to be retarded.

I.5 Elaboration of the research

In Africa, there is a great variety of urban and peri-urban farming and market gardening systems. They can be classified according to such criteria as motivation, land use, degree of commercial vs. subsistence production, urban vs. peri-urban location, economic standards, type of tenure, access to water and other inputs, ties with the zone of origin, technology and many other characteristics. City farmers may have an advantage over the peri-urban zone in some respects (e.g. better access to water supply), but generally, the peri-urban zone is better endowed.

A number of typologies have been offered to cope with the compounded criteria (e.g. van den Berg, 1984; Gura, 1996). Gura distinguishes three types of urban farming operations:

- *Urban shifting cultivators*: landless, using empty spaces, growing mainly leafy vegetables for subsistence and informal markets, using few inputs, and selling to the low-income urban population, usually recent migrants.
- *Household gardeners:* reside in towns and own or rent integrated farms, involving trees, livestock and vegetables. Most are landowners or have secured land rights. They have a fairly high return on their investment, a stable social status, and good prospects for reasonable economic progress.
- *Peri-urban market gardeners:* are specialised producers, who have relatively secure tenure, but are at the mercy of pollution hazards and urban sprawl. They operate agricultural enclaves in the urban zone or at a short distance from the urban edge. The gardens are largely

irrigated and intensively cultivated. The output value is high. The produce is sold mainly in the formal marketing system and bought by the more affluent urban population.

Van den Berg (1984) aimed at a complete coverage of farm-like activities in (peri-)urban areas and arrived at 17 types on the basis of the following three variables: farmers' background, importance of farming as a source of income and farm size.

The present study is concerned only with the small-scale market gardeners and only those operating in the (peri)-urban areas. These cover four out of van den Berg's 17 types, i.e. private urban invaders as well as rural stayers at the small and the medium scale, for whom farming (horticulture) is the main source of income.

The study focuses on the production of fresh fruit and vegetables for sale in urban markets (*cf.* "truck farming" or horticulture) and on (mainly vegetable) food production and marketing in the zones adjacent to the cities or in the city itself. Thus, small subsistence gardeners within the city[4], as well as the (few) large-scale individual or corporate farmers, who produce fruit, vegetables and flowers mainly for export or for direct supply to factories, have been excluded. Although many of the small-scale gardeners also participate in rain-fed farming, this study emphasises their dry-season gardening operations.

[4] Although the subsistence sector of urban agriculture is of marginal interest in this study, it should be recognised that it is part of the same urban agricultural system.

II. Results

II.1 The areal extent of small-scale market gardening

A crucial condition for sustained market gardening is the availability of suitable horticultural land, easy access and stable tenure or secured land-use rights. Hence, this study estimated the extent of currently used and potentially available and accessible *fadama*, as well as adjoining irrigated and irrigable farmland. Within the whole study area, the total *fadama* and adjoining irrigable (up-slope) land has been estimated at 6,910 ha. Such land is to be found in 48 different locations, in patches of less than 10 ha to about 900 ha each, the average being about 145 ha. The sketchy distribution is caused mainly by the lava flows and basalt hills which abound in the Jos Plateau. Plot sizes are not equally distributed within the above range. Most patches are very small, which is also reflected in the average size of the plots (0.25-1.0 ha), but plot sizes differ in the different parts of the study area.

The northern zone, located within and around the Jos urban area, extends to about 12 km around the city centre, which is the area's main market. The central zone gardens lie mainly around Bukuru Town, at a distance of 12-26 km south of the Jos city centre. The southern zone is located at a distance of 26-40 km from the Jos city centre. In addition to the varying distances of the zones from the Jos city centre, they also differ in the numbers and total areas of irrigable land patches.

The irrigable land patches are classified into four main types: river flood plain or basin *fadama* (constituting 4.8% of the total); unreclaimed mined-out land *fadama* (36.9%); reclaimed mined-out land *fadama* (2.5%) and up-slope land (55.8%). The term up-slope land applies to land that is usually not termed *fadama*. However, with the introduction of motorised pumping technology, such up-slope land has now become part of the fadama-based horticultural system. In this classification, the term *fadama* is extended to include all irrigable land, even if it lies beyond the proper *fadama*. The distribution of the four types over the various zones is given in Table 1.

Table 1 Types of gardening land per zone (ha)

Zone	Floodplain basin fadama	Unreclaimed mined-out fadama	Reclaimed mined-out fadama	Up-slope land	Total	
Northern	32	153	-	140	325	(4.7%)
Central	-	1,764	171	1,259	3,194	(46.2%)
Southern	298	632	-	2,460	3,390	(49.1%)
Total	330	2,549	171	3,859	6,909	
	(4.8%)	(36.9%)	(2.5%)	(55.8%)		(100%)

The low proportion of market gardening land in the northern zone (4.7%) suggests that the irrigable areas in this zone have largely been taken over by urban land uses. Indeed, only four main patches are still available for market gardening in this zone and even these are constantly threatened by encroachment and competition from alternative urban land uses.

While the largest patches occur in the central and southern zones, which are the least affected by urban encroachment, the smallest ones are also found in these areas. This is because flood plain *fadama* patches are usually small and scattered, as the relatively large and gradually increasing numbers of market gardeners in these zones has induced considerable fragmentation. Conversely, relatively large areas of irrigable up-slope land still exist in these central and southern zones and some gardeners who can afford the extra costs involved, have extended (and can still extend) their plots to the up-slope areas.

Currently, 4,824 ha (68.6%) of the total irrigable gardening land is being cultivated throughout the study area, leaving 2,086 ha of irrigable land available for future market gardening. This land is mainly located in the central and southern zones. Growers in the northern zone will be able to continue using their currently cultivated and potential land only if their tenurial rights are properly settled or if proper administrative measures are taken to guarantee their access to and use of the land.

II.2 The use and availability of water

As Schoeneich (1995) pointed out, “irrigated agriculture (gardening) is fast becoming the largest water consumer and the priority industry on the Jos plateau”. Vegetable gardening began in the 1920s, when some tin-miners and traders from Northern Nigeria’s Hausaland started to grow vegetables for household use and the local market. In the mid-1930s, they started to grow vegetables from the temperate zones, such as Irish potatoes, tomatoes, cabbages, lettuce, spinach, carrots, peas and garlic, which were introduced

and consumed by European tin miners. This phase marked the start of the progressive increase in the regional use of irrigation water, achieved through changes in irrigation techniques. With a tendency towards vegetable production for more distant markets in Nigeria, increasing numbers of large-scale market gardeners and the transformation of small-scale gardening activities into sustained production, there may be an increased demand for irrigation water in the near future and it may ultimately become scarce. Hence, a crucial factor for dry-season market gardening is the existence of adequate quantities of suitable and non-polluted irrigation water, as well as regulations for its allocation to individuals and groups.

In the Jos area, irrigation water is available at a relatively low cost from rainfall, shallow wells, or from boreholes at various depths. Most growers (about 85%) depend on local streams. The mined-out pond is next in order of importance and is used by about 10% of the gardeners. Small earth dams and reservoirs constructed across streams are used by a little over 3%. About 2% of the growers construct and rely on shallow hand-dug wells. Current irrigation water need and use in the three gardening zones amounts to approximately 47.8 million cubic metres per annum (m^3/a). The total irrigation water available in the study area is estimated at about 52.3 million m^3/a. Thus, at current levels of irrigation water use by small growers in the study area, there is an overall water surplus of about 4.5 million m^3/a.

There are, however, significant variations between the three market gardening zones and the different *fadama* locations within each zone. Some of the patches enjoy water surpluses, while others suffer considerable deficits. Few locations have precisely the amount of water they need. While sufficient irrigation water is available in parts of the northern zone, even during the peak dry months, in parts of the southern zone the available irrigation water is already completely exhausted after the first three or four months of the dry season. This may abruptly terminate the season of vegetable farming, with considerable adverse consequences for the growers. One particular location in the central zone suffers from industrial waste dumping into the stream, which periodically causes severe pollution of the available water source. Because of ineffective supervision and practically non-existent monitoring, the present situation may lead – or does already lead – to a severe health hazard. The sanitary situation is especially severe during the peak dry months. If controls are eventually imposed, this may force the growers to abandon further use of this water. Administrative measures, legislation and strong advocacy may be required to deal with the problem of industrial waste pollution.

In both the central and southern zones, the irrigation water situation in the now deficit locations can be improved. Sources and yields can be

increased though rainwater tapping, storage and the integration of various sources, such as river flows, abandoned tin-mine ponds, basins and depressions, groundwater, shallow sources and deep aquifers. Other ways include the introduction of water-saving practices, recycling and multiple use after appropriate treatment and filtration. While the gardeners in these zones may be encouraged and empowered to develop such alternative sources of irrigation, many of these measures may not be possible or profitable for individual small-scale growers or small groups of them. They could be viable, however, if undertaken by larger gardener groups or associations or if developed by the government, NGOs or other assistance sources.

II.3 Demographic and social characteristics of small-scale market gardeners

In 1993/94, the number of small-scale market gardeners in the study area was estimated at 2,000. They are diverse in their ethnic origins and demographic and social characteristics, reflecting the highly mixed population of the Jos-Bukuru metropolitan region. They include the local Birom and other Plateau State ethnic groups (19%), the large migrant (and settler) group made up of Hausa, Fulani, Kanuri and other northern Nigerian ethnic groups (74%) and Igbos, Efiks and other groups from the South (5%). The immigrant population became involved in market gardening as the mining industry declined. Thus, the small gardeners studied include the migrant settlers, seasonal migrants who come and go during the dry gardening season, and indigenous Birom gardeners (Table 2). Traditionally, the latter are mainly rainy season farmers, who used to lease their *fadama* land during the dry season to (seasonal) migrant farmers from the North (mainly Hausa), who were already familiar with irrigation techniques. Today, some of the Birom have also become dry-season farmers.

Table 2 also demonstrates that the number of women involved in market gardening is remarkably low (less than 2%). The gardeners' age distribution shows a large number of experienced gardeners, while increasing numbers of younger ones guarantee the prospects for possible present improvements and future transformations, if they can receive appropriate incentives. In the southern and, to some extent, in the central zone, where gardening land is still available, young men are in the majority among the new entrants. Educational levels are low, with only 40% of the gardeners having received formal education. Most gardeners are married, either monogamously or polygamously. The generally large family sizes (55% of the households have more than 4 children) provide the bulk of the labour used by most of the growers, thereby keeping their labour costs low.

Table 2 The gardeners' basic characteristics

Characteristic	Category	Percentage (n = 273)
- Ethnicity	Birom	19.1
	Hausa and Fulani	74.0
	Other Plateau State groups	5.1
	Other groups*	1.8
	Total	100.0
- Sex	Men	98.2
	Women	1.8
	Total	100.0
- Age	18-29	20.1
	30-49	52.0
	50-69	22.0
	70+	5.9
	Total	100.0
- Education	Western education	
	- Primary school	16.8
	- Secondary and post-secondary school**	13.2
	Koranic education	65.2
	Adult literacy classes	2.9
	Unknown	1.9
	Total	100.0
- Marital status	Single	7.0
	Married monogamously	47.6
	Married polygamously – 2 wives	30.8
	Married polygamously – 3 wives	8.1
	Married polygamously – 4+ wives	3.7
	Divorced/separated/widowed	2.8
	Total	100.0
- Household size	1-4 children	44.0
	5-9 children	42.1
	10+	13.9
	Total	100.0
- Religious affiliation	Islam	78.0
	Christianity	22.0
	Total	100.0

* From other parts of Nigeria or abroad (mainly the Republic of Niger)
** Teacher training, technical training or grade three training

As a group, gardeners generally enjoy a high social status in their communities and maintain cordial social relationships with non-gardeners. The more successful gardeners, in particular, who own their land and houses, are relatively well off and enjoy social acceptance, recognition and leadership.

Because of the relatively recent origin of dry-season gardening in the area and the diverse ethnic origins of the gardeners, no traditional form of organisation or cooperation has developed. So far, the farmers' associations being revived or set up since 1993 are the only formal organisations for the gardeners' common good. (Igoche, 1995; Ajaegbu, 1999). These associations vary in size between 20 and 60, have an executive committee of 4-8 males and have worked on issues like procurement and distribution of farm inputs, communal labour, transport and water management. Considerable facilitating is still needed for these associations to achieve their full benefits, including specialised support in marketing, input sourcing or advocacy. Facilitation and motivation will lead to greater understanding, integration and trust among the gardeners, as well as better cooperation in communal activities.

Box 1 Local market gardening practices

Much of the productivity achieved so far by the small-scale gardeners derives from the highly ingenious cropping systems and crop management they have evolved. As Okwudire (1995) described, they practise the following:

Mixed inter-cropping of two or more of the following vegetables simultaneously in a bed, without any distinct rows or other arrangement: spinach, carrot, egg plant, lettuce, cabbage and tomato.

Row inter-cropping of two or more crops in definite rows, alternate rows or columns, such as rows of tomato, alternated with those of cabbage, egg plant, pepper and/or cauliflower.

Strip inter-cropping of two or more crops, each in definite strips or plots, such as strips of beetroot, garlic, leak, spring onion and celery.

Relay inter-cropping by which two or more crops are grown in combination and in sets, with one set following another, when the former reaches its peak vegetative or reproductive growth state, but not yet the harvest stage. Such sets of crops are, for instance, relay leg of onion, spinach, pepper and irrigated maize; followed by a leg of egg plant, tomato and cabbage, or other combinations.

Sequential phase cropping of two or more crops in sequence on the same plot/field, one following on the heels of the former after it is harvested. Combinations are made of early carrot, cabbage, Irish potato and pepper, planted in September and harvested by December, followed in January by another combination on the same plot.

Tree-intercropping of combinations of vegetables within orchard farms having a mixture of tree crops and fruits, usually meant to increase the economic returns from the orchards, particularly in the early periods of the trees' growth.

II.4 Productive capacity and income

As a group, the small-scale market gardeners in the study area contribute quite substantially to the regional and national food production and economy. The productive capacity of individual gardeners is relatively low, however. In terms of gardening land, inputs, production and income, most operations are small-scale.

The technology employed is rudimentary. The techniques and tools have undergone slight changes over time, but generally, the use of traditional tools prevails. Only a few gardeners in the southern zone occasionally use a tractor for land preparation and levelling, but in most cases the local small hoe, machete and digger are used. A significant change, however, was the introduction of small (5-7.5 cm) mobile petrol-fuelled water pumps. Over 90% of the gardeners currently use these pumps, while about 60% of them actually own them.[5] Other tools used are *shadoof*,[6] a combination of *shadoof* and motorised pump and hand-held bucket. The prevailing watering method is flooding the beds. No sprinkling or drip system has been tried as yet, although this would save water and labour (for levelling the land) and make possible the extension of gardening to moderately sloping land.

Improved seedlings, chemical fertilisers, insecticides and herbicides are also widely used today, but are not always available or affordable.

The farming operations are neither high-tech nor capital intensive, as the gardeners face considerable constraints in raising capital or securing loans from the banks. Hence, the substantial progress made by the gardeners thus far cannot be attributed to overall progress in the technological sphere, but is rather the combined result of their human skills, ingenuity and labour (Box 1) and the "revolution" brought about by the small water pump and chemical fertilisers.

There are variations in productive capacity between the relatively large, successful gardeners, moderate scale growers and the smallest growers.

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5 The introduction of these pumps was completed within a single decade. The diffusion of the new technique could have been even more complete if the fair-priced pumps provided to the farmers had reached their destination directly. However, they disappeared and reappeared at inflated prices on the black market.

6 The *shadoof* – originally an Arabic word – is a traditional hand-operated device, which uses leverage to draw buckets of water from wells. It has a long arm whose edge is tied to a rope holding a bucket. The other end is much smaller, but has a heavy weight. By raising the heavy part, the long rod is lowered to the water (originally to the Nile), allowing the farmer to raise water to his field and irrigate it.

The most striking difference between these groups is the size of their capital investments. The smallest-scale gardeners (84% of the total) who generally cultivate less than 2 ha, spend less than ₦(Naira) 10,000 per season (US$ 455 in 1994 prices). The intermediate group (13% of the total), cultivating between 2 and 2.9 ha, invests between ₦10,000 and ₦20,000 (US$ 455-910). The largest among the small-scale growers (3% of the total) cultivate at least 3 ha and invest between ₦20,000 and ₦50,000 (US$ 910-2,275). The main source of financing is personal savings (70%), followed by loans from friends and relations, including middlemen (29%). Banks as a source of credit were reported by about 1% of the respondents. Because of the heterogeneity of the gardeners, no such savings system as *essussu* clubs existed. In sum, the farmers still struggle against the big constraint of lack of access to sufficient market gardening funds. This problem, like that of low technology, severely affects their productivity, both individually and collectively.

The range of vegetables produced is wide, including up to twenty types. The six most widely cultivated are tomato, cabbage, spinach, lettuce, carrot and green beans (Table 3). Gardening areas in the northern and central zones, located within about 15 km from the Jos City centre, tend to grow the more perishable and exotic vegetables. Gardeners in the southern zone, where more land is available, but irrigation water is deficient during the peak dry months, seem to concentrate on Irish potato, carrot and pepper, which require relatively larger farm sizes and less water.

The average small-scale market gardener in the study area realises, based on 1994 prices, about ₦26,000 (US$ 1,200) per year from tomato sales and – in the southern zones, only – about ₦36,000 (US$ 1,600) from the sale of Irish potato. The six widely cultivated vegetables yield the average gardener about ₦55,000 (US$ 2,500) in a good year. These sums are quite substantial by local standards. Yet the enormous potentials and advantages in each gardening zone need to be fully utilised in order to further increase production and income. Moreover, the irrigation water shortage experienced in the southern zone, where land is plentiful, needs to be solved, in order to achieve greater productivity. Small low-cost dams could provide sufficient water storage to help the present market gardeners to consolidate their operations.

II.5 Transport and marketing

A network of hierarchical market points and a complex marketing system for fruit and vegetables have emerged. The marketing points range from

local morning and evening markets, roadsides, hawking in strategic locations and kiosks, through city retail markets and regional satellite markets, to distant city markets in other parts of Nigeria. Different primary, secondary and tertiary marketers are involved in the vegetable trade. Marketing is further complicated by the multiplicity of agreements and marketing links, with trading and financing often being closely intertwined. The pricing system is also quite complex, involving substantial fluctuations and considerable bargaining between buyers and sellers, with little room for manoeuvre by the gardeners.

The actors involved in marketing can be divided into primary, secondary and tertiary traders. The main *primary* traders are the gardeners themselves who sell, usually on a weekly basis, to middlemen and women on their farms, in the main markets or, in a few instances, in some distant markets. They usually do not sell on the small retail markets. Other primary marketers are the gardeners' wives who, often daily, harvest from their husbands' farms with their permission and take the produce to the small retail markets, where they sell it mainly to the end consumers. The money they gain is generally used for their specific needs or for immediate household expenses.

Table 3 Estimated total vegetable production during 1993/94 by small-scale gardeners in the study area (n = approx. 2000 gardeners), for the six most widely cultivated vegetables

Vegetable type	Estimated total production		Estimated total amount realised	
	Container measure (number)	Approx. weight (kg.)	₦	US$
Tomatoes	411,076	10,276,900	5,343,988	242,908
Cabbage	97,906	5,874,360	19,581,200	890,055
Spinach	119,833	599,165	2,995,825	136,174
Lettuce	104,548	522,740	2,613,700	118,805
Carrots	65,550	1,638,750	19,665,000	893,864
Green beans	58,600	351,600	14,650,000	665,909
Total			64,849,713	2,947,715

₦ (Naira) 22 = US$ 1 (1994)

Among the secondary traders are the middlemen, the smallest among them being mainly, but not exclusively, women. The smaller-scale middlemen generally purchase on the farms and usually sell on one of the satellite markets to retailers and hawkers. The larger middlemen – predominantly men, but some women – are the bulk buyers and sellers. They own and

operate warehouses, where they stockpile the products for varying periods until they are sold. They handle most of the bulking, packaging, transport and wholesaling. In this way, they pay most of the costs, absorb most of the risks and, in return, gain most of the profits from marketing the fruit and vegetables. In each satellite market, they have well-organised and strong associations, which fix their buying and selling prices once or, in some cases, twice or more times a day. The price depends on the quantities supplied and the time of year, with prices being higher during off-season periods. All farmers and non-member middlemen are subjected to the association's rules and forced to sell to the members of middlemen associations, at prices fixed by the latter. Nonetheless, they form a secure outlet for any amount of produce the farmers want to bring to the market.

The *tertiary* traders are the long-distance carriers and traders, who serve consumers in other cities, as well as numerous retailers who operate at different evening markets, roadside sheds, kiosks and supermarkets. They also include street vendors, who retail minor quantities from small stools or low tables and several hawkers who, in search of buyers, take the fruit and vegetables to workplaces, the homes of potential buyers or public places. In this way, the fruit and vegetables are widely distributed at the smallest possible units at costs that many people can afford, thus expanding the total market demand for gardening produce in the country.

The bulk of the vegetables are traded in the region's four major satellite markets (Box 2), but not all products are sold in one of these markets. Gardeners also sell their products on their farm plots, mainly to small retail traders (usually women), but occasionally also to middlemen. The small retailers at this level sell the produce at strategic roadside points or at one of the many morning and evening markets that are spread over the neighbourhoods of the Jos-Bukuru urban area.

Irish potatoes from the southern zone are nearly always bought by middlemen and loaded on vans or lorries right on the farms. They are then transported to cities in southern Nigeria, without going through the local satellite markets. The same occurs with much of the carrots, peppers and tomatoes from this zone.

Little spinach is hardly taken to the major markets, because small-scale female marketers take it to the evening markets.

There is, as yet, no case of direct supply to any factories or export outside the country by the small-scale market gardeners from the study. Only capital-intensive, large-scale producers are able to assure a steady supply or to finance and satisfy the requirements for the export market.

Box 2 Major satellite markets in the study area

The study area has four main satellite markets, each with its specialised functions. The largest and most important one is the weekly Thursday "Building Materials market" south of Jos City in the central zone. Here, most of the vegetables are traded. This market is insignificant only for tomatoes and eggplants. By contrast, it deals with nearly all the peas, green beans, watermelons, celery and radishes, which come from both inside and outside the region. This market serves both wholesalers and retailers, as well as the urban consumers. Middle and upper class housewives and bulk buyers, such as restaurants and boarding schools, prefer this market for their purchases. It is also the market that serves the largest number of distant destinations, particularly in the central and south-western parts of the country.

Farin Gada in Jos City is another major market. Together with the Building Materials market, it handles the vegetables brought to the Jos region from the neighbouring states of Bauchi and Kaduna. It also handles the bulk of the tomato sales. Truck loads of vegetables from the Farin Gada market head mostly to cities in south-eastern Nigeria.

The second important market in Jos City, Kwararafa, is mainly a retail market directed to serving urban consumers. This one, too, handles substantial quantities of tomatoes, which are mainly sold to the city's inhabitants.

The Radura Foron market, located in the southern gardening zone at some distance from Jos City, serves mainly as a bulking point for the carriers to cities in south-western and south-eastern Nigeria. It handles mainly tomatoes, carrots, peppers, sweet peppers and other crops grown in the surrounding gardening locations.

The means of transport used to bring the gardening products to the markets range from head portage to 3-5 tonne lorries. Most small-scale gardeners pay vehicle owners to transport their vegetables to the markets. The pick-up vans charge between ₦10-15 (US$ 0.45-0.70) per basket, depending on the weight of the basket and the distance to be bridged. A group of gardeners may collectively hire a pick-up van or lorry, but it is more common for gardeners and middlemen to convey the produce to the roadside, where roving vans pick them up. One case was reported of an association of women vegetable traders from the Miango village area, located at some 50 km north-west of Jos, who collectively hired 3-5 tonne lorries or pick-up vans to transport fruit and vegetables to the Kwararafa satellite market in Jos. Charges per truckload range from ₦17,000 to 25,000 (US$ 770-1,135) for destinations in the south-eastern or south-western parts of the country, respectively. Gardeners, their wives or women retailers, who transport small quantities from the farm to the main retail markets or smaller retail points, often use small pick-up vans or head portage.

II.6 Constraints on small-scale gardening

In the preceding sections, some constraints to small-scale gardening were already mentioned. These included poorly defined tenure rights, local shortages and pollution of irrigation water, lack of cooperative experience and the problem of raising capital or securing loans from banks.

Some demographic and other characteristics of small-scale gardeners (see Section II.3), such as the low educational and training levels, the ethnic plurality and the low number of women among the gardeners, also pose major constraints that need to be addressed. The generally low levels of education and training, combined with the lack of extension services and on-farm demonstrations in the market gardening sector, leave a large gap that needs to be closed if substantial changes and farming transformations are to be expected from innovations. The market gardening sector currently suffers from a lack of extension services and on-farm demonstrations. During the fieldwork period, no extension officers were seen on the farms – unless the research team had explicitly invited them – nor did the gardeners covered by the survey report any visits. The challenge is to tackle this constraint through appropriate and prolonged educational and training facilitation packages, aimed at achieving a transition to modern gardening forms and practices. These should pay special attention to the young growers, who have the future of market gardening in their hands. However, the older growers also need to be targeted, in order to improve their farming performance, incomes and welfare.

The multi-ethnic composition of the gardeners is another complicating factor. Social cohesion among the diverse ethnic groups is rather weak, sometimes giving rise to inter-ethnic suspicions and rivalries. This is brought out, for instance, in the functioning of the market gardeners' associations in each of the study locations. Yet, if managed in such a way that harmony and cooperation between the groups could be achieved, this ethnic character could lead to a healthy complementarity and more achievements through joint communal effort and pooled resources.

Considerable social distances and mistrust also seem to exist between the older and younger gardeners; males and females; and gardeners operating at different scales. Such social distances hamper communality, collaboration and joint action. In locations, however, where gardeners nearly all belong to the same ethnicity and share a common migratory history, social cohesion and cooperation are relatively high.

Women gardeners are small in number and the smallest among them, in particular, suffer greater disadvantages and handicaps in their activities

than the others. If more women could be encouraged to engage in market gardening, this would bring in some badly needed entrepreneurial and organisational skills, such as social stabilisation, interpersonal and inter-group conflict management. However, the ethnic majority among the gardeners, the Hausa/Fulani settlers and itinerant farmers, do not allow their women to farm. There are still also few women from other (migrant) Nigerian groups engaged in dry-season gardening, because of the difficulty of getting land for that purpose.

The main problems for market gardeners in transport and marketing are their diseconomies of scale and lack of organisation. Totally depending on middlemen at all stages of the marketing process, they lack effective control in sorting, packaging, transport or price setting. This has given rise to a deep-rooted lack of confidence in their ability to change the situation even acting collectively or to challenge the middlemen. The sense of helplessness is even greater when the gardeners have got into debt. Although money lending by middlemen enables gardeners to raise some credit, it ultimately reduces their bargaining power in the sale of their produce.

The solutions to most of these constraints seem to lie mainly in the effective organisation and facilitation of the gardeners. When organised in functional associations or other groupings, they can be helped to improve the quality and volume of their produce and to improve their post-harvest operations. Collectively, they could also improve the transport of their crops to both the main and distant markets and undertake concerted action for better gardening and marketing infrastructure and official support. The female members of the market gardeners' associations, in particular, need to be encouraged to participate actively in any collective marketing system that may be evolved by the farmers. An effective communal approach and training programme, aimed at improved marketing strategies controlled by the gardeners themselves may not only help them to raise their incomes, but also to become more respected partners in the field of marketing, with their interests being taken into account.

The constraints as perceived by the 146 dry-season gardeners interviewed during the 1993 survey are presented in Table 4. The table illustrates the complexity of their perception of the problems. In general, they show a greater concern for short-term than for long-term issues. Consequently, such crucial problems as the poor marketing system and land insecurity rank low in their perception. Conversely, day-to-day problems, such as fuel

scarcity, are rated high. Most of the farmers neither perceived, mentioned or rated the constraints arising from their low business management levels, their little concern with costs, returns and profits or lack of organisation.

The rather low perception and assessment of some major constraints has affected the growers' approaches and their capacity to deal with the constraints. This is a major constraint in itself, as it results in an absence of long-term planning and preparedness in the growers' operations.

Table 4 Constraints as perceived by dry-season gardeners (%)

Order	Constraint	Percentage of farmers (n = 146)
1.	Non-availability and inappropriate application of fertiliser	87.6
2.	Fuel scarcity	59.5
3.	Inadequate finance and low investment levels	26.0
4.	Inefficient implements and poor equipment maintenance	25.3
5.	Weeds, pests and disease infestations	19.1
6.	Irrigation water shortage	10.9
7.	Inability to purchase herbicides 8.9%	8.9
8.	Labour unreliability	8.9
9.	Difficulties in purchasing seeds and seedlings	8.2
10.	Poor marketing system	8.2
11.	Inadequate transport	4.1
12.	Water pollution	3.4
13.	Low yields	2.7
14.	Inadequate preservation and storage of produce	1.3
15.	Land insecurity	0.5

II.7 Results and efforts of gardening improvement in Korot village

As an integral part of this study, a pilot gardening improvement project was set up and evaluated in Korot village, located about 32 km south-east of Jos City. The main purpose of the sub-project was to find out how the various constraints that the small-scale market gardeners face could be tackled, with a focus on social organisation and networking. The small-scale gardeners were encouraged to adopt a communal approach to their operational constraints and to implement gardening improvement measures on an individual basis. Right from the start, the project has promoted the gardeners' full ownership and leadership over their association.

The village of Korot numbers over 5,000 people, many of whom practise rain-fed farming. About 200 of these farmers are also engaged in dry-season market gardening. Thirty-two of them, including six women,

participated in the market gardening improvement project.

After mapping the area and documenting information about the gardeners and their operations, various packages were designed and introduced. They included training, extension, integrated irrigation water sourcing and management, land and soil improvement and advocacy (for more details see Ajaegbu, 1995). Various agencies collaborated in the project and continue to do so (Box 3).

Box 3 Collaborating agencies in the Korot market gardening improvement project

- The Population, Environment and Development Agency (PEDA)
- The three local authorities concerned (Jos North, Jos South and Barkin Ladi LGAs)
- The Jos-Bukuru urban planning and development authority (Jos Metropolitan Development Board: JMDB)
- The Plateau State Ministry of Agriculture through the Plateau Agricultural Development Program (PADP)
- The local community authority in Korot
- The local dry-season farmers' association

The participating gardeners were organised into a local gardeners' association, through which they held meetings and discussed their common problems. They also received some on-site training and demonstration sessions on various topics, including land preparation, nurseries improvement, seedling transplantation, watering and water conservation, composting and manure application, pest control and the relation between quality measures and the value of fruit and vegetables (Okwudire, 1999). The PADP, in particular, which also recognised and registered the local gardeners' associations in Korot and the other locations in the study area, organised these lectures and demonstrations. In the course of 1996, four such lectures or training sessions were held.

The PEDA was particularly concerned with consciousness-raising among the agencies and advocacy on behalf of the small-scale gardeners, encouraging them to take on such advocacy activities by themselves through their association. This has yet to take root, however, as they still feel shy of presenting their cases to the authorities or standing up to the middlemen in their marketing system.

The project proved to be revealing as far as the individual and collective behaviour of the participating gardeners was concerned. Despite considerable overall enthusiasm and willingness to pursue or try out the components of the improvement measures, not all the gardeners responded equally to the improvements suggested. The project's success was larger at the level of

individual farms than at the communal level, while at the individual level success varied between groups of different age, education and scale of operation. It was especially the younger (20-45 years) and more literate and educated gardeners (at least three years of western education in primary school or adult education) who showed a great desire to implement improvements, to participate in the on-plot demonstrations or to try the simple record keeping of horticultural operations they were trained in. The project was also successful among the relatively large and moderate scale operators, particularly those between 40-65 years of age, and the settler farmers. The elderly gardeners (more than 65 years old) among the relatively large operators showed much less enthusiasm for the improvements introduced and tended to send their sons or successors to the training and demonstration sessions in their place. In general, the settler (Hausa/Fulani) gardeners in Korot tended to perform much better than the indigenous (Birom) ones, while the women participants had the lowest score on such assessment indicators as participation in meetings and adoption of improvements.

The differences between the indigenous Birom and Hausa/Fulani settlers significantly influenced the success of the project. The Hausa/Fulani are not only more numerous and experienced in market gardening, but also more powerful in the industry. The Birom gardeners, although they own most of the land and are actually leasing it to the Hausa/Fulani, are still too few and too far behind in skills to compete with them effectively in either production or marketing. The settlers, however, feared that extending the membership of the association to include the Birom and letting them invest in the project could lead in the long run to the termination of the leases which now allow the settlers to engage in dry-season farming. This is because the Birom will increasingly be able to practise dry-season gardening themselves. The fear of losing their comparative advantages made the Hausa/Fulani settlers feel rather hesitant about fully supporting or cooperating in the communal activities and fuelled the suspicion, lack of trust and limited enthusiasm for collective action. This is also, perhaps, one of the reasons why many of the gardeners are reluctant to take over the control of the central farmers' association from the project team members and the staff of the Population, Environment and Development Agency (PEDA) (see Ajaegbu, 1995; Igoche, 1995). It will probably require much more time than the relatively few months of the improvement activities so far, to remove or reduce this constraint and change behaviour in this respect. As to whether transformation and sustained production can be achieved through this

project, its duration so far has been too short for it to have any measurable impact. Yet the seeds for transformation and sustained production were sown and, it is hoped, will ultimately lead to the desired changes.

II.8 Lessons from Israel and the Netherlands: conditions for improved gardening and sustained income

The history of Dutch and Israeli horticulture is marked by an evolution from peasant (in the case of the Israeli Arabs) small-scale operations on field plots to present-day levels of large-scale, sophisticated, high-tech and efficient greenhouse farming oriented towards export markets. The conditions, which made possible these achievements, point to some ways in which present weaknesses and constraints in the study area could be overcome.

The example of Israeli Arab settlements, in particular, where there has been a very fascinating transformation, is possibly the most relevant to the Jos gardeners. From still being at a stage of traditional peasant farming in the early 1950s, the Israeli Arabs started to improve in the 1960s. Their horticulture was considerably transformed in the 1980s through intensification and the adoption of agriculture based on the use of plastic sheets for various operations: for mulching and covering low tunnels or high structures, covering up to four hectares each. The floors of all these structures are also mulched with plastic sheets. By the 1990s, the system included the use of high-tech equipment, drip irrigation and capital-intensive ventures. By 1996, many of the gardeners had become successful and some even rich, living in good houses and enjoying high standards of living. This seems to suggest that achieving a transition is not a utopia, but that it is feasible. The success story of gardeners in the Netherlands and Israel, and that of Israeli Arabs, in particular, is considered very relevant to the small-scale gardeners in the Jos-Bukuru area.

The following factors made possible the farming revolution in the Arab settlements:

- the farmers' ambition and determination to succeed and confidence in their ability to do so;
- the presence of educated (literate), knowledgeable and young farmers, who were willing to invest in new techniques and practices;
- government investments in basic education;
- the capacity and willingness to imitate successful practices of the Jewish farmers in the *kibbutzim* and *moshavim* near their village (Yamma), which enabled them to acquire the necessary skills and

commercial orientation and to attain the required quality standards, even for export;
- intensive demonstration programmes, on-plot training and other extension services to acquaint the market gardeners with modern horticultural practices and management;
- the farmers' ability and determination to organise themselves. Although private farming and ownership are the rule, cooperatives and joint group efforts strengthened the farmers, enabling them to overcome diseconomies of scale, to gain control of the marketing system and to tackle several other constraints;
- the farmers' determination and self-discipline to save money, accumulate some capital and to invest in agriculture;
- government assistance in the form of grants which cover part of the initial capital investments;
- proximity to the market for the products (Tel Aviv and other urban centres), effective access to the market and adequate market information;
- the existence of considerable physical, human and technological resources and opportunities, as well as favourable infrastructure and administrative support.

In the case of the Netherlands, the Nigerian researchers were greatly inspired by the impact of cooperative auction markets developed by the Dutch horticulturists themselves in the early 20th century.[7] They also saw the benefits of local authorities helping market gardeners whose land is needed for urban growth. Instead of paying them as little compensation as possible, the local authorities helped the Dutch growers to relocate to new land where they could continue and improve their operations. Such payment in kind tends to be far more effective than compensation in cash. These two elements are now being integrated into their work with the market gardeners in and around Jos, where they help them to organise themselves.

It should be stressed that the success of the horticultural sectors in Israel and the Netherlands depended to a considerable extent on a stimulating

[7] The auction market is a transparent and professionally managed way of having prospective buyers bid against each other for the produce brought to the market every day. The innovation was the use for each consignment of a big clock, the arrow of which is moving from a maximum to a minimum price. The arrow stops when a buyer shouts "mine!" The auction market is cooperative in the sense that the market space is developed and owned jointly by the farmers.

administrative environment. In both countries, the gardening sector received official support and legal protection. Such an environment is crucial in enabling small-scale producers to increase their productivity. In both countries, other vital success factors included adequate access to updated information, adequate resource management (land, water and other inputs), effective influence on the marketing system and a good balance between collective and individual decision making and actions.

What works in the Netherlands or in the Israeli experience of Arab settlements does not (yet) work in similar peri-urban locations in Nigeria. Although there is no blueprint for successful transformation, the findings of this study suggest that improved market gardening and sustained income from gardening can be achieved if the following prerequisites are met:

- constraints are removed and gardeners utilise the opportunities and potentials;
- the small-scale market gardeners are mobilised and organised to undertake joint actions;
- the gardeners are adequately facilitated as individuals, groups and communal organisations; and
- the associations or other communal groups are modelled on the basis of homogenous interests, small size and scope of concern, and self-governing principles, with consideration given to both individual and group differences and needs.

If the gardeners can be facilitated to organise, mobilise, use their common resources and act in consort rather than as lone individuals, their chances for success will be increased. They require support in very many respects and from local and national government and government agencies, NGOs, researchers, donors, horticultural input producers, importers and consumers. The kind of support and actions that need to be fulfilled will be further detailed in Part IV (Recommendations).

II.9 Conclusions

The possibilities exist for the Jos market gardeners to improve their position, but this requires the removal of their constraints and making it clear how they can make the best use of the resources and opportunities available to them. They should also be made aware of how they can deal with external factors that may often be beyond their control. Some of the necessary conditions outlined in the previous sections are present, but others have yet to be attained. The Jos area has sufficient suitable land and

irrigation water for current levels of market gardening and substantial potential for future improvements. Human resources are also abundant, with sufficient labourers and experienced and young growers. Its nearness to a metropolis guarantees a high demand and access to the market for fruit, vegetables and flowers, but little else is really in the growers' favour. Basic education and the physical infrastructure are deficient and they lack the structural, legislative and administrative support that proved to be essential in the successful examples elsewhere. They are also still far away from the required organisational, technological, managerial and investment levels. In particular, the bottlenecks affecting land-use rights and the insecure tenure of the various groups of gardeners – indigenous, settlers, itinerant farmers, women and the very smallest of them – need to be effectively removed before the full benefits of the abundant resources can be realised.

The study showed that the farmers in the Jos area are aware of many of their constraints. Yet they feel unable to do anything about them. In some cases, they are suspicious of their leaders or group members from a different ethnic background. They refrain from working together in associations and feel even less capable of tackling the problems of urban encroachment or irrigation water management.

The heterogeneous and diffused social fabric of market gardeners in the study area calls for considerable social engineering to weave all of them together for a common purpose. Such common purposes which the small-scale gardeners could be expected to develop and create formal organisations include input sourcing; communal credit, savings and loan systems; post-harvesting activities such as sorting, grading and packaging; and transport and marketing. These organisations could also be instrumental in their search for a more conducive operational environment and infrastructure and in acting as a counter force against the present marketing system, which is dominated mainly by middlemen. Several measures could also be undertaken collectively to control and improve the quality of the fruit and vegetables produced or to achieve some value-added to the produce sold. Yet the small-scale gardeners in the study are generally and essentially individual operators and owners, despite their various constraints.

The growers also need to learn to plan for the next and subsequent seasons' needs. Although they appreciate the need to keep records and simple accounts of their horticultural activities, inputs, harvests, sales, savings and investments, they are often unable to do so through lack of education. Moreover, they feel abandoned by government and extension service

officials and by urban and market administrative organs, which do not provide the necessary infrastructure, inputs and information. They also feel cheated by the middlemen in the marketing of their fruit and vegetables. Yet they feel helpless and are resigned to their fate.

This study suggests that the adoption of modern technology, where it is within the means of the small-scale gardener, is quite effective. A good example is the impressive replacement of the *shadoof* and the rope-and-bucket method of irrigation by the motorised pump in most of the Jos peri-urban zone. This diffusion was almost fully completed within a single decade and would even be more complete if the fair-priced pumps provided to the farmers had not been traded on the black market.

At present, the Jos market gardeners (and others of their type in sub-Saharan Africa) face too many constraints to improve their operations and income. There are many unknowns in their operational environment, such as market information, consumer preferences, price changes and pricing systems. Their input-output and profit-and-loss balances are largely unknown, while the influences of various externalities (in Nigeria and the wider world) in their operations are enormous. Transformation of their horticultural activities to higher scales of operation than at present will ultimately lead to sustained production. The latter can, however, only be achieved when the constraints, vagaries and unknowns are effectively removed or contained.

To bring this about, there is a need for several actions, changes and developments, which must happen largely simultaneously through the adoption of a multi-faceted approach, and with interventions by all the actors concerned. The latter include the growers, government officials, the urban local authorities, facilitators such as NGOs and development agencies, manufacturers and suppliers of technologies and other inputs and all others who impact on the gardeners' performances.

III. Discussion

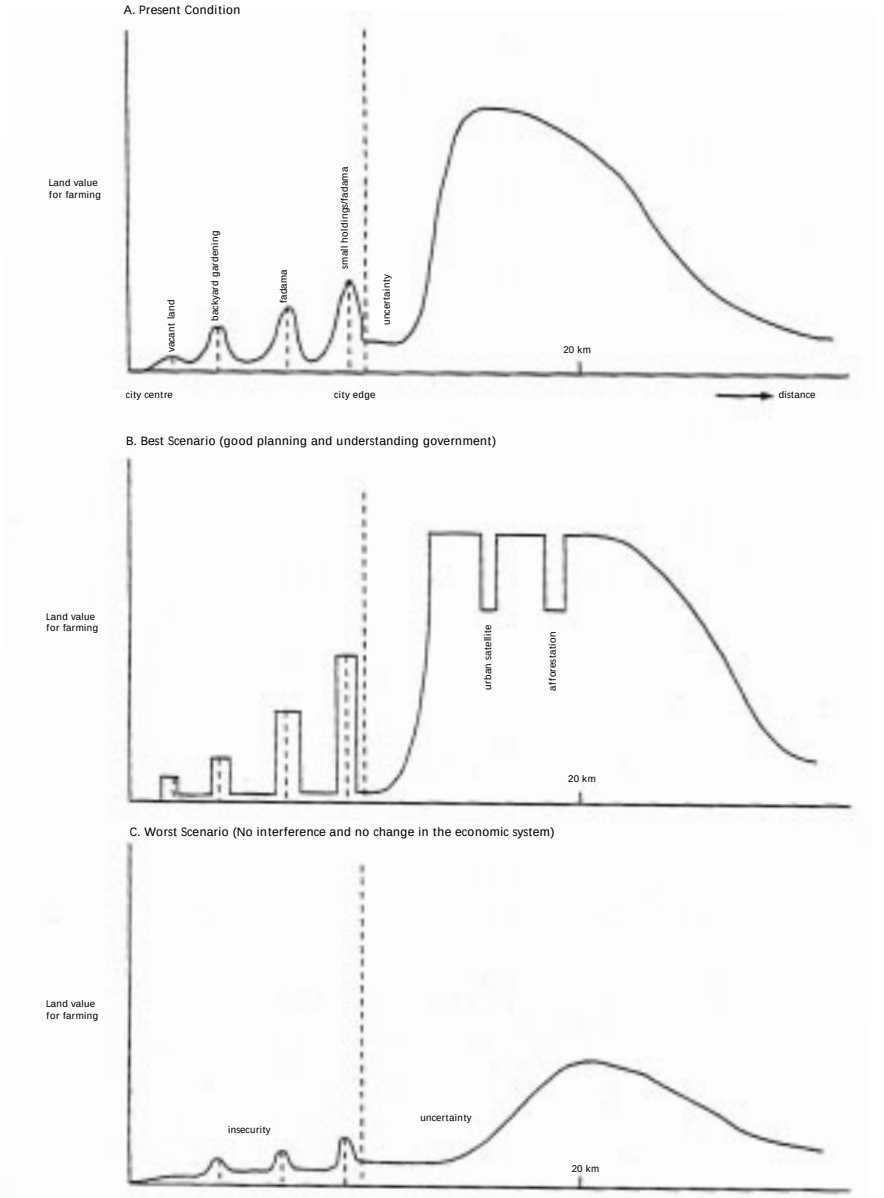
III.1 Scientific relevance

This study has shown that the spatial models of peri-urban land use, values and zoning do apply to some extent to the Jos-Bukuru area, but that land-use patterns are somewhat more complex than in models developed elsewhere. Similarly, the study confirms the postulations and expectations of various behavioural models of resource use and management by farmers, their responses to constraints and the conflict between individual and common interests. Last, but not least, this study has generated a model for achieving sustained income generation from small-scale market gardening which is also applicable to other areas and other agricultural sectors. In particular, the need was highlighted for institutional support from governmental and non-governmental organisations and the important role that facilitators without a vested interest can play as liaison agents between the government and the gardeners, in an area where governmental support is not stable or effective.

III.1.1 The spatial models

The study demonstrated that the spatial patterns of land use are more complex than those found in industrial countries (e.g. Von Thünen, 1826; Sinclair, 1967) or on the Addis Ababa periphery (Horvarth, 1969) (Figure 3). The study has shown that conditions in late 20th century Nigeria do not necessarily duplicate those of early 19th century Europe. There are some similarities, but today's developing countries differ from the European countries of 200 years ago in living standards, transport modes, land market conditions and many other respects.

One of these differences that is closely reflected in the spatial patterns is the incomplete transition from traditional to modern modes, resulting in two economic circuits – a formal and an informal one. The spatial pattern of the formal economy generally resembles the equivalent sectors in developed countries. In both cases, there is a pronounced zone of uncertainty in the ring closest to the city (Figure 3a/c). Unlike the developed countries,



42 *Figure 3 Three models of urban and peri-urban farming*

however, there is no large-scale abandonment of farming in the inner ring, nor is agriculture confined to clearly defined rings. Farming rather starts in the very heart of the city, probably because most farmers operate in the informal circuit under unstable economic conditions and poorly defined tenurial rules. Under these conditions, they tend to farm in all possible open spaces within the city, even where such operations are illegal. From the inner ring, farming tends to rise towards the periphery, to decline again where the strong impact of inadequate transport is felt.

Another difference is the role of policy for open spaces. European countries and Israel give high priority to the preservation of open spaces. The optimal scenario for the Jos area, however, takes into account the need for extending the urban farming zone in the urban core and fringe (Figure 3b). In Nigeria, even if adequate planning were imposed, the priority of preserving space for food production would still be of paramount importance.

The varying availability of surface and ground water is another important factor giving rise to deviations in the general spatial patterns. In contrast to the situation in developed countries, where public or private companies supply water through an extensive network of pipes, irrigation-based gardening in the Jos area depends on the quantity, seasonal fluctuation and spatial distribution of locally available water sources. This explains the generally linear pattern of vegetable gardens in the study area, which follows the stream pattern (Figure 1).

III.1.2 The commons model and its application to communal systems and rural organisations

This report makes a number of recommendations for promoting rural associations. The inability of the government to satisfactorily provide basic support systems and services is a major reason for turning to the bottom-up approach. Although small communities have a more limited capacity than larger official bodies to solve unique problems, experiences elsewhere have demonstrated that resource allocation and management are more effective at the community level. In the Jos area, for instance, the growing seasonal or permanent water shortage in the southern Jos-Bukuru zone can be met only through some form of equitable distribution and management. The best way to achieve this is through intra-village organisations. To be effective, however, such an organisation should be restricted to the single function of water management. It also has to provide a list of clearly stated rules, as well as “teeth” to enforce them. If these conditions are not met, the village may face a sort of “tragedy of the commons” as selfish members will derive personal benefit at the expense of the common good (Ostrom, 1990).

Cooperation is mostly concerned with procurement and distribution, rather than with production. The reason is that a common front is most vital for rural people when they deal with outsiders. The value of pooling resources is clearly understood and the peasants know that they can "beat the middlemen" if they can organise. Organisation can also facilitate access to credit and investment capital, which neither the formal circuit (banks) nor the informal circuit (*essussu* clubs) appeared to supply effectively. However, the pitfalls associated with marketing cooperatives are potentially greater than those of resource-oriented ones like water cooperatives, as marketing cooperatives have to draw on a larger and more diffuse group. This was indeed one of the main difficulties encountered in the study area, where the social and ethnic disparities are greater that usual. Most of the market gardeners – and the best of them – are migrants, coming from a variety of places, which results in great ethnic and cultural differences.

Another possible handicap to the creation of marketing cooperatives is that they are difficult to supervise, as was learned from the experience with the Israeli *Moshav* cooperatives. The potential for the occurrence of the "tragedy of the commons" applies most strongly to cooperation in marketing, because there it is relatively easy to "free ride". This does not mean, however, that the prospect of cooperation should be totally given up. It should be encouraged, but with the caveat that a strong enforcement system has to be imposed. With marketing, as with water supply, the best policy is to form small cooperatives; each of them dedicated to a limited purpose and a small range of crops.

It must be stressed that the main enemy of communality is change. It is difficult to see how the communal systems recommended in this study can survive under highly dynamic conditions. As development proceeds, it may be necessary to reorganise the associations to enable them to function under the new circumstances. In some cases, their operations may have to be totally discontinued. It is certainly hoped that development will reach a stage that will force the Jos gardeners to face this "difficulty" in the study area. Clearly, however, there will be a need for highly qualified and visionary leadership to meet the changing situations successfully. Many institutions have collapsed in the absence of such leadership.

This study has also emphasised the importance of the human resource. The ability to upgrade all phases of farm operation and to apply self-help and cooperation clearly depends on suitably trained and informed gardeners, even if it is granted that this is not the only requirement for success. It is obviously unreasonable to expect this lacuna to be filled within a short time, but there is ground for optimism. The Jos-Bukuru market

gardeners have demonstrated an impressive capacity for hard work and an unusual ability to apply their indigenous knowledge of complex and intensive rotational systems to their commercial gardens. Their tenacity and industry is expressed in the fact that their land is never totally out of use. The results are also commendable. They obtain good returns on their investment, although their income level is low by Western standards. They are certainly not devoid of learning ability and are willing to learn new techniques. In this sense, they are readily available human resources.

III.1.3 The way towards improved gardening and sustainable income

This study has increased our knowledge of the availability of irrigation land and water and the demographic, social, organisational, behavioural and other characteristics of small-scale market gardeners in the Jos area, while information about their operational and productive capacity, marketing activities and constraints is now also available. The main point made in this study is the important role of farmers' organisations, communality and joint action in tackling constraints that are beyond the capacity of the individual small-scale gardeners to handle or solve. Other prerequisites for improved market gardening and income generation – adequate and well-modelled support – have been identified, too. The key factors identified reinforce insights into similar problems and challenges elsewhere in Africa.

The study has shown, too, that urban and peri-urban farming is not solely practised, as in some other African countries, by the urban poor and lower middle class as a response to food insecurity. Instead, within the city, it is mainly the urban middle and upper class inhabitants and, at the city fringes, the indigenous rural population, migrant settlers and itinerant farmers who practise market gardening. They are primarily motivated by economic considerations and the desire to increase their incomes. In general, meeting household food needs is secondary, especially as far as dry-season market gardening is concerned.

III.2 Recommendations for further research

Among the many reasons why small-scale market gardening has remained small, despite a high demand for its products, is the lack of a stimulating administrative environment. One of the issues that received little attention was the scope for improving the performance of government institutions. The present study assumed support could not be provided by these institutions. Case studies of breakthroughs in this worrying situation are recommended. After last year's return to civilian rule in Nigeria, such case

studies are becoming not only desirable, but also a viable, proposition.

III.3 Practical applicability

This study has made clear that a properly implemented participatory community approach and community-based methodology work favourably among small farmers, who might otherwise be sceptical and suspicious of the researchers and their intentions. This is especially the case when new ideas and technologies are introduced. A participatory approach stresses the importance of indigenous knowledge and technologies, thus ensuring that new techniques, seeds or breeds are blended with what people already know and practise over generations. In this way, a wider acceptance and diffusion can be achieved.

Secondly, the research and development (R&D) orientation adopted for this study ensured that the development aspect went side by side with the research component. The direct application of some of the research results in the Korot project, which tackled some of the gardeners' constraints and needs, shortened the usual time lapse between concluding a research project and the application of its findings. Hence, this kind of project design is recommended as a viable and useful approach to conducting research among small farmers in Nigeria and other developing countries.

Thirdly, the results and recommendations from this study have contributed to our knowledge of the characteristics, behaviour and constraints of small market gardeners and the possible ways of tackling their problems, increasing their incomes and improving their operations. At the practical level, the study has contributed to our understanding of the gardeners' behaviour and motivations for acting as individuals in relation to their personal interests or as members of a group for communal needs and joint action.

Fourthly, this study has generated a considerable amount of data on various aspects of market gardening in the region. These data will continue to be available for analysis by scholars for many years to come. In this way, the study has brought the market gardening industry to the attention of scholars, agencies, authorities and farmers – including women and young adults. The project seminars conducted so far (see Appendix II) and other forms of dissemination of the results and recommendations provide input to the advocacy of sustained market gardening in the Jos area and other parts of Africa.

Finally, this study has highlighted the importance of different forms of facilitation, the role that different facilitators should play in achieving the successful transition to sustained market gardening and the importance of

continuity in these efforts. Various actors have a role to play in this process: government agencies at the national, state and city or village levels, NGOs, donor agencies, middlemen, financial institutions and suppliers of various inputs. They all have to provide the infrastructure and inputs needed to create or enhance an enabling environment. The need for such concerted action extends to policy, legislation, technology, information, education, training and marketing facilities.

How unique is Jos-Bukuru urban area or how applicable are the results of this study to other areas in Nigeria and sub-Saharan Africa? Compared with other parts of Nigeria, the Jos-Bukuru urban area and the Jos Plateau region are unique in their physical conditions – altitude, geology, soils, weather and climate – and resources for market gardening. Similar conditions can, however, also be found in northern, eastern and southern Africa.

The study area is also quite peculiar in other respects. Demographically, it is unique in the mix and diversity of indigenous, settler and itinerant (migrant) market gardeners. The market gardening industry is unique in the long experience of many growers and the use of intricate cropping systems. The markets developed in the urban zone and the marketing strategies practised are also unique. Finally, the primarily market-oriented nature of small-scale market gardening is rather unusual: market gardening in the Jos area is certainly not restricted to poor urban households attempting to minimise their food insecurity.

The uniqueness does not, however, extend to the operational and behavioural characteristics of the small-scale market gardeners. The region's comparative advantages have not removed the fundamental constraints common to all small-scale farmers elsewhere in Nigeria and in many other parts of Africa south of the Sahara. For instance, the growers in the Jos area face the same diseconomies of scale, insecurity of tenure, lack of credit and inputs, inadequate infrastructure and lack of support and market information as elsewhere. As in other regions, they keep few records of costs, returns and gains. They also lack the organisation and concerted collective effort to tackle many of their constraints. Moreover, the problems of inadequate marketing strategies and exploitation by middlemen exist elsewhere in Nigeria and sub-Saharan Africa. The results of this study and the recommendations on how to achieve improved gardening and sustainable incomes can therefore also be applied to market gardening in other peri-urban areas.

IV. Recommendations

To improve market gardening and income from that source, a multi-facetted approach is required, which takes ecological, economic and social aspects into account. This calls for straightforward, sustained facilitation by a wide range of agents. The small-scale market gardeners are quite capable of solving many constraints, both individually and collectively, but many other constraints are beyond their control. This is where outside facilitators – governmental agencies, NGOs, development organisations and the private sector – come in. The recommendations below summarise what all the actors involved need to do. Most of these recommendations were agreed at a seminar held in Jos in December 1998, in which more than 40 representatives of small-scale market gardeners, farmers' organisations, local, state and national governmental bodies and NGOs participated. The recommendations presented here indicate what each group of actors is willing and has decided to do.

It would be preferable for all constraints and prerequisites to be addressed concurrently and collectively. To identify a major bottleneck and do something about it is not enough. All the agents involved in small-scale market gardening need to be mobilised and motivated to do their job. Advocacy and facilitation are therefore crucial. Making the non-gardening people involved aware that providing the small-scale market gardeners with inputs and marketing facilities could also be in their own interest is at least as important as working with the gardeners themselves.

IV.1 What gardeners can do as individuals

- They should use the abundant potential land and water and increase the size of their holdings.
- Those who operate in areas suffering from land shortage, urban land competition or water pollution should try to relocate to other areas, for instance, the southern zone, where enough irrigable land is still available. New entrants should look for land in the southern zone.
- They should not use polluted water to irrigate their plots.

- They should adopt improved seeds and modernise their gardening systems and methods (*cf.* the success story of the Israeli Arabs).
- They should strive to acquire basic functional literacy and the skills to keep records.
- They should look ahead and plan over two or more years.
- They should adopt local, low-cost solutions, such as using compost, manure and insecticides.
- They should avail themselves of extension services, on-farm training, demonstrations and advice.
- They should take some risk and look for promising markets.
- They should try out a greater variety of fruit and vegetables, possibly including apples and flowers, taking advantage of the altitude, relatively cool climate, skills and high market demand available.
- They should diversify their operations and try out other aspects of farming, such as poultry, pig farming, bee keeping, etc.
- They should train and encourage their successors to enter the market gardening industry.

IV.2 What gardeners can do collectively as groups and associations

The importance of a communal approach was emphasised throughout this study. The growers should mobilise and organise in order to overcome diseconomies of scale and facilitate effective collective action and advocacy. Some considerations need to be taken into account, however, if communal efforts are to succeed. The first set of recommendations refers to these considerations, while the second set summarises what the associations need to do.

- A proper balance needs to be found between individual interests and actions and communal ones. Individual achievements should be encouraged, even if some resources are pooled and commonly managed. Individual gardeners should retain their private identities as much as possible, thereby retaining their own land, inputs, products, sales and returns. At the same time, they should be encouraged to fulfil their obligations in the communal organisation and to contribute to the associations and common action committees. Only a balanced combination of, for instance, private savings and pooled resources or private ownership and communal management will be effective in tackling the major constraints.
- Membership of associations should be open to all market gardeners within a locality, whether they are indigenous, settlers or migrants; women or men.

- Conversely, associations should be fairly homogenous and be made up of gardeners with similar interests and aspirations. This may imply that more than one association should be set up within a locality.
- Associations should be small, target-oriented and local-based.
- Only democratic participation and self-determination will enable the gardeners to take their fate into their own hands. This requires strong commitment and honesty from both leaders and members. Leaders should be open and determined to work for the benefit of all members. Members, in turn, should assume a strong commitment to fulfil their obligations and share the benefits.

Set up this way, the associations and functional groups can embark on communal projects to improve inputs and operations and tackle the problems of their members. Actions recommended here include:

- Associations in areas of water shortage should increase the water available to them through the adoption of water-conservation and water-saving practices and evolving regulations for water use.
- They should strive to increase their water sources and supply through communal efforts and the pooling of resources, so that earth dams and sink wells can be constructed and water can be channelled from the ponds.
- They should organise and operate cash mobilisation and credit or small loan schemes to help their members.
- They should set up village advocacy teams or committees for effective lobbying for secure land-use rights and adequate institutional support.
- They should encourage more women to practise market gardening.
- They should embark on the collective purchase of inputs in order to lower their prohibitive costs.
- They should organise their own transport and marketing system, in order to gain more control and participation in the selling of produce and obtain a larger share of the benefits.
- They should be instrumental in securing, processing and using information on price levels, market conditions and input sources and in arranging demonstrations and training activities.
- They should approach the relevant agencies for assistance.

IV.3 What governmental institutions and officials can do

There are various forms of urban and peri-urban agriculture in the Jos area that are capable of making a substantial contribution to the urban economy, improving environmental quality and enhancing the social and economic life

of many people. Urban farming should therefore be taken into account in urban planning and land management in the Jos metropolitan area. Specific actions by government institutions and officials include the following:

- In urban land-use allocation, they should provide land for market gardening on a permanent basis, e.g. protect the Delimi river valley plain as a green belt and area of market gardening land.
- They should protect the *fadamas* and water sources against encroachment.
- They should guarantee by law land-use rights for the gardeners for at least 15 years, in order to enhance investment in land improvement and the creation of more stable and permanent water reservoirs.
- They should use legislation and environmental protection measures to protect irrigation water from municipal and industrial pollution and wild urban waste dumping.
- They should help the gardeners in land-pressed and polluted areas (northern and central zone) to relocate and develop their gardens in either protected market gardening belts, to be designated within these zones, or in the southern zone, through cash incentives and seed money. Market gardeners whose land is really needed for urban growth should be adequately compensated.
- They should assist new entrants to locate in the southern zone.
- All relevant agencies should help the gardeners to obtain regular and timely supplies of their inputs and spare parts at subsidised, stable prices.
- They should provide intensive and sustained information, training and extension services to assist the processes that will transform and improve the performance of the market gardening industry. Training in record-keeping and other managerial and organisational skills, and the use of improved breeds and modern gardening methods and techniques are particularly important here.
- Indigenous knowledge and technologies should form the basis of a "from known to unknown" approach to innovations.
- They should encourage continuous research into irrigation farming.

IV.4 What NGOs and other facilitators can do

The group of facilitators includes NGOs, advocacy groups, middlemen and women marketers, importers, distributors and retailers of the various inputs used by the gardeners, and local and international development agencies. They could help the gardeners in various ways:

- They should help the gardeners to organise into associations and task committees.

- They should give special incentives to the women gardeners, who are often among the smallest-scale gardeners. This applies both to their access to resources and inputs and to their role in gardeners' associations and task committees.
- They should help the farmers to become functionally literate, so that they can read and understand simple instructions about fertiliser application, seeds or insecticides, keep records of their expenditures and earnings and appreciate and interpret relevant market information.
- They should provide effective advocacy and lobby on behalf of the gardeners in order to obtain official governmental and legal support, favourable marketing conditions, relevant and low-cost inputs, security of tenure and reduce pollution.
- They should help the gardeners to overcome their sense of helplessness and gain confidence to solve their problems, thus empowering both sexes and all age classes and ethnic groups.
- They should provide on-farm demonstrations, training, advice and information, including market information.
- They should provide seed money and help the farmers to organise revolving credit and small loans schemes.
- They should assist the farmers in funding or constructing earth dam reservoirs, boreholes and/or hand-dug wells.
- They should form a coalition of facilitators in order to harmonise their activities and inputs to the farmers.
- They should help the growers to improve the post-harvest management of their produce.

IV.5 Concerted work plan

Detailed follow-up actions and working plans are needed, involving the market gardeners and all facilitators, so that each stakeholder and actor can work to improve urban and peri-urban farming in the Jos area. An important step in this direction was taken during the 1998 seminar, where all the parties involved resolved to join hands and work together to:

- give the farmers the necessary basic education, demonstrations and information;
- improve their access to inputs, including finance, land, water, pumps and improved seeds;
- mobilise the farmers into viable, functional associations for greater communal effort to tackle their constraints;
- introduce and popularise new forms and species, such as apples, fisheries, pig farming, rabbit keeping, bee keeping, etc.

- provide intensive, sustained and purposeful extension services and information to the farmers and advocacy on their behalf;
- guarantee to the farmers all the necessary conditions, including legislation, to improve and sustain the market-gardening industry.

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Appendix I

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4. Other members from SC-DLO (Wageningen)

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Plus several field survey staff

Appendix II

Follow-up of the project: capacity building, seminars and project-related publications

The project enabled administrative and technical staff members of the Population, Environment and Development Agency (PEDA) to realise their MSc and PhD plans through providing funding and a framework for fieldwork. As most of them were also linked to the University of Jos, either as staff members or graduates, the skills acquired will be passed on to younger generations of researchers, thus having a cumulative effect. Seven MSc candidates successfully graduated under the formal training component of the project, while one PhD candidate, Mr. Adem Igoche, is still working on his PhD thesis. The training programme at these post-graduate levels is now virtually permanent and will continue for many years to come.

The project also provided the Jos team with the opportunity to establish new partnerships abroad through visits to the Netherlands and Israel.

An important part of the project was to encourage the small-scale producers to approach their activities in a more analytical way. During numerous visits to the field, the project team members stressed the importance of the producers keeping a record of what they spend and what they receive in return.

The results of the project and literature review were presented during a workshop organised by Dr. van den Berg in Wageningen in the summer of 1995. The papers presented provided an excellent summary of the work done during the two preceding years.

In 1996, this was followed by the international workshop on Market Gardening, Farm Associations and Food Provision in Urban and Peri-urban Africa, which was held in the Green Beach Hotel, Netanya. Thirty participants from ten countries attended this workshop.

Finally, Prof. Ajaegbu (PEDA) organised a two-day seminar on Dry-Season Market Gardening in the Jos Metropolitan Area in Jos in December

1998. The main objective of this seminar was to present and discuss the results and recommendations of the study to all the stakeholders involved. More than 40 representatives of the small-scale market gardeners, the local authorities, the Jos urban planning authority, the relevant Plateau State ministries and the federal government attended the seminar.

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