

PESTICIDE PROVISION IN LIBERALISED AFRICA: OUT OF CONTROL?

Stephanie Williamson

Abstract

This paper reports on case study research carried out in Benin, Ethiopia, Ghana and Senegal, looking at changes in smallholder pest management strategies and use of pesticides in cotton, vegetables, pineapple, cereal and legume crops for export and domestic markets. It describes recent changes in pesticide provision and smallholder access to synthetic inputs following liberalisation, detailing the proliferation of informal trading, and farmer perceptions of the pros and cons of different provision sources. It describes how pesticide access is facilitated by governments, donors and development agencies, as well as the activities of private sector distribution and commodity companies, and the widespread diversion of pesticides from intended targets. Farmers' and other stakeholders' assessment of provision, access and use are summarised and the policy implications of the research findings for pesticide provision, control and alternative pest management strategies are discussed.

Research findings

- Pesticide provision has proliferated since liberalisation, especially through the growth of informal trading.
- Current provision channels encourage highly hazardous practices, using inappropriate and often unapproved products, particularly among smallholders.
- Pesticide dependency continues despite the removal of most government subsidies and the rapidly rising costs of pesticides.
- Pesticides for smallholders are promoted via government programmes, donors and development agencies as well as the private sector.
- Current attempts to control pesticide distribution and use are weak and mainly ineffective.

Policy implications

- Control of hazardous informal trade and pesticide diversion require multi-stakeholder dialogue and inter-institutional collaboration with farmers and civil society.
- Agricultural investment programmes should pay particular attention to farmers' access to safe, affordable and sustainable means of pest management.
- Subsidies for pesticide facilitation should be phased out in favour of investment in alternatives to pesticide dependency.
- Changes in export market requirements for pesticide use may provide a useful pathway for reducing the hazards and poor quality of current pesticide provision.
- Sustainable agriculture requires new strategies for pest control and innovative means of delivering safer products and pest management inputs to smallholders.

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Acronyms

AGENT	Agribusiness Entrepreneur Network and Training
AISCO	Agricultural Input Supply Company (Ethiopia)
BUCADEF	Buganda Cultural and Development Foundation
CAPSARD	Community Action for Participatory Sustainable Agriculture Research and Development (Ghana)
Cocobod	Ghana Cocoa Board
CPA	Cotton Production Assistants
DPV	Department for Plant Protection (Senegal)
EC	Emulsifiable Concentrate
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GV	Village Groups (Benin)
IFAD	International Fund for Agricultural Development
IPM	Integrated Pest Management
MRL	Maximum Residue Level
NGO	Non-Governmental Organisation
OBEPAB	Organisation for the Promotion of Biological Agriculture (Benin)
PAN	Pesticide Action Network
PHI	Pre-Harvest Interval
PROFIC	<i>Projet de Promotion des Filières Céréalières/Cereal Supply Chain Promotion Project</i> (Senegal)
SARI	Savannah Agricultural Research Institute (Ghana)
SDI	<i>Société de Distribution Intercontinentale</i> (Benin)
SEG	Safe Environment Group (Ethiopia)
SEPAS	<i>Sénégalaise des Exportations des Produits Agricoles et de Services/Senegalese Association for Agricultural Produce Exports and Services</i> (Senegal)
SODEFITEX	<i>Société de Développement des Fibres Textiles</i> (Senegal)
SONAPRA	<i>Société Nationale pour la Promotion Agricole</i> (Benin)
SPIA	<i>Société des Produits Industriels et Agricoles/Society of Industrial and Agricultural Products</i> (Senegal)
ULV	Ultra-Low Volume
USPP	District Farmers' Association (Benin)

PESTICIDE PROVISION IN LIBERALISED AFRICA: OUT OF CONTROL?

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1 INTRODUCTION

There is broad consensus on the frequently negative impact of liberalisation on African smallholders' access to the inputs required for agricultural production, particularly seeds, synthetic fertilisers and pesticides. Shepherd and Farolfi (1999) have reviewed extensively for the Food and Agriculture Organization (FAO) of the United Nations the recent changes documented following the liberalisation of export crops in Africa, discussing trends in traditional cash crops (coffee, cocoa, cashew, cotton) in several countries. From their analysis of case studies, these authors conclude that agricultural input supply has been the major casualty of liberalisation, intimately linked to: (a) the disappearance of specific and (relatively) well-organised pan-national supply channels following the privatisation of former state-controlled commodity boards, and (b) the removal of government subsidies for farming inputs, under structural adjustment recipes for cutting state expenditure. Input use for cash crops is reported to have dropped significantly and is partly blamed for the observed serious declines in the quality of traditional agricultural exports, along with the dismantling of government quality control services. Yields have also been affected in some cases. For example, coffee yields in Tanzania have fallen from around 250 to around 200 kg per ha since liberalisation which is attributed to the reduced use of inputs.

Numerous commentators (e.g. Dorward et al., 1998; Coulter et al., 1999; Chisvo, 2000) have highlighted how smallholders in remote areas, or those where few cash crops are grown, have been poorly served by liberalisation and structural adjustment processes in terms of greatly reduced access to external inputs. In their view, smallholders need increased access to inputs, including agrochemicals, in order to improve productivity and compete in the harsher markets of a liberalised world. The shift from state to private provision over the last decade has not only made it more difficult for such farmers to get hold of pesticides but has also affected the coverage and quality of agricultural extension, national research and development, and market information and predictability. For many farmers, the agricultural production rug has been pulled effectively from under their feet and they are left with precious little support or resources to cope in a rapidly changing socio-economic, political and biophysical climate. The provision of 'Starter Packs' of hybrid maize seed and fertiliser by the Malawian government to rural communities since 1998 constitutes perhaps the most direct effort to address these problems (Cromwell et al., 2001).

Pesticide provision before liberalisation

In many African countries, smallholders used to be provided with agrochemicals by the state, either through commodity boards or via the extension services. Pesticides were subsidised, sometimes even free, to farmers growing cash crops of importance to national economies, such as coffee, cotton and cocoa. In Côte d'Ivoire, for example, insecticides were given to cotton farmers free of charge during the period 1966 to 1994 (Ajayi, 2000). Pesticides were sometimes provided for use on food cereal or legume staples for local markets or for control of outbreak pests such as locusts, armyworm and quelea birds. This phenomenon was well established in the Sahelian countries, where village pest control brigades were set up from the late 1980s to organise resource-poor farmers to apply pesticides provided by the government or donors. Some of these still exist, in Senegal, for example, although there has been much criticism of their effectiveness and safety as well as complaints about unequal distribution of pesticides and benefits amongst villagers (de Groot, 1995).

Subsidy removal and state withdrawal from direct provision

Commodity boards in general had a relatively well organised and pan-territorial system for delivering agrochemical inputs to farmers, although there were often problems with timely supply. The privatisation or dismantling of the boards has had significant impact on input access. For example, cashew growers in Tanzania have serious problems in getting hold of sulphur dust (for the control of powdery mildew disease) under the privatised supply system. Even when it is available, they need finance up front to buy the sulphur and hire mistblowers to apply it (Shepherd and Farolfi, 1999). Ghana's Cocobod (which remains part-government controlled) has, for decades, supplied insecticides and fungicides at highly subsidised prices to the nation's cocoa growers. With plummeting cocoa prices from the mid-1990s, many farmers could no longer afford even these subsidised inputs, resulting in an accumulation of unused lindane, a highly persistent organochlorine insecticide which has now been banned in the European Union (EU). Over one million litres of lindane were estimated to be in store in Ghana in 2001, causing controversy when the government embarked on a mass spraying campaign, free of charge to farmers, with the declared objective of improving cocoa yield and quality, but also to use up stockpiles before new EU lindane residue levels for cocoa products came into force (Buffin et al., 2002).

In Benin, state subsidies for pesticides had been removed completely by 1991 under government restructuring following the country's democratic emergence in 1990. The Agricultural Services Restructuring Project transferred a large proportion of former state provision of advice and inputs to the new private sector, working directly with farmers' organisations at village and sub-prefecture levels. The Beninois cotton company SONAPRA which supplied agrochemical inputs to farmers under state monopoly until 1991 has been gradually replaced by private companies which organise distribution to farmers, via their Village Groups (GV). By 2001 there were 23 distribution companies operating in Benin and eight companies supplying inputs to cotton farmers (PAN UK, in press). Pesticide facilitation by commodity companies, including cotton, is discussed in detail in Section 3.

Ethiopian government subsidies and monopoly over pesticide distribution were removed from 1995. Pesticide imports attract an import duty of 5%. Privatisation of state-owned input supply companies has taken place and other private companies have been set up. Pesticide imports from 1992 to 2000 averaged 1452 tonnes per annum, a 65% decrease compared with 1983–91, mainly due to the closure of many large-scale state farms in the 1990s (Alemayehu, 2001).

In Ghana, price subsidies for pesticides were removed in 1996. In general, agricultural inputs, including herbicides, fungicides and growth regulators, are exempt from import duty and VAT. Insecticides, rodenticides and fumigants in theory attract an import duty of 10% but importers almost always apply for a waiver on duties, while declaring a zero VAT rating (Gerken et al., 2000). The remaining form of indirect subsidy lies in the sale by the Ministry of Food and Agriculture of Japanese pesticide donations, estimated to be worth around US\$1 million in 1999.

It should be noted that there remains considerable variation between countries in terms of the extent of government restructuring, level of subsidy or tax on pesticides and facilitation of agrochemical inputs. Major currency devaluations have had huge impacts on the prices of imported agrochemicals purchased in hard currency. For example, pesticide prices increased by 200% in Cameroun following devaluation of the francophone CFA in 1994 (Shepherd and Farolfi, 1999). Malawi's farmers experienced massive devaluation in the late 1990s, provoking a three-fold increase in fertiliser prices in just one season (Orr and Mwale, 2001). In Uganda, in contrast, agrochemical supply is reported to have improved since liberalisation without major price rises, helped presumably by the government's removal of taxes on imported agricultural inputs (Shepherd and Farolfi, 1999).

Agrochemical affordability and availability post-liberalisation

Development analysts concerned about the knock-on effects on smallholder income and food security following liberalisation and devaluation often highlight the dramatic declines in cereal production in southern

Africa as farmers struggled to obtain and pay for improved variety seed and fertiliser inputs. This was the main motivation for Malawi's Starter Pack scheme of seed and fertiliser provision, mentioned above, and for development agency interventions such as CARE Zimbabwe's AGENT project, which helps local-level input retailers increase availability of products to smallholders, via credit and training in book-keeping and marketing for village shops (Coulter et al., 1999). Rural household cluster analysis in Malawi revealed that fertiliser use was the most important distinguishing variable between smallholder households, and that vulnerable households, especially those headed by a single woman, faced the severest cash constraints in affording hybrid maize and fertiliser (Orr and Jere, 1999).

It is frequently assumed that a similar pattern exists for pesticide affordability and usage, predicting that, under current economic climates of rising input prices, smallholders will be forced to reduce or abandon their use of pesticides, except on high-value crops. A survey in 1997 in Lesotho, for example, recorded that the most common reason for farmers not controlling stalkborer pests in their maize and sorghum was lack of capital to buy insecticides, reported by 68% of respondents, followed by unavailability of insecticides (Ebenebe et al., 2001). Ajayi (2000) reports a reduction in the quantity of pesticides used on all crops in Côte d'Ivoire since the elimination of direct subsidies in 1994–5, indicating that the farmers' reaction is price elastic. The overall situation cannot be generalised, however, partly due to differences between fertilisers and pesticides in terms of: volume required and hence transport costs; the moisture constraints on economic use of synthetic fertiliser in areas with increasingly erratic rainfall; and the fact that a comprehensive appreciation of the costs and benefits of application is far more complex for pesticides than for fertilisers. Farmers' perceptions about the need for pesticide application are rarely based on economic grounds alone and much pesticide use is unnecessary, ineffective or uneconomic, as Wilson and Tisdell (2001) reflect in their paper. Orr and Jere's study (1999) found that cash constraints were less important on pesticide than on fertiliser use: three-quarters of vegetable cash-cropping households in Malawi did, in fact, use pesticides but their low average yields of maize, beans and pigeonpea decreased economic incentives for chemical pest or disease control. However, they noted that pesticide use may be feasible in small doses, for example, three of five household types in their typology applied insecticide dressing to maize seed to prevent damage by white grubs.

It has been widely believed that African farmers do not apply pesticides to their pigeonpea crop even though insect pests may cause major losses. Research in the mid-1990s confirmed this general pattern for pigeonpea farmers in Malawi, Tanzania and Uganda but in Kenya, between 35 and 53% of farmers were using pesticides on their long-duration pigeonpea landraces, notably in the major cash-cropping parts of the country. These farmers mainly used pesticides destined for coffee, cotton, vegetables or rice and

available via agricultural cooperatives (Minja et al., 1996). This study suggests another important reason why farmers' use of pesticides may not be directly related to their apparent costs on the open market, which is the issue of diversion from commodity supply chains, discussed in Section 3. Continued indirect subsidy or facilitation via specific programmes constitutes further 'push' factors encouraging reliance on pesticides, despite overall cost increases. These are discussed in Sections 3 and 4.

The aim in this paper is to share the findings from recent case study research on changing patterns of pesticide supply and distribution in sub-Saharan Africa under liberalisation and how these and other factors affect smallholder pesticide practice. It explores the hypothesis that, contrary to popular perceptions, pesticide reliance is increasing among certain smallholder cropping systems and socio-economic groups, despite rapid price rises for agrochemical inputs in recent years. It outlines the policy implications of these findings for government, donor and development agency programmes to support agricultural intensification and food security and suggests some courses of action for improving smallholder pest management and farming profitability and sustainability in the next five to ten years.

2 CASE STUDY RESEARCH AND METHODS

Research objectives and partners

Case study research was carried out by the Pesticide Action Network (PAN) UK in 2000–1, which aimed to contribute to a better understanding of the linkages between pesticide use, food security and human and environmental health in the context of liberalisation processes. A prime objective was to help African policy-makers and their non-governmental organisation (NGO) partners to take informed decisions to eliminate the hazards of pesticides and to promote Integrated Pest Management (IPM). A second was to inform donors and other stakeholders of current trends in pesticide use, and of hazards and problems experienced by smallholders, their families, food consumers and rural communities.

Research objectives and appropriate methodology were developed in close collaboration with PAN partners from: PAN Africa in Senegal; the Beninois Organisation for the Promotion of Biological Agriculture (OBEPAB) in Benin; the Safe Environment Group (SEG) in Ethiopia; and Community Action for Participatory Sustainable Agriculture Research and Development (CAPSARD) in Ghana. The complete research results and analysis will be published early in 2003 (PAN UK, in press). This paper concentrates on issues relating to the supply, distribution and use of pesticides, although the research project also covered the direct costs of pesticide use, health and environmental impacts, regulation and controls, alternative pest control methods and the specific issues for export horticulture of compliance with European regulatory and market requirements on pesticide residues and practice.

Research methodology and study sites

We aimed to find out whether agricultural intensification and income generation strategies aimed at small farmers were delivering improved incomes and enhanced food provision for specific farming households, and how pesticides contributed to these objectives. Crops and study sites were selected which would provide insights into the broad changes in rural livelihoods under current agricultural production strategies and the impacts of deregulated markets, and a detailed look at changes in cropping systems, pest problems and how farmers are dealing with these.

Pesticide usage data in developing countries, especially in Africa, is notoriously poor; many African national pesticide regulators possess only sketchy figures for quantities or values imported, which bear scant relation to usage at field level. The little data available often show large fluctuations from year to year, reflecting changes in government or donor programme purchase ability or production policies, private sector import capacity and to some extent, seasonal demand in different cropping systems. Pesticide donations are frequently missing from government import data and, not surprisingly, official data do not include informal trade or unregulated cross-border supply. Nor do they cover sales figures from national or international pesticide importing agencies or distributors, although certain countries, such as Ghana, aim to make such reporting compulsory in the future. Ghana's Environmental Protection Agency, for example (the authority mandated with pesticide registration) estimates that 20% of pesticides used by Ghanaian farmers are sourced via unauthorised trading and do not enter official figures at all (G.S. Klufio, personal communication, 2001).

Given the dearth of accurate data on supply and usage, we decided there would be little value in attempting to relate pesticide data available with trends in the field, or to try and unravel the complex threads at aggregate level between pesticide use, production volumes and areas, food security indicators, etc. Instead, we opted for an approach which would provide quantitative and qualitative data from specific farming communities and triangulate this with information provided by key informants from different sectors with a good knowledge of pesticide use, production or smallholder practice. For PAN UK and its African partners, it was also important to listen to the experiences and opinions of women and men smallholders and to transmit their views to policymakers and donors, many of whom lack understanding of what really happens in the field.

A range of cropping systems for local and export markets in high and low potential agroecological zones was chosen and the following crops were selected:

- **cowpea** as an example of a crop in transition from subsistence status to cash crop and because its increased cultivation in several African countries has been accompanied by the recent introduction of pesticides;
- **mixed cereal and legumes** as an example of local food production in medium- to low-potential areas

- moving into a more cash-oriented economy;
- **peri-urban vegetables** due to their renowned status for pesticide misuse but also their profitability and the rapid growth in production as urban populations rise;
 - **cotton** due to its energetic promotion by West African governments and donors as the dominant livelihood strategy for the savannah zones, its reliance on pesticide use and increasing concerns about the levels of pesticide use;
 - **pineapple** as an example of a lucrative export crop which smallholders have started growing in the last decade. Smallholders produce varieties for local markets with little or no use of agrochemicals but when producing for export markets many of them regularly apply pesticides.

In consultation with local Ministry of Agriculture staff, farming communities which were broadly representative of smallholder cropping systems, and where at least some farmers were using pesticides, were chosen. Fieldwork took place with African partners in four countries, as summarised in Table 1. A combination of participatory assessment methods (wealth ranking, partial farm production budgets (as developed by Galpin et al., 2000), matrix scoring and group discussion) and individual interviews explored the experiences of women and men farmers in dealing with pest problems and cropping system change and how their current farming contributes to income generation and food security. Discussions in farming communities were complemented by open-ended interviews with key informants from government agricultural extension and research; the health and environment ministries; private sector agrochemical distributors; export companies and producer associations; donors, development agencies and NGOs. PAN Africa and OBEPAB also conducted formal questionnaires with 25–40 selected farm families at each community site in Senegal and Benin.

3 CASE STUDY FINDINGS ON PESTICIDE SUPPLY AND DISTRIBUTION

The proliferation of informal trading

Many case study farmers relied on obtaining pesticides via informal, unlicensed dealers, often petty traders visiting village markets or selling informally in larger towns. Senegalese vegetable farmers, for example, described how many small traders have appeared in Les Niayes horticultural zone in recent years. They sell products in small quantities and at lower cost than from authorised channels in order to meet the reduced purchasing power of many small-scale farmers. These products are repackaged locally into smaller units, e.g. 250ml flasks and 25–100g sachets. Farmers identified four separate supply channels which they use:

- specialist retail outlets established by authorised distribution companies, e.g. Senchim, SPIA;
- small-scale informal traders operating via local shops;
- itinerant peddlers;
- in bulk from general markets in larger towns.

Products from the the last three channels, many of which are of dubious quality, are frequently repackaged and re-labelled, while their contents may have been diluted, mixed or changed so that they do not always correspond to the label.

Beninois farmers described similar practices and growth of informal pesticide trading in the vegetable and pineapple sectors. Farmers’ lack of cash has encouraged the development of village-level trading of pineapple inputs in small volumes (e.g. Fury insecticide by the glassful or eighth of a litre). Authorised outlets mainly sell one- or five-litre containers for liquid pesticides. Pineapple farmers admitted to often using products without knowing their identity, name or characteristics. Herbicide is often sold unlabelled. Farmers explained that as chemical prices have increased, they look to obtain them via cheaper, informal sources.

Table 1 Cropping systems and sites for the case studies

Pineapple	<i>Benin</i> : 45 farmers (men and women) from Sekou village (export and local production) in Allada Sub-Prefecture, Atlantic Department <i>Ghana</i> : 14 men and 8 women from Fotobi and Samsam villages (export production) near Nsawam in Eastern Region; 15 women and 23 men from Abontsin village (local production) near Mankessim in Central Region
Cotton	<i>Benin</i> : 45 farmers (men and women) from Kpako village in Banikoara Sub-Prefecture, NW Benin <i>Senegal</i> : 25 farmers (men and women) from Diaobé, Sare Bounda, Linguewal, Nemataba villages in Velingara Dept, Kolda Region, SE Senegal
Vegetables	<i>Benin</i> : 45 farmers (men and women) from Sekou village, in peri-urban Cotonou <i>Senegal</i> : 50 farmers (men and women) from Sangalkam, Gorom II, Tivaoune Peul and Wayembame villages in Les Niayes zone, near Dakar
Cereals + Legumes	<i>Ethiopia</i> : 74 men and 4 women from Yigoma, Zenzelima and Fereswega villages near Bahir Dar, Amhara Region
Cowpea	<i>Ghana</i> : 69 men and 17 women from Sakuba, Moglaa, Voggu and Ziebiikura villages near Tamale and Gbambaya village near Yendi, in Northern Region

Ghanaian pineapple smallholders either access pesticides through the export company if they are registered members or buy from local retail outlets in nearby towns. Only some of these retailers are fully licensed. Smaller retailers may decant products into smaller containers to meet farmers' purchasing ability, using bags and paper sachets, usually without proper labels, which should describe active ingredients and concentration, dosage, handling instructions and hazards, batch and date of expiry. Retailers interviewed, for example, had repackaged diuron and atrazine herbicides in 1kg plastic tubs with just a product name label and their store name and address. Retailer informants explained that small-scale farmers like to buy small quantities, so they do good sales on 250ml cans of insecticides available pre-packaged from francophone countries. These can be readily found in Ghanaian stores – the research team observed Karate insecticide bottles packaged in Côte d'Ivoire, 250ml Karate cans from Abidjan and the Novartis company's Polytrine cotton insecticide, all labelled in French, which neither retailers nor farmers can read.

Some of the Ethiopian case study farmers obtained pesticides via the extension service or local branches of formal, licensed private sector distributors such as Ethiopian Amalgamated Ltd. and Ambasel Co., but many purchased from informal, unlicensed local traders in nearby towns and via small shops that have sprung up in the villages, selling pesticides and medicines. The semi-clandestine nature of these enterprises became obvious when the research team tried to buy pesticides from stores mentioned by farmers, only to discover that they were now 'unavailable'. Farmers highlighted the fact that insecticides are now readily available informally in local shops wherever *chat* (a narcotic shrub, the leaves of which are chewed for recreational purposes) is grown. *Chat* is one of the crops on which pesticide is used most intensively, indicating its key role in pesticide promotion and in the flourishing informal supply chain.

One of the difficulties faced particularly by poorer farmers in Ethiopia is that both the government and formal licensed distributor channels only supply ready-packed pesticides, usually in volumes of 1kg or 1 litre, or in 5-litre containers. One litre of Rogor (dimethoate) insecticide, for example, cost the equivalent of US\$10.52 in 2001, a huge outlay for a farm family subsisting on less than a dollar per day and cultivating under two ha of land. Many farmers do not require this amount on their small plots and cannot afford the cash outlay involved, so informal traders sell products including DDT, Malathion and Rogor insecticides, and Lanirat rodenticide, which they have decanted into smaller containers (often empty penicillin vials for liquids or scraps of plastic for dusts). In contrast to Benin and Senegal, these repackaged products are sold to farmers at much higher relative prices than from official outlets. Yigoma village farmers recounted paying the equivalent of \$6.08 per litre for a very small volume of Malathion 50% insecticide from informal traders, compared to the official price of \$3.04 per litre from distribution

companies. Small packages of DDT were available at the equivalent of \$3.50 to \$4.00 per kg, compared to prices of \$0.58 to \$0.80 per kg from the Agricultural Input Supply Company (AISCO). The advantage of the informal channel, according to farmers, is that it is quick, readily accessible and the cash outlay is within their means but they run a substantial risk of being sold adulterated or fraudulent products. Some farmers may club together to buy one-litre containers between two or three people, to save on transport costs and time, but they tend to be the richer farmers.

Facilitation by government, donors and development agencies

The case studies revealed considerable promotion and distribution of pesticides by public sector or civil society organisations, usually on a purchase basis but sometimes subsidised or given free.

In Ethiopia, pesticide supply channels have changed considerably in the last five years, with the entry of private sector trading and changes in local cropping systems. A government-managed channel still exists via the extension service and the now partly-privatised AISCO. A farmer must request an individual field visit by his or her local extension agent to assess the need for pesticide purchase. The extensionist then writes to the district-level Agricultural Office to request the appropriate chemical, the office contacts AISCO to order supplies, then the farmer has to deposit his payment in the local bank before taking delivery of the product on presentation of his bank receipt. Farmers explained that this route requires substantial legwork and is time-consuming but has the advantage of guaranteeing access to good quality, legitimate products.

In Northern Ghana, District Agricultural Office staff may sometimes help farmers to obtain pesticides, whose distribution in many districts by the licensed private sector is minimal or non-existent (compared to fertilisers which are sold in most local markets). Some farmers may also give cash to the local extension staff to buy pesticides for them from the large towns. Extensionists may run small pesticide stores in their private capacity. For example, the only two pesticide outlets in Mfantisman District in Central Region were run by extension agents, selling mainly to vegetable growers. Ministry of Food and Agriculture informants saw no conflict with their duties in this practice; in fact, it is seen as far preferable for farmers to buy pesticides from somebody with appropriate training, who can give them proper advice.

Even in the wholly private input distribution network for Senegalese horticulture, government intervention may still take place, as happened in 2001 when the government supported fertiliser distribution to smallholders and exporters at subsidised prices, to solve critical problems of poor quality products in circulation. The Department for Plant Protection (DPV) has also subsidised the very expensive Preempt insecticide, used for combating whitefly, in order to support the cotton sector and to tackle recent critical problems of whitefly resistance to older generation chemicals.

Commodity chain-based provision

Specific crop commodities continue to enjoy specialised importation and distribution of pesticides, most notably cotton and cocoa, while others, such as the local vegetable sector, now have to purchase all their inputs on the open market. The situation for export horticulture crops varies according to the scale of production and whether growers are members of a producer association or work as outgrowers to export companies, which may facilitate access to inputs in some way.

Provision to the cotton sector

The structure of the commodity-specific distribution channels and level of direct state involvement has evolved and diversified in the last decade. Benin's part-privatised cotton company SONAPRA continues to oversee private sector provision, including the geographical demarcation of different companies' operations and maintenance of figures on total input supplies to the cotton sector, and may intervene directly in cases of extreme need. Of the 23 distribution companies operating in Benin, the largest is the Société de Distribution Intercontinentale (SDI). Out of a total national cotton insecticide supply of 770,255 litres in 2000–1, SDI distributed 120,000 litres of insecticide to Banikoara farmer groups, the largest zonal delivery by any company in Benin's cotton zones. SDI works with the District Farmers' Association (USPP) to organise delivery of inputs on credit to the Village Groups (GVs), each of which now has a small warehouse. GV farmer officials are then responsible for allocating stocks to individual farmers. This system operates in a far from transparent or equitable manner in some villages, as discussed in the following section.

Export horticulture

Pesticide supply varies quite widely in the pineapple sector in Benin and Ghana and for export vegetables in Senegal. Nevertheless, stricter EU market requirements and, particularly, the recent imposition of much lower Maximum Residue Levels (MRLs) has focused the mind of the African export horticulture sector on pesticide issues in the last few years.

In Senegal, small export companies source from smallholders to whom they rent land for a cropping season and provide logistical and technical inputs on credit (seed, pesticides, fertilisers). A few independent smallholders also exist, who sell to export companies on an ad hoc basis. The export company SEPAS trains its growers about correct timing and the importance of pre-harvest intervals (PHIs) and now takes measures to control production practices much more closely. MRL issues are a priority concern for most companies. Government, FAO and export company staff now liaise with NGOs and horticulture projects to raise awareness of the new regulations and measures to be taken to minimise residue levels, as well as organising specific training for some growers. According to SEPAS, their growers' pesticide use is changing as they now only authorise use of pesticides approved in Europe.

Quantities used have not changed since these are determined by volume of production but product selection has changed related to performance and toxicity. The company sources its pesticides from SPIA and Senchim distributors, who are in tune with what export markets now demand.

A similar tightening-up of provision and application guidelines is taking place in export pineapple in Ghana, in which around 40% of fruit is grown by smallholders, either cooperative members, outgrowers or independent farmers. One large export company has instigated a system of company-approved input dealers who are given the company's recommended product list and growers may only purchase from these dealers and this list. It strongly advises growers only to buy pesticides sold in original packages, as there had been some previously reported problems with poor quality or ineffective products, especially from Nigeria and Côte d'Ivoire. Each farmer keeps his/her own field record book which is audited twice a year and agronomists keep a file on each grower, including full records of each chemical application (date, dose rate, product, worker name, crop stage). The system ensures traceability to a particular plot and farmers' own outgrower sources.

This company probably represents best practice in the Ghanaian pineapple sector and other exporters are beginning to follow. One large co-operative is training farmers in correct pesticide use and keeps them informed of new requirements. Pesticides may be provided on credit via growers' groups, at slightly lower than market prices. To qualify for input provision requires 'before' and 'after' field visits by the company agronomist to advise and check on correct application, make sure that only recommended products have been used and that the empty containers are shown as proof. Compliance by smallholders supplying to larger farmers is a challenge in terms of making sure they get correct training and monitoring and understand how compliance will bring advantages in accessing higher value markets, but the industry has to make a concerted effort to ensure this happens.

Amongst export pineapple smallholders in Benin, in contrast, pesticide use is not as firmly established as in Ghana. Smallholders interviewed source their own pesticides as they choose, frequently from the informal market and in small volumes, but they do tend to use the products widely recommended for pineapple production and used by large-scale growers.

Illicit trade and diversion of pesticides from approved uses

A substantial proportion of pesticides circulating in the informal supply network comes from unauthorised, sometimes illicit sources, according to several key informants, farmers interviewed and observations by the research team when viewing farmers' pesticide containers. These sources may be:

- i) unauthorised cross-border trade which takes advantage of price and currency exchange rate differentials and availability to move pesticides;

	Vegetables (Senegal) N= 25	Cotton (Senegal) N= 50	Pineapple (Benin) N= 45	Vegetables (Benin) N= 45
Supply channel				
Informal channels only			54%	
Formal channels only			40%	
Both	✓	✓	7 %	✓
Access to pesticides				
'Very easy'	n.a.	n.a.	4%	20%
'Easy'	n.a.	n.a.	28%	45%
'Difficult'	n.a.	n.a.	68%	35%
Non-approved usage				
Non-approved products on food grains	8%	72%	✓	n.a.
For non-agricultural purposes (e.g. household pests)	43%	64%	n.a.	n.a.
Cotton products on maize	n.a.	40%	✓	n.a.
n.a. = data not available or not applicable				

- ii) smuggling or even theft;
- iii) diversion of pesticides supplied on credit or free to specific farmers or organisations.

Table 2 lists data on case study farmers' sources of pesticides, their use for non-approved purposes and their views on ease of access.

Cross-border trading

Farmers in Benin described illegal trading of pesticides from Nigeria and Togo among local vegetable farmers. They also explained that several endosulfan products intended for cotton are frequently used on vegetables and admitted to using these clandestinely themselves. One farmer said they knew that the products were forbidden for vegetable production but they were very effective. By using them they could be surer of combating insects, especially in cabbage, and reducing their losses as much as possible. Lower costs for pesticides supplied via informal traders imply they are sourcing their wares from outside the official distribution channels. OBEPAB suspects the source for many of the pesticides used in vegetables is organised theft from shipments unloaded at Cotonou port.

Liberalisation in Senegal has been accompanied by a surge in illegal trade in pesticides, of doubtful origin, sourced from neighbouring Guinea Bissau, Guinea Conakry, the Gambia and Mali. Case study farmers in the Koukane cotton zone admitted that certain farmers re-sell their cotton insecticides to traders who operate across the border with the Gambia, particularly since the growth of the market at Diaobé and the opening of cross-border markets. In Ghana, unauthorised cross-border trade is common with Côte d'Ivoire and Togo, as evidenced by the widespread sale of pesticides labelled in French, violating one of the labelling requirements in the FAO Code of Conduct on the Distribution and Use of Pesticides, that products and advice must be provided in an appropriate language (FAO, 2002). Cross-border trade is encouraged by wide price and exchange rate differentials between countries:

In late 2001, certain registered pesticides used in northern Ghana cost ten times more than their francophone counterpart products in Côte d'Ivoire, providing an obvious stimulus for lucrative, unauthorised trading (A. Salifu, Savannah Agricultural Research Institute, pers. comm.).

Diversion of cotton insecticides

The Savannah Agricultural Research Institute (SARI) in northern Ghana investigated why farmers chose to grow cotton in the early 1990s and found that the three most common responses were: (i) to earn cash, (ii) to take advantage of the residual fertiliser effect on their following cereal crop, and (iii) to gain access to cotton pesticides for application on cowpea, a legume crop of increasing importance in the region. In Gushiegu-Karaga District, there are no licensed private sector suppliers of pesticides at all, even in Gushiegu town, so local farmers have either to travel to the regional capital, Tamale, or obtain them from extension staff. The District Agricultural Office reckons that the cotton system is by far the biggest source of pesticides in the district, which leads to huge problems of diversion and highly hazardous practice. Around 20% of local farmers, for example, are now estimated to use cotton pesticides to preserve their stored maize or other cereals (Z. Mustapha, pers. comm.), while SARI is aware that some farmers persuade their cotton-growing friends or relatives to sell them insecticides, which they may spray on cowpea or maize plots. Official prices for insecticides approved for food and vegetable crops have soared recently, for example, a litre of Karate (lambda-cyhalothrin) increased by 50% during one cowpea cropping season in 2001, providing added incentives for resource-poor farmers to make use of cotton insecticides which are generally much cheaper.

Cowpea farmers interviewed in Ghana described their common use of ten different insecticides to combat field pests, five of which are products destined specifically for cotton use. They only spray insecticide

on improved varieties of cowpea, which are very susceptible to attack by pests in the field and in storage. The use of the organochlorine insecticide endosulfan on cowpea is of greatest concern, due to its persistence and toxicity. Endosulfan was introduced into the francophone cotton company production system ('filière' system) in 1998–9, in order to overcome resistance of cotton bollworm pests to other insecticides. It is widely found in the savannah farming zones in West Africa. OBEPAB has documented 277 cases of acute poisoning and 61 fatalities among farm families between 1999 and 2001 in Benin, with endosulfan responsible for 88% of fatalities in the 2000–1 season (Tovignan et al., 2001).

The case study research in Benin revealed serious problems in distribution and re-sale of cotton insecticides at village level. Cotton farmers were quite frank in discussing the incidence of diversion of cotton agrochemicals and the channels used. After inputs are distributed to individual farmers (delivery coincides with the lean season) certain farmers will sell some or all of their inputs in order to buy food. Farmers explained that those diverting inputs were usually people with access to very little land and/or those with 12 or more mouths to feed. Farmers sell their inputs at prices far below the credit supply price, for example, one litre of insecticide supplied on credit for US\$5.80 may be sold for around \$2. Farmers diverting pesticides are therefore making a loss of more than 50% on the costs that will be deducted from their cotton revenue. Diverted inputs are sold either to better-off farmers, who may use them on their own farms or sell them on via the GV officers, or to traders from Niger who sell them in neighbouring regions of Benin. Similar scenarios emerged from discussions with cotton company managers, cowpea farmers and researchers in Ghana, as detailed in Box 1. The tragedy is that farmers often sell their inputs for a pittance when they are desperate for cash to feed their families. For example, selling a litre of insecticide costing 40,000 Ghanaian *cedis* for only 3000–4000 *cedis*, even though the full price will be deducted at harvest.

Re-use and resale of empty pesticide containers is perhaps the most hazardous practice linked to the diversion trade, particularly when they are used for storing drinking water or food by farm families or unwitting consumers. Over 75% of poisoning cases recorded by PAN Africa partners in the cotton zones of Benin and Senegal have been the result of food and drink contamination, rather than of operator exposure during spraying, with an alarmingly high proportion of children affected. Diversion of highly toxic insecticides destined and approved only for use on cotton represents an extremely hazardous practice, incurring significant health and productivity costs to rural communities.

Farmers and stakeholders' assessment of pesticide provision, access and use

We asked farmers' groups and key informants about their assessment of pesticide trends and how specific

government policies or agricultural investment programmes might influence pesticide use. Virtually all key informants highlighted the huge growth in informal pesticide trading and most attributed this directly to liberalisation of input supply markets and government withdrawal from direct provision. One informant from Senegal described how many farmers and petty traders have entered the informal trade, becoming 'chemists' overnight by mixing up their own combinations for sale. The majority opinion was that privatising pesticide provision has led to an increase in hazardous practice, and some informants called for a return to government-controlled provision in order to guarantee legitimate products for sale, with some form of advice to farmers on appropriate pesticide selection and handling. Pesticide distribution companies were equally scathing about the informal trade, which, of course, undercuts and reduces their market.

Government, NGO and private companies in all four countries identified the emergence of a parallel supply chain selling products of dubious quality or products provided free by donors. The informal channels provide no guarantees for product quality, there is no understanding of appropriate storage and containers leave much to be desired. Many traders don't even know what product they are selling, much less its characteristics or recommended use. SPIA distribution company in Senegal analysed samples of products bought from the informal network and found in many cases no correlation between the active ingredient on the label and its actual composition. Cross-border trading of supposedly interchangeable pesticide products is another factor which may reduce the effectiveness of pesticide application and lose farmers money: Ghanaian informants described problems with the francophone glyphosate herbicide formulation available through informal channels, whose active ingredient is only half as concentrated as that in the English-labelled products imported officially into Ghana. Some dealers omit to explain this difference to their customers, leaving farmers to find out when they apply their usual rate and it fails to work.

Diversion of pesticides from the cotton and cocoa sectors was identified as a major problem by several informants, mainly in government and NGO agencies. Some commodity companies were frank in admitting the scale of the problem, for example the three Ghanaian cotton companies detailed in Box 1. Others were less willing to address the issue or claimed that it was now under control. Informants from the SODEFITEX cotton company in Senegal considered that farmers' diversion of cotton insecticides onto food crops was very low but confirmed that farmers do sell these pesticides to vegetable growers in Les Niayes zone or to Gambian traders, and that customs officers had recently arrested some traders in Diaobé market. Cotton farmers in Nemataba village explained that some of them preferred to sell their inputs across the border rather than use them on cotton since the returns on cotton were so disappointing. In fact, Nemataba village's record on credit repayment became so bad

Box 1 Stakeholder assessment of cotton input diversion in Ghana

We interviewed production managers from three private cotton companies operating in the Northern Region, including the largest company in Ghana. Two managers concurred that input diversion of fertilisers and pesticides constitutes the most important problem facing all companies. One company estimated that 50% of the inputs they deliver to village-level company stores are sold on, resulting in huge losses to the company and greatly reduced yields for the farmers. Another judged that their improved efforts to control diversion have been quite successful so that now only around 25% of fertilisers supplied and less than 10% of insecticides are sold on. All agreed that diversion leads to serious yield losses and one of the reasons that Ghanaian cotton farmers average a meagre 900–1000kg of cottonseed per ha, compared to 1200kg in francophone West Africa. Repayment recovery is falling in most areas in Ghana and the recent government-imposed geographical demarcation of cotton company operation zones has yet to deliver its anticipated benefits and stability.

Free provision of inputs before 1997 by some companies engendered a hand-out mentality among farmers, which is proving difficult to change. Some managers accept that their staff are as much to blame for diversion as farmers, and fraud by their field-level Cotton Production Assistants (CPA) is common, such as registering 'ghost' farmers whose inputs may then be used to generate profits for those complicit in the action. Sometimes allocated inputs never reach certain farmers who complain that they are still waiting for their quota. All three companies recognised that cotton input diversion is now a major illicit business network, with traders buying and reselling pesticides to major wholesale markets, to cocoa and vegetable production in the south of Ghana and across the border with Togo. Some traders reportedly pay in advance for diverted products before they are delivered to a particular village. Local police collude with or catch those transporting cotton agrochemicals and demand payment to prevent their arrest.

Companies have tried several tactics to reduce diversion, including the supply of ultra-low volume (ULV) oil-based formulations for use in battery-operated ULV sprayers, rather than the conventional emulsifiable concentrate (EC) formulations. EC products are much more popular among farmers as they don't require specialised spray equipment and they fetch a higher price in informal markets. Two of the companies mainly supply ULV formulations. Another tactic is to tighten up monitoring of input delivery and use. All companies recommend a calendar-based insecticide regime of five applications at fortnightly intervals. Inputs are delivered to farmers one round at a time to prevent stockpiling or reselling large volumes. One company operates a 'credit card' system on which CPAs record inputs supplied to each farmer but this system is open to abuse when many farmers are not literate. The company experimented with printing its name on insecticide containers but people simply removed the labels. To prevent re-use of empty pesticide containers, it devised a scheme to retrieve empty containers but the diversion network persuaded company farmers to reject the scheme and the company was forced to abandon it. Highly hazardous recycling of containers for storing food or water and illicit resale to the diversion network are major problems acknowledged by all companies interviewed.

Research and extension public sector key informants confirmed that cotton input diversion is a huge problem and blamed the attitude and practice of the cotton companies, their lack of hazard minimisation policies and their promotion of unnecessary pesticide use under blanket recommendations for preventative spraying. Inefficient company practices have been compensated for by the very low producer prices paid recently but farmers are starting to protest strongly. One informant estimated that diversion will continue until farmers get a decent return on their cotton crops. Another highlighted the fact that cotton farmers do not know how to handle hazardous chemicals safely, nor are they trained or advised properly by the CPAs in practice, despite company claims. Companies were criticised for being 'interested only in making money'.

that SODEFITEX excluded it from their area of operation.

This example illustrates widespread and growing disillusion with cotton revenues and the practices and attitude of the cotton companies expressed by most case study farmers in Senegal and Benin. The high and rising cost of pesticides was specifically mentioned as a major factor by which, in the farmers' eyes, they lose out and the company profits. In Benin, national cotton income per ha remained static between the 2000 and 2001 seasons, while average pesticide treatment costs rose by 80% (S.D. Vodouhe, pers. comm., 2001). SODEFITEX set up its PROFIC cereal programme in 1996 to imitate the cotton company production system to provide credit and marketing support for cereals with the objective of improving farmer income and food provision. Informants acknowledged that a secondary, less publicised objective was to reduce the increasing diversion of cotton inputs onto food crops. Farmers interviewed recounted problems with delayed payment, forcing families to sell cereals at low prices or to sell maize inputs for cash.

State-managed cooperatives used to distribute seed, pesticides, spray equipment and fertiliser free of charge to vegetable farmers in Senegal before liberalisation.

Farmers interviewed highlighted state withdrawal from the mid-1990s as a major loss of support to smallholders and one which has contributed to much higher pesticide costs. The majority of vegetable farmers in Benin considered pesticide access had become easier since liberalisation. Beninois pineapple farmers, however, complained that government withdrawal had led to a proliferation of private companies mainly interested in supplying the cotton sector. Pineapple does not enjoy the company production system organisation available to cotton farmers and access to inputs is problematic, so farmers have had to develop their own strategies to obtain these.

In terms of pesticide reliance, the farmers and a majority of key informants concluded that smallholders had become more reliant on pesticides and many had increased their use in the last five to 10 years, despite the rapidly rising costs of agrochemical inputs and declining revenues from certain crops. Table 3 summarises the situation across the cropping systems studied. Factors encouraging reliance are discussed in Section 4. Within this general pattern, it is important to distinguish exceptions, as farmers clearly drew out during group discussions. Vegetable farmers in Senegal considered that the farmers' wealth was unrelated to

patterns and levels of pesticide use but derived from their capacity to gain access to quality products and their choice of supply channel, although certain of the poorer farmers had been forced to reduce their pesticide use because of recent cost rises and poor marketing. They said that they bought chemicals from the informal market although they doubted their quality. However they didn't have any choice because they didn't have enough cash to go to official stores which were a long way away and where the products were more expensive.

Women may have particular difficulties in obtaining pesticides, since they usually have less cash than their male relatives. This was the problem for women cowpea farmers in Ghana who were unable to grow improved varieties requiring insecticide application to yield well. Others had had to reduce their scale of cultivation of cowpea as a cash crop. Women pineapple growers in Ghana also reported that many of them were cutting back or abandoning pineapple, as input costs, including pesticides, had risen beyond their means. In Benin, the imposition of farmer Village Groups by the cotton company production system has given rise to highly inequitable distribution of inputs in some villages, including the case study village. Distribution is managed by the GV secretary and officers and instead of receiving the amounts recommended according to plot area, certain farmers obtain a far larger share, according to traditional relations of wealth, influence and patronage within the community. The re-sale of cotton inputs by the most disadvantaged families reinforces the inequitable distribution of inputs and benefits.

Some of the most telling statements from farmers emerged during an analysis of strengths, weaknesses, opportunities and obstacles to community development conducted by PAN Africa with cotton farmers. The farmer discussion group in Linguewal identified pesticides as one of the major obstacles to their village development since they bring only problems (poisonings, suicides, increased production costs and debts on cotton) without improving yields. Diaobé cotton farmers described insecticides, herbicides and synthetic fertilisers as a failure, since they affect people's

health, kill animals and impoverish the soil, and their cost reduces the farmers' income. They saw abuse of pesticides as an obstacle and requested help to overcome it.

4 DISCUSSION AND POLICY IMPLICATIONS

Growth of pesticide trading and the need for control

PAN UK's findings confirm the assessment of many pesticide commentators throughout Africa of the explosion of unlicensed and uncontrolled dealing since liberalisation. A 1999 survey by Tanzania's Tropical Pesticides Research Institute found that the number of pesticide retail shops had almost tripled since 1995. Substantial quantities of unregistered, unlabelled, expired and repackaged pesticides were displayed openly in these shops (Macha et al., 2001). Around 30% of pesticides marketed in developing countries do not meet internationally accepted quality standards. They pose a serious threat to human health and the environment and the problem is particularly widespread in sub-Saharan Africa, where quality control is weakest (FAO/WHO, 2001). For instance, counterfeit agrochemicals made up 15% of the Kenyan market in 1999, causing estimated 40–60% yield losses due to ineffective action (AGROW, 1999).

Liberalisation of the agrochemical input markets aimed to induce a more competitive market, which could lead to lower prices, higher quality products, more timely procurement and delivery and encourage more rational use of inputs according to economic signals. However, African regulators acknowledge that this has rarely been the experience so far. Entry of more firms into the market runs the risk of erosion of quality control and packaging standards, the breaching of national regulations and the unimpeded movement of banned or restricted chemicals across borders (Mudimu et al., 1995).

In Côte d'Ivoire, nevertheless, the level of pesticide misuse and cases of unauthorised re-sale are reported to have declined in reaction to higher prices (Ajayi, 2000), a rather anomalous finding if one assumes that

Table 3 Case study farmers' assessment of pesticide use patterns

Cropping system	Increase in pesticide reliance ?	Increase in application frequency ?	Increase in pest incidence ?	Calendar-based spraying ?
Cotton				
Benin	n.a.	Yes	n.a.	Yes
Senegal	Yes	Yes	n.a.	Yes
Vegetables				
Benin	Yes	Large	Large	Yes
Senegal	Yes	Large	Yes	Yes
Pineapple				
Benin	Yes	n.a.	Yes	No
Ghana	Yes	No	n.a.	Yes
Cereals & Legumes				
Ethiopia	Yes	Yes	Severe	No
Ghana	Yes	n.a.	Some	Yes

n.a. = assessment not available

increased prices for pesticides will act to increase the likelihood of informal trading. This illustrates the danger of making generalisations about farmers' sourcing practice, without investigating the specific local context, including factors such as confidence in different supply channels, relations of power among farmers of different resources, company practice, policy and integrity, farmers' attitudes to pesticide quality and to consumer demand and perceptions, as well as the more obvious economic and policy signals.

Large-scale agrochemical distributors have increased their scale of operations and networks under liberalisation. The Senegalese pesticide formulation company SPIA, for example, has opened 25 retail outlets in large towns in order to supply farmers more directly and employs local sales agents who spend part of their time visiting individual farmers, to increase sales among smallholders. Chemico Ltd in Ghana has extensive marketing channels via a nationwide network of smaller retailers. Both SPIA and Chemico have adapted their sales strategies to meet the low purchasing power of smallholders: SPIA now offers several products in volumes of 100–200cc and Chemico repackages popular products into small containers affordable by smallholders. The bulk of pesticide imports into Senegal is in large-volume units, attracting a current import tax of 5%, as opposed to 20% for containers of less than five litres capacity. This tax policy encourages in-country formulation of active chemical ingredients by national chemical companies, who export to neighbouring countries, but also stimulates repackaging into small volumes. As many stakeholders have noted with concern, local repackaging often leaves much to be desired in terms of quality control, advice and safety, especially when hazardous products are decanted into poorly labelled and unsuitable containers (even drinks bottles, food containers and empty penicillin vials have been redeployed for this purpose).

Our case study research found that government regulators and others are deeply concerned about the hazards and inefficiencies related to the flourishing informal trade and to poor pesticide practice in general, but they lack concrete data on pesticide impacts on rural communities, agroecosystem productivity, natural resources or micro- and macro-economic performance. Some senior managers in the Environment, Health and Agriculture ministries admitted to having no idea that smallholders were using pesticides at all, reflecting a general problem of inadequate understanding of field reality and the lack of basic information on which to develop policy.

Factors influencing pesticide provision and demand in Africa

We identified six factors which appear to be driving increased pesticide use or reliance among case study farmers:

- deliberate promotion by programmes or agencies to improve productivity or access to new markets;
- improved varieties of maize, cowpea and vegetables which are more susceptible to pests and diseases;
- recent spread or introduction of pest and disease

problems, linked to absence of advice on non-pesticide control methods;

- pest resistance and/or disruption of natural control mechanisms, due to inappropriate or excessive use of pesticides;
- farmers' attempts to compete with imported vegetables;
- farmers' desire to increase yield or quality and lack of knowledge on how to achieve this without reliance on pesticides.

Ghanaian pest management experts in an earlier study identified the three most important factors influencing current levels of pesticide use in the country as: (i) price, (ii) indirect subsidies (exemption from import duties and VAT) and (iii) preferential distribution programmes, mainly of Japanese Kennedy Round 2 (KR2) donations and of cocoa pesticides (Gerken et al., 2000). Of Ghana's annual KR2 budget of US\$2.5million, around half is spent on pesticides, which are sold at subsidised wholesale prices to distribution companies, development projects or sometimes individual farmers. Japan's pesticide donations have been severely criticised by many commentators (e.g. Tobin, 1996). It would be misleading to focus on pesticide donations and direct subsidies alone as responsible for excessive pesticide promotion. Nevertheless, the continued provision of pesticides free of charge, as is the case with Senegal's village pest control committees and many African locust control programmes, is fraught with problems of late delivery, pesticide diversion, inequitable distribution, food safety hazards and the accumulation of stockpiles of obsolete, highly hazardous chemicals. It also sends out erroneous messages about the desirability and indispensability of pesticides instead of tackling complex socioeconomic, ecological and political issues in food security and agricultural intensification.

While few commodity companies now provide free agrochemicals, indirect partial subsidies may continue. Ivoirean cotton farmers receive insecticides from the cotton companies on credit but interest is charged at below the market rate, while spraying equipment is supplied on credit repayable within two to four years (Ajayi, 2000). Such easy access and availability of pesticides and application technology gives chemical control strategies an advantage over non-chemical alternatives and integrated approaches. This author stresses that current credit policies serve to promote pesticides and reinforce reliance on chemical technologies and that cotton remains the pivot around which pesticide use and practice in the northern part of the country revolve.

It is no surprise that agrochemical companies want to promote chemically-based control strategies. What is more worrying is the trend among certain donors, notably the World Bank and IFAD, to allocate public funds or staff resources to encourage public-private sector partnerships with agrochemical companies. A recent example in Senegal concerns the role of the Bank in fostering Rhone-Poulenc's (now part of Bayer) activities to combat pesticide misuse among vegetable and rice growers in the Senegal River Valley. The

demonstration packs promoted by the company introduced two further hazardous products into already dangerous farmer practice and increased recommended application frequency in tomato. The packs also included the company product Regent (fipronil) which is prohibited for use on tomato in the US, Canada and the EU, thus jeopardising the Senegalese producers' export markets. The associated credit packages lock farmers into a cycle of credit and pesticide reliance and result in a local monopoly for Rhone-Poulenc and its Senegalese partners (FAO, 2001).

Current bilateral and multilateral donors advocate investment in agricultural intensification by smallholders to achieve food security and alleviate poverty (e.g. IFAD, 2001, and FAO/IFAD/WFP, 2002) and underline the need to build farmer-based organisations, working with private sector services and extension. Ghana's new Agricultural Sub-sector Investment Programme pays welcome attention to human and environmental health protection and adopts IPM as its strategy for export and local crop protection (World Bank, 2000). It remains to be seen how well this is implemented, particularly given the World Bank's dismal record on implementing its own pesticide and IPM guidelines (Tozun, 2001). A particular concern is whether the project focus on farmer-based organisations and credit facilitation will increase or reduce reliance on agrochemicals and whether any lessons will be learnt from the shortcomings of input provision in the cotton and cocoa sectors.

Direct or indirect promotion of pesticide dependency is certainly not unique to the large donor organisations or private sector. The US MacKnight Foundation recently gave \$100,000 to BUCADEF, a Ugandan development NGO, to improve the livelihoods of rural women. Part of these funds is loaned to local stockists to supply agrochemical inputs, including pesticides (The New Vision, 2002). The beneficiaries were urged to sell only genuine inputs and to use the loans properly, an exhortation which hardly inspires confidence. PAN Africa partners have criticised the project for failing to address more pressing concerns about lack of markets for smallholder produce, exploitative farm-gate prices and high transport costs and for its explicit promotion of Monsanto products (Byakola, 2002). In Mozambique, Technoserve, a US development agency, is working with cotton companies to promote new pigeonpea varieties as a profitable rotation crop and to enable farmers to access insecticides through similar credit arrangements as for cotton (Jones et al., 2002). We learnt of active promotion of pesticides by several NGOs and development agencies in our case studies, with no attention to IPM strategies.

Our research highlighted the role of certain improved varieties of cereals and legumes in encouraging pesticide reliance and fostering deeper inequality in programmes that ostensibly aim to improve food security and income of some of the poorest farmers in the most degraded agricultural zones. It raises serious questions as to why varieties which are far more susceptible to pest and disease attack are foisted upon

resource-poor farmers, without adequate attention to pest management strategies and post-harvest storage (Williamson, 2002). In Ethiopia especially, case study farmers have fallen into a vicious circle of debt and reliance on expensive agrochemical inputs.

Options for better regulation of pesticides and control

The use of pesticides in Africa continues to be extremely low, if considered in terms of the global pesticide market. Africa's share has remained around 2% in recent years, with annual pesticide imports fluctuating between \$503–580 million over the period 1996–2000 (FAOSTAT, 2001). However, low usage should not be equated with low risk to health and the environment, given the prevalence of highly toxic products widely available in Africa. Nor should it be assumed that improving smallholder access to pesticides will lead to better yields, higher household incomes, food security or farm family welfare. Recognising that pesticides incur considerable direct and indirect costs to farmers, households and society and frequently exceed the benefits accruing, remains a key stumbling block for policymakers, donors and many of those involved in agricultural production and food security. (Pincus et al., 1999). Conventional cost/benefit analysis of pesticide productivity has serious shortcomings unless effort is made to quantify the external costs and compare chemical control with other pest management strategies. The first step in addressing pesticide regulation and control has to start with reflection on current policy and traditional paradigms concerning long-held views on the need for pesticides.

Prior to liberalisation, there were relatively few actors involved in pesticide provision, which made regulation and control fairly simple. The entry of many new players raises concerns about the ability of regulatory agencies to control their activities, since it requires more vigorous scrutiny and screening of imports and monitoring of distribution and usage (Mudimu et al., 1995), with huge financial and human resource implications for these agencies. Pesticide provision in a market-driven economy needs an effective regulatory framework in order to create full and fair competition, to protect the environment, to guarantee the quality of the products and to avoid the spread of pests and diseases (Shepherd and Farolfi, 1999). These are critical challenges for hard-pressed African regulators. Pesticide regulators in Ethiopia, Botswana, Guinea-Bissau and Rwanda responding to a PAN UK questionnaire cited the main constraints on improving pesticide regulation, in order of importance, as:

1. insufficient human resources;
2. insufficient budget; inadequate data on imports; insufficient guidance on good practice; and need for capacity-building;
3. inadequate implementation of laws.

These responses suggest that whilst funding is always a constraint, capacity-building should be the priority in improving regulatory processes.

In striking contrast to the cotton input diversion situation discussed earlier, our research suggests that

there is only very minor, occasional diversion of company-supplied inputs in the export pineapple sector in Ghana. This situation is closely related, no doubt, to the much stricter requirements on export horticulture pesticide residues and the motivation of export companies to comply with Good Agricultural Practice and to avoid any bad press in Europe on health and safety issues concerning farm workers and outgrowers. It also demonstrates that pesticide provision and use can be made much safer and more rational when a concerted effort is made amongst exporters, pesticide companies and farmers to reduce hazardous and unnecessary use and to ensure cropping system sustainability and market acceptability of the produce. Some companies have taken unilateral decisions to withdraw use of particularly hazardous pesticides and to invest in and implement serious IPM programmes which reduce reliance on chemical control as the dominant pest management strategy. These companies are likely to obtain better prices and/or preferential purchase from European importers anxious to minimise pesticide residues in food and fibre products and to improve ethical standards related to human and environmental safety (Möller, 2000).

Such market signals, reinforced with well-informed consumer demand, better understanding and communication along the supply chain, and investment in capacity-building, provide the best options for tackling many of the factors which drive pesticide misuse and dependency and which under-resourced regulatory authorities have been unable to address. Whether these improvements in pesticide control and use will influence the situation in non-export crops is debatable. Senegalese public servants have pointed out the double standards existing between food safety requirements on produce exported to Europe and national capacity and monitoring of residues in local vegetables and food grains. Through the efforts of CERES Locustox and the Global IPM Facility, however, farmer training in IPM and professional capacity-building for pesticide safety and food quality practice is now underway in Senegal (D. Mbaye, CERES-Locustox, pers. comm.). Such initiatives highlight the need to re-think pesticide promotion, policy and provision in order to reduce reliance on chemical control.

PAN UK's research suggests that there is a growing awareness of and concern about pesticide use, residues and food safety among African producers and consumers. This assessment leads into one of the most neglected aspects of pesticide regulation and control, namely the active participation of food and farming stakeholders and civil society in pesticide policy processes. The absence of clear mechanisms for public involvement in the decision-making process constitutes a major problem confronting many developing countries. Without established and transparent procedures of this sort, policies portrayed as serving the public interest may serve only to promote the interests of specific individuals or sectors (Pincus et al., 1999).

Two recent experiences of PAN partners in Africa demonstrate concrete ways in which civil society

collaboration with local and national government departments and other stakeholders can help regulators to control hazardous products and farmers to reduce risks of pesticide poisoning. In Senegal, PAN Africa first alerted the health authorities to numerous cases of a mysterious acute illness among groundnut farmers, which it suspected were pesticide-related. These proved on investigation to be due to two highly toxic fungicide formulations for seed treatment, Granox and Spinox, containing carbofuran insecticide, which caused hundreds of poisonings and at least 20 fatalities in 2000. As a result, the Senegalese authorities became the first developing country regulators to notify a highly hazardous pesticide formulation under the Prior Informed Consent (PIC) Convention, to alert decision-makers in other countries of the danger posed by these particular products (Dinham, 2002).

In Benin, OBEPAB's pesticide poisoning research among cotton farming communities has documented over 600 cases since the 1999/2000 season, disaggregated by age, gender, exposure route and product. Between 41 and 60% of cases concerned children under 10 years old and the data highlighted the products most commonly responsible. Such data are not collected systematically by government agencies, and the sporadic reporting by hospitals and health posts is widely recognised as a gross underestimate. OBEPAB has since worked with local radio stations and authorities to broadcast hazard messages, including testimonials from affected families, about cotton insecticides and unsafe practices and has observed a decrease in poisoning cases in subsequent seasons in areas reached by these programmes.

Meeting the pest management needs of smallholders in the 21st century

Control of informal trade and the reduction of pesticide diversion from approved uses will require dialogue between the different stakeholders involved and inter-institutional collaboration with farmers and civil society. In view of the serious health impacts on rural and urban communities of hazardous products and practice, awareness-raising and education on pesticide use and dangers must go beyond conventional extension activities to reach women and children in particular. Government agencies need support to obtain accurate data on pesticide imports, supply and usage to identify the most problematic products and practices and to develop hazard minimisation strategies with relevant stakeholders.

The cotton sector is currently responsible for pumping huge quantities of highly hazardous chemicals into poor, rural areas, with serious consequences for food safety, health, sustainable production and livelihoods in the savannah zones. There is an urgent need for a shift from blanket pesticide application regimes to needs-based application and IPM programmes, accompanied by policy commitment from government, the cotton supply chain and donors for major change in cotton production systems.

Phasing out existing direct and indirect subsidies for pesticide provision should be a high priority for

governments and donors, along with evaluation of the various factors promoting or reducing reliance on chemical control strategies. Options for adapting existing pesticide channels to supply safer and more sustainable pest management products, such as biopesticides, traps, attractants, anti-feedants and botanical extracts, need to be explored. Regulators can help by establishing fast-track systems for rapid registration of such products and making sure these are not taxed unfavourably compared with pesticides. Investment in pesticide imports should be redirected to helping set up in-country production of alternative products at community level and by small and medium enterprises, with appropriate quality control and marketing systems.

Safer, more sustainable methods of pest and crop management exist and are being used successfully by millions of small-scale farmers worldwide, delivering substantial yield, income and welfare benefits in some of the most challenging agroecological environments. Governments and donors should invest in adapting and refining these methods and in training and knowledge exchange as a priority in new programmes for smallholder intensification, in conjunction with crop varieties which do not lead to reliance on pesticides. Pesticide and pest management issues and policies must be considered in a more holistic context of crop management, marketing and better cost-benefit assessment, with opportunity for public participation in decision-making.

Supply chain factors should be used to reduce reliance on pesticides and to promote alternative strategies, including financial support from the agrifood and retail sectors in export markets, and commitment along the supply chain to shift production and marketing to more sustainable forms of farming. This will need to address issues of pesticide application for cosmetic purposes (to achieve blemish-free produce rather than to safeguard yield), quality standards, and the susceptibility to pests and diseases of the fresh produce varieties favoured by supermarkets. Improved consumer awareness of pesticide hazards and production constraints is required, along with opportunities to take part in risk assessment and standard-setting. Farmers choosing to grow crops under IPM or organic systems should be given active encouragement and incentives.

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