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Pesticide Use and Policies in Zimbabwe

**Current Perspectives and Emerging
Issues for Research**

**Godfrey D. Mudimu
Solomon Chigume †
Maxwell Chikanda**

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Pesticide Use and Policies in Zimbabwe

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The Pesticide Policy Project

The Pesticide Policy Project started in April 1994 as a project of the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), sponsored by the BMZ (Ministry of Economic Cooperation and Development) and carried out under supervision of Prof. Waibel, Institute of Horticultural Economics, University of Hannover. Within the project four country studies in Latin America, Africa and Asia are conducted which principally follow the guidelines elaborated in the course of the project.

The overall hypothesis of the project states that the current use of pesticides goes beyond a level which is acceptable from the society's point of view. This seems largely a result of ignoring economic considerations in pest management. The objective of this project therefore is to augment the use of economic instruments in pesticide policy. This is expected to lead to increased agricultural productivity and ecologically benign pest management.

Within the five year duration of the project a series of publications will be published inform about the latest findings of the project as well as related topics. The series is titled "Pesticide Policy Publication Series" and is available on request through:

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Editorial Foreword

The present paper has been written by Godfrey Mudimu, Solomon Chigume and Maxwell Chikanda. Godfrey Mudimu is a Senior Lecturer and the late Solomon Chigume was a Lecturer in the Department of Agricultural Economics and Extension, University of Zimbabwe. Maxwell Chikanda is an Agricultural Economist, Economics and Markets Branch, Ministry of Agriculture, Zimbabwe

The report deals with the current state and the future perspectives of pesticide use and policies in Zimbabwe. The country is of particular interest for pesticide use patterns in Africa. Among the Sub-Saharan African countries, Zimbabwe has an outstanding record of agricultural productivity and competitive export production. High levels of chemical pesticide usage are strongly believed to play a vital role in upkeeping the present level and structure of intensive agricultural and horticultural production. Unlike many other countries in the region, Zimbabwe has established a functioning scheme of pesticide registration. A successful cooperation between government and private industry's marketing has been experienced.

Thereby, Zimbabwe holds the position as one of the major pesticide-consuming nations in Sub-Saharan Africa. Negative side effects on human health, the natural environment and on agricultural productivity - as experienced increasingly in other parts of the world - have not yet been felt seriously. They influenced regulatory decisions only to a small extent, although they may exist. However, considering the increasing dependence on agricultural and horticultural exports, externally imposed regulations may be of growing importance and influence the country's further approach. Strict maximum residue limits of some major countries that import Zimbabwean agricultural and horticultural products are only one example of this trend.

The origin of the present report dates to a meeting among plant protection economists and donor representatives from several countries. In February 1994, the Institute of Agricultural Economics - commissioned by the Food and Agriculture Organisation (FAO) - held a workshop on pesticide policies in Göttingen in order to develop a joint framework on economic and political analysis of plant protection systems.¹ The present report is an extended version of the paper held during this workshop.

¹ The results are documented in: Proceedings of the Göttingen Workshop on Pesticide Policies, ed. by S. Agne, G. Fleischer and H. Waibel (1994). Göttinger Schriften zur

It intends to serve three major purposes:

- a) to provide a preliminary overview on the economic factors of chemical pesticide use, its influencing political framework conditions and the underlying problems in the course of structural adjustment in Zimbabwe,
- b) to serve as a reference baseline for a multidisciplinary national workshop among ecologists, toxicologists, regulatory administrators, economists and policy specialists which will be held in Harare in February 1996,
- c) to facilitate the design of future activities of the GTZ/University of Hannover Pesticide Policy Project in Zimbabwe.

Furthermore, the report aims at preparing the further analysis of the economic and political factors that influence chemical pesticide use in the country. This analysis will follow the general methodological framework developed in the course of the project.² Together with other country studies conducted in Asia and Latin America, it will enable the successful design of approaches that result in comprehensive pesticide policies in developing countries.

The Editors

Agrarökonomie, Vol. 66, Institute of Agricultural Economics, University of Göttingen. The publication is available on request with the Pesticide Policy Project.

² Guidelines for Pesticide Policy Studies (1995), The Pesticide Policy Project Publication Series No. 1.

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Pesticide Prices and Percentage Increases for the Period 1989 -1995

List of Abbreviations

ACIA	Agricultural Chemical Industry Assosiation
AIPC	Agricultural Inputs Priority Committee
ARDA	Agricultural and Rural Development Authority
BMZ	German Ministry of Economic Cooperation and Development
CFU	Commercial Farmer's Union
CL	Communal Land
CSO	Central Statistics Office
EDB	Ethylene dibromide
F.O.B.	Free on Board
GTZ	Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
LSCF	Large-Scale Commercial Farming
NR	Natural Region
RA	Resettlement farming areas
SSCF	Small-Scale Commercial Farming

1. Introduction

Zimbabwe's agricultural sector contributes 10 to 12 percent of the Gross Domestic Product, 45 to 52 percent per annum of the value of exports and generates direct employment for one third of the work-force (MINISTRY OF LANDS, 1994). The principal agricultural export commodities are tobacco, horticulture, beef, cotton, maize and sugar. In addition to exports, these commodities provide raw materials that sustain the manufacturing sector. The performance of the agriculture sector is important for the economic performance of the whole economy of Zimbabwe.

Agricultural chemicals are a major input into crop and livestock production thereby sustaining Zimbabwe's agricultural productivity and output. These agricultural chemicals can be grouped into insecticides, herbicides, fungicides, growth stimulants, dips, anthelmintics and rodenticides. It is estimated that the agricultural sector now uses chemicals worth US\$ 20 - 30 million per annum (CHIKANDA, 1990). Most of these chemicals are imported as active ingredients and then formulated into end use products in the country.

The agricultural chemical industry, that evolved in the past 30 years, is well established. However, it is set to change as a result of the liberalisation of the agricultural chemical input market following the economic structural adjustment programme started in 1991. There are a number of emerging issues that relate to the marketing and pricing of pesticides and their implication on use and the environment.

The purpose of this paper is two-fold:

- to outline the state of pesticide use and policies in Zimbabwe, and
- identify emerging issues for policy research.

The paper is sub-divided into seven sections inclusive of the introduction. Section 2 gives an outline of the characteristics of the farming sectors and the farming systems that determine pesticide use. Section 3 describes the structure and marketing arrangements of the agricultural chemical industry highlighting the pesticide sub-sector. Section 4 gives an outline of the pricing arrangements highlighting the transition from a regulated pricing environment to an open market system that came through the economic structural adjustment programme initiated in 1991. Government's past involvement in the pricing and control of pesticides imports are discussed in section 5. The pesticide regulatory environment and information systems are outlined in

section 6. Section 7 outlines issues for further research. The last section is the summary and conclusion.

This paper should be treated as preliminary analysis of pesticide use and policies in Zimbabwe. It does not attempt to make an exhaustive and in-depth analysis. It is intended to raise issues that could be followed up in more in-depth studies.

2. Pesticide Use in Zimbabwe's Agricultural Sector

Agricultural chemical use in Zimbabwe is very much determined by the nature and structure of agriculture and the farming systems. The main features of Zimbabwe's agriculture sector are its nature in terms of types of farmers and the farming systems as determined by the agro-ecological zones. These are described below.

2.1 Farming Sub-sectors

There are five farming sub-sectors. One is the large scale commercial farming (LSCF) sub-sector characterised by large-sized farms under private land-ownership. Most farms are owner-operated farms of between 1,000 and 2,000 hectare.

The second sub-sector is the Communal Land (CL) farming sub-sector made-up of up to one-and-half million households occupying land under communal land ownership but with household title to land use. This sub-sector occupies the large part of marginal land in low rainfall areas, producing crops mainly for their own consumption such as maize, groundnuts, small grain cereals and vegetables. They also produce cotton, tobacco, sunflower for sale as cash crops.

The third farming sub-sector is the Resettlement farming areas (RA). This sub-sector was created in 1980 following the establishment of resettlement areas where land acquired from the large-scale commercial farmers was used to settle households from the Communal farming areas. This sub-sector is made up of households settled on 5 ha individual arable land units and communal grazing. There are about 75 000 households on close to 100 000 ha scattered across the country.

The fourth sub-sector is the small-scale commercial farming sub-sector (SSCF) created in the 1940s to allow individuals from the Communal Lands to

acquire land under individual title ownership. There are about 10 000 such farming units on a total of 30 0000 ha of land found in different parts of the country.

The fifth sub-sector is the state farming sector. This is made up of state farms. This land is farmed through the parastatal Agricultural and Rural Development Authority (ARDA).

2.2 Agro-ecological Factors and Farming Systems

Figure 1 shows the agro-ecological zones that determine agriculture in Zimbabwe. Zimbabwe is divided into five agro-ecological regions on the basis of the rainfall regime, soil quality and vegetation among other factors. The quality of the land resource declines from Natural Region (NR) I through NR V. The distribution of land for the sub-sectors in each Natural Region (NR) is shown in Table 1.

Figure 1: Zimbabwe's Agro-ecological Zones

Natural Region I is a high rainfall zone, with average annual rainfall of 1 000 - 1 200 mm with some precipitation in all months. This zone is along the eastern strip of the country which is mountainous and with cool temperatures. NR I occupies 2 % of the total land area comprising of 74% large scale commercial farms, 24% Communal Lands, and 2% small scale commercial farms. Tropical commodities such as bananas, coffee and tea are widely grown. In the higher, cooler areas, deciduous fruit, potatoes, peas and other vegetables are grown. Flowers, particularly proteas and other horticultural crops for export, are becoming important. Communal Land farmers occupy only 20 per cent of this region and contribute to the large local informal and formal markets of fruits and vegetables, especially tomatoes and bananas.

Table 1: Proportion of Farming Sector in Each Natural Region,

Natural Region	CL¹	LSC² Farms	SSC³ Farms	RA⁴	State Farms	Total Area⁵
I	0.8%	1.8%	0.6%	0.9%	2.0%	1.8%
II	7.8%	32.8%	17.9%	17.9%	2.0%	15.0%
III	17.2%	21.5%	35.8%	37.8%	32.0%	18.7%
IV	44.9%	21.7%	38.2%	24.6%	12.0%	37.8%
V	29.3%	22.2%	7.9%	18.8%	52.0%	29.7%
Total Area⁶	16.4	11.2	1.2	3.3	0.5	39.07

¹ Communal Land

² Large-Scale Commercial

³ Small-Scale Commercial

⁴ Resettlement Area

⁵ Including parks and wildlife, and other areas

⁶ Million hectares

Source: Central Statistics Office, 1991

Natural Region II, accounts for about 15 per cent of Zimbabwe's land area and has much of the fertile land soils. Rainfall is moderately high (700 - 1000 mm) and relatively reliable. The major commodities are grown in the wet summer months from November to March. Flue-cured tobacco is the most economically significant crop grown by the large scale commercial farmers, followed by maize, cotton, wheat, and soybeans. Other crops include sorghum, groundnuts, seed maize, burley tobacco and various horticultural

commodities. The introduction of irrigation for winter wheat and supplementary irrigation for the dryland crops has been an important feature in extending the growing season, increasing yields, reducing risk and seasonal variability. Beef production for export is also concentrated in this region. Dairy, pig, and poultry production is concentrated here because of the proximity to urban centres. The large-scale farmers use sophisticated and relatively capital-intensive technologies.

Communal Land households occupy about 22 per cent of the land in NR II. Large scale commercial farms occupy the bulk (74%) of the NR II land area, with the small scale taking about 4%. Maize is the dominant crop in terms of the area planted by Communal Land farmers in Natural Region II. Groundnuts and vegetables are widely grown. There is considerable differentiation within Communal Lands. The successful farmers in Region II are achieving yields of around 4 metric tonnes per hectare for maize and over 2 metric tonnes per hectare for cotton, groundnut and sunflowers. The average area cultivated ranges from 0.5 to 4.5 hectares per household.

Natural Region III has moderate rainfall (650 - 800 mm). Most of the rainfall is accounted for by infrequent heavy falls and the region experiences fairly severe mid-season dry spells that make crop production risky. In Natural Region III, Communal Land farmers crop relatively intensively whereas the large-scale commercial sector crops only 15 per cent of the arable land using most of the land for extensive beef ranching. Communal Land farmers use technologies designed for higher rainfall areas and would benefit from the development of seed, technologies and recommendations more closely aligned to their need. As in other Natural Regions, maize dominates production although cotton, groundnuts and sunflowers are important and burley tobacco has potential.

One and half million farming households in the Communal Lands farm on about 49% of the country's agricultural land, of which over 70% falls in Natural Regions IV and V. Thus, most of the CL are in the marginal agro-ecological regions. These are characterised by a) low rainfall, average 450 - 650 mm per annum; b) periodic seasonal droughts, c) severe dry spells during the rainy season; and d) shallow soil of low fertility. Such conditions are very marginal for production of the major crops except for the drought tolerant small grain crops like sorghum, millets. The soils being inherently low in physical productivity and low fertility have to be limed to correct soil acidity and then fertilised to correct for low phosphorus and potassium levels. Such

applications on continual basis are necessary for optimal economic production of most crops for most of the farm, investment in soil fertility is low due to financial constraints. Although Natural Regions IV and V are too dry for crop production, Communal Land farmers grow crops in these areas despite the low rainfall. Small grains are the most suitable crops but most farmers grow maize, which is the preferred staple. Grain yields are extremely low and there is a risk of crop failure in some years due to mid-season dry spells. Livestock is important but it is mainly consumed at home and marketed locally. Communal Land farming sector cattle in Natural Regions I, II and III are used primarily for draught power, manure and as a source of wealth. Beef production under extensive ranching dominates large-scale commercial production in Region IV and V.

2.3 Pesticide Use

Table 2 gives estimates of the average annual total pesticide used in Zimbabwe and share of use by farming sector.

Table 2: Average Quantity and Share of Value and Annual Total Pesticide Use by Farming Sector in Zimbabwe, 1986-1991.

Pesticide	Annual Average		Share by Farming Sector	
	Quantity (tonnes)	Value (%)	Large Scale (%)	Communal Lands (%)
Insecticides	3 031	60,77	70-80	20-30
Herbicides	1 022	39,03	95-99	1-5
Fungicides	447	14,44	96-98	2-4
Growth Regulators	447	6,62	99	< 1
Rodenticides	81	0,30	10-15	2-3

Source: Estimated from Ministry of Lands, and ACIA Reports 1989-91

In terms of value and quantity, insecticides constitute the bulk of the pesticides followed by herbicides. Herbicides, fungicides, and growth regulators are predominantly used in the large-scale commercial farming sub-sector. The share of insecticides used by the Communal Land farmers ranges from 20 to

30 per cent. Rodenticides are used to control rats in both the agricultural and non-agricultural sectors. A significant user of pesticides, though in small quantities, is the household market in home flower and vegetable gardens.

Table 3: Average Annual Pesticide Use by Crop, 1986-1993

Crop	Percentage by Value (Z\$ million)			
	Insecticides (%)	Herbicides (%)	Fungicides (%)	Regulators (%)
Tobacco	54	18	48	80
Cotton	26	12	-	-
Maize	8	30	-	-
Soybeans	3	30	-	-
Wheat	4	-	-	-
Vegetables	3	-	24	-
Coffee	-	-	18	-
Other	2	10	10	20

Source: Estimated from CSO, 1994; Ministry of Agric.; and ACIA reports 1989-1991

In terms of crops, about 80 per cent of the insecticides used by Communal Land farmers are applied in cotton and the balance in maize against the stalkborer and grain storage pests (Table 3). In terms of value and quantity, most of the pesticides used by the large-scale commercial farmers, in order of magnitude, are applied in tobacco, cotton, maize, soybeans, wheat and horticultural crops. Tobacco and cotton use up to 80 per cent of the insecticides. Maize and soybeans account for up to 60 per cent of the herbicides. Close to half of the fungicides are applied in tobacco with the balance shared by vegetables and coffee. Tobacco uses the bulk of the growth regulators. Table 4 lists the main crop pests and diseases.

Table 4: Some of the Major Crop Pests and Diseases

	Maize	Wheat	Soybean	Cotton
Pests	Stalkborer	Quelea	Semi-looper caterpillars	Bollworms
	Snoutbeetle	Caterpillar	American bollworm	Semiloopers
	Cutworms	Beetles	Cutworm	Cotton leaf-worm
	Surface beetle	Hoppers	Aphid	Elegant grasshopper
	Armyworms	Aphids	Snout beetles	Termites
	Caterpillar	Corn maggot	Nematodes	Cutworms
	Cobworm	Termites		False wireworm
	Termites	Weevils		Nematodes
	Leaf hoppers			Aphids
	Aphids			Jassids
Disease	Cob- rot	Stem rust	Red leaf blotch	Bacterial blight
	streak virus	Leaf rust	Bacterial blight	Boll drop
		Streak virus	Purple seed stain	Boll rots
		Loose smut	Wildfire	Leaf spots
			Bacterial pustule	Damping-off and soreshin
		Brown spot	Verticilium wilt	
		Downey mildew	Lightning injury	

Source: AGRITEX, Farm Management Hand Book, 1984

The ranges of types of pesticides used by Communal Land farmers is very limited to specific pesticides. On the other hand, large scale commercial farmers use a variety of pesticide mix. Table 5 gives estimates of the share of pesticide costs in the variable production costs of selected crops in the two farming sub-sectors. Communal Land farmers apply disproportionately less pesticides compared to the large scale commercial farmers. The farmers apply pesticides once they observe the need to apply while the latter apply routinely as a preventative measure. This may be due to the Communal Land farmers unwillingness to make losses from the use of pesticides as the returns may not justify the use to the farmer. In the large-scale commercial farming sub-sector, the rates and levels of pesticide application are based on economic analysis for optimal use.

Table 5: Pesticide Costs as Share of Variable Production Cost
1990/91 - 1993/94 Seasons (Percent)

Crop	Insecti- cides	Herbi- cides	Fungi- cides	Growth Regulators	Soil Fumigants	Total
<i>A: Large Scale Commercial Farming Sub-sector</i>						
Tobacco	3.0	10.0	0.4	0.3	5.0	18.7
Cotton	8.0	8.5	-	-	-	16.5
Maize	7.7	5.7	-	-	-	13.4
Soybeans	6.5	7.5	-	-	-	14.0
Wheat	4.6	8.2	-	-	-	12.8
Vegetables	3.2	-	-	-	-	3.2
<i>B: Small Farming Sub-sector</i>						
Cotton	13.9	-	-	-	-	13.9
Maize	1.5	-	-	-	-	1.5

Source: Estimated from CFU (1995), AGRITEX Crop Budgets, 1990-94

3. Zimbabwe's Pesticide Industry

The Zimbabwe agro-chemical industry has its roots in the 1960's when locally based companies were selling agricultural chemicals directly to end-users. At that time most of the companies were subsidiaries of multinational chemical corporations. However, as time went by a number of small independent local companies were also established to distribute some agricultural chemicals. Most of these localised companies were set-up during the period 1965 to 1975 as a reaction to the imposition of international economic sanctions against the unilateral declaration of independence when international companies dis-invested from Zimbabwe. Currently, there are close to 40 companies involved in formulation and marketing up to 450 agro-chemical products (CHIKANDA, 1990). They all belong to the Agricultural Chemical Industry Association (ACIA) which is affiliated to the International Group of National Association of Pesticide Manufacturers/Distributors. The ACIA and its members have subscribed to observe the International Code of Conduct on Distribution and Use of Pesticides.

3.1 Structure of Industry and Marketing Arrangements

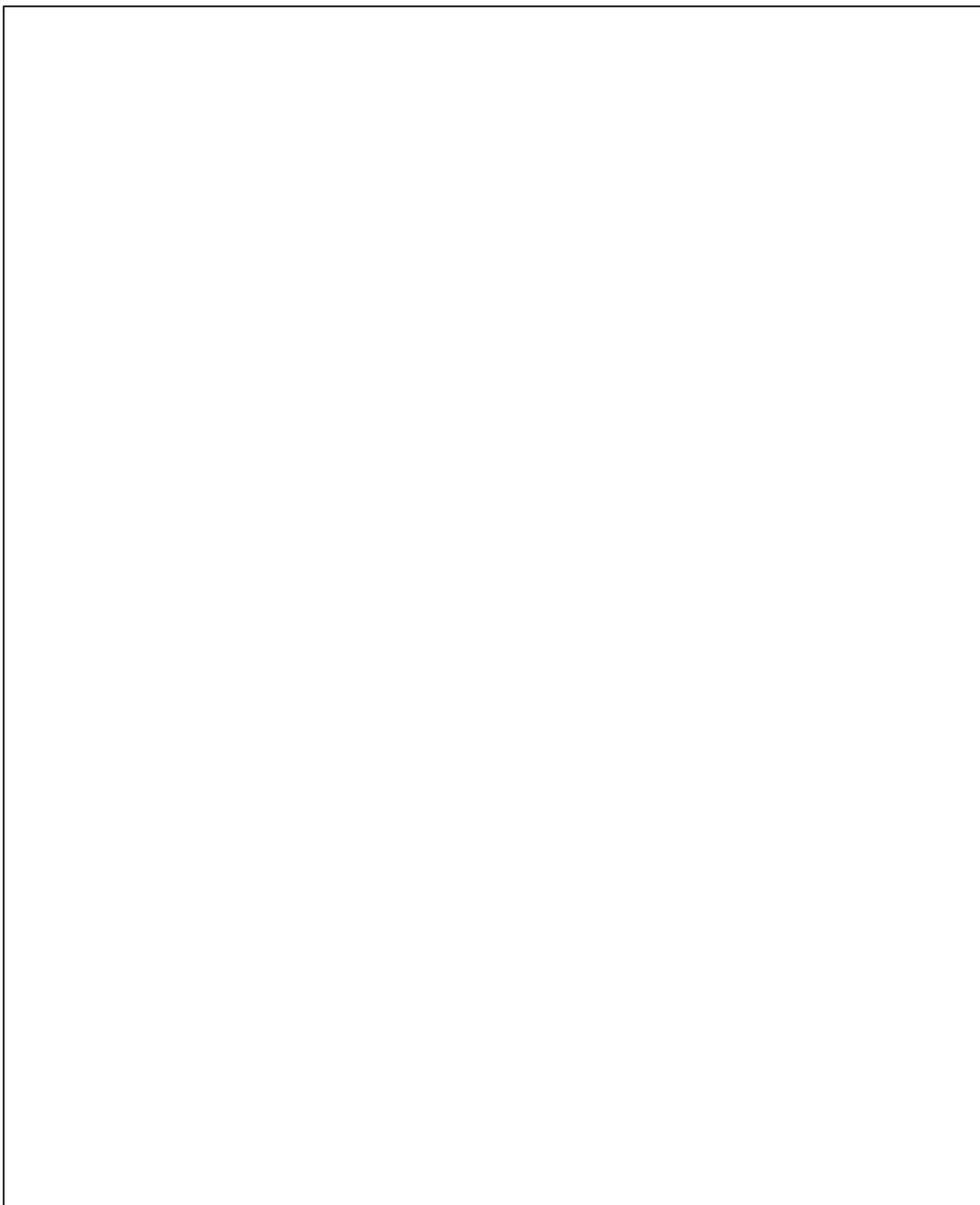
Figure 2 illustrates the structure and marketing arrangements of the agricultural chemical industry in Zimbabwe. There are two distinct categories of companies namely, importers (I) and distributors (D). The importing companies are mostly subsidiaries of multinational corporations. They specialise in the importation of active ingredients for formulation into a variety of chemical products with some specialising in agricultural chemicals. These companies also import end-use products in bulk for repackaging. The tendency in the past was to import ingredients for formulation in support of the country's local industrial development and employment creation through local content input as well as to conserve foreign exchange. Sixty to seventy per cent of the pesticide products were formulated locally.

The importing companies generally have no distribution facilities of their own. Distribution arrangements are with the distributing companies. These companies had limited direct contact with farmers. However, they have sales representatives who promote new products through the sales teams of the distributing companies.

The distributing companies, in category D, are generally locally owned. They have facilities to receive bulk chemicals from the importing companies, breaking the bulk, repackaging and distributing end-use chemicals to the

farmers. These firms also import and formulate in their own right. The distributing companies have direct contact with farmers through sales teams. As part of the marketing strategy, the sales representatives advise the farmers on the use of the chemicals in the market.

Figure 2: Marketing Arrangements and Distribution Channels for Agricultural Chemicals in Zimbabwe



Source: Adapted from CHIKANDA, 1990

Farmers also buy directly from general dealer retail outlets and input supply co-operatives. Large scale farmers generally purchase directly from the distributing firms where and benefit from volume discounts. The small farmers generally buy from the retail outlets because of the low volumes per individual farm. These farmers also pool resources through input-purchasing groups to be able to buy in bulk from the distributing firms.

3.2 Volume of Business and Market Share

The Zimbabwe pesticide industry generates close to US\$ 20 million worth of business on an annual basis. There are close to 450 registered agro-chemical products. The industry is a significant employer of industrial labour and a source of new chemical technologies into the country.

Table 6: Share of Pesticide Market, 1991/92 - 1993/94

Agro-chemical Firm	% Share	Crop	% Share	Pesticide Group	% Share
ZFC	30	Tobacco	50	Insecticides	53
Agricura	22	Cotton	20	Herbicides	20
Shell	19	Maize	12	Fungicides	12
Windmill	15	Soybeans	5	Others	15
Sprayquip	12	Vegetables	8		
Others	2	Miscellaneous	5		

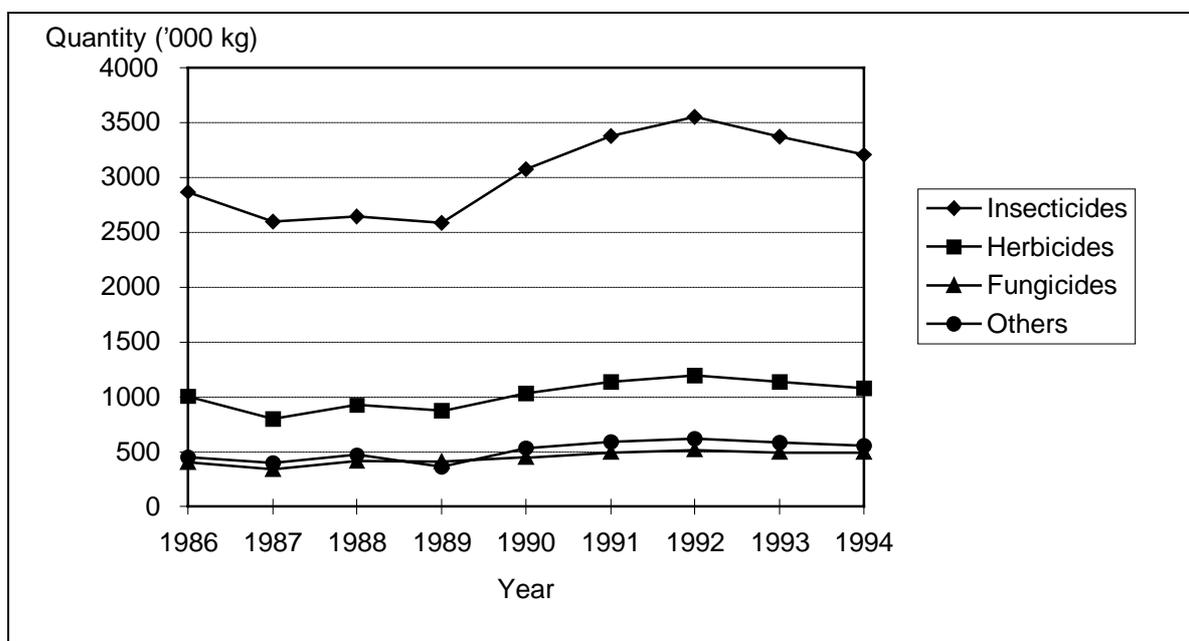
Source: Estimated from various reports on chemical sales and Ministry of Agriculture, Agricultural Statistics Bulletin, 1994

The major players in the pesticide market, in order of market share, are shown in Table 6. Insecticides make up 50 to 55 per cent of the marketed pesticides. Tobacco uses close to 50 per cent of all the marketed pesticides, cotton takes 20 per cent and maize 12 per cent. The horticultural sector takes 5 to 13 per cent of the market and is growing.

Figure 3 gives estimates of the quantity and value of sales of pesticide products from 1986 to 1994 (see also Appendix 1). The trend has generally been an increase up to 1992. Estimates for the 1993/94 season indicate some decline. This could be due to a number of factors. One factor could be

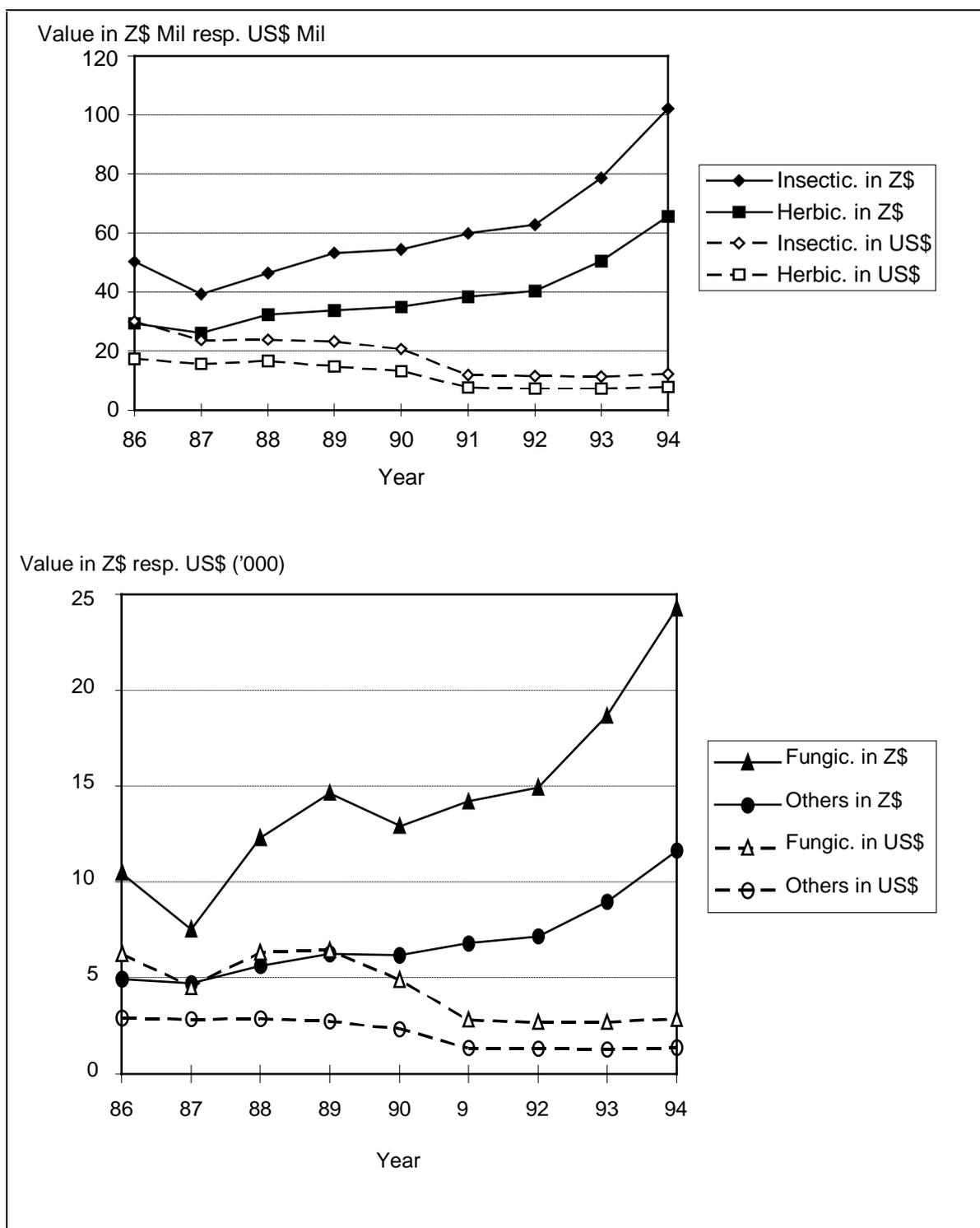
the increase in input prices combined with increase in interest rates that could have depressed the sales to the farming sectors. The increase in production costs at rates faster than increase in output prices induced reduction in crop areas, particularly maize, in the large scale commercial farming sub-sector. In the Communal Areas the increase in input prices induced farmers to reduce input use, particularly of fertilisers and pesticides. In terms of sales volume, there has been a sharp increase since 1987, from about Z\$ 78 million to over Z\$ 200 million in 1994. However, the devaluation of the local currency contributed much to this increase. Expressed in US\$ values, there has been a decrease in sales volume except for fungicides in the period of 1987-1989 (Figure 4, see also Appendix 2).

Figure 3: Quantity of Pesticide Product Sales (1986-1994)



Source: CSO and estimates from unpublished data of the Ministry of Lands, Agriculture and Water Development and of ACIA

Figure 4: Value of Pesticide Product Sales (1986-1994)



Source: CSO and estimates from unpublished data of the Ministry of Lands, Agriculture and Water Development and of ACIA

4. Pricing of Agricultural Chemicals

This section discusses the pricing arrangements followed in the past, prior to the structural adjustment programme and the prevailing situation.

4.1 Past Pricing Approaches

Until 1993, the Government controlled prices for agricultural chemicals as was done with prices of most commodities. Regarding pesticides, a maximum mark-up of 100 per cent was allowed on the sum of F.O.B. cost, freight and insurance, surtax and internal handling and production costs. But companies normally did not put a mark-up in excess of 70 per cent. This pricing system was considered flexible allowing self-adjustment to increase in the transaction costs (CHIKANDA, 1990). The pricing mechanism was reinforced by (a) foreign exchange control and rationing (described in section 5) and (b) the structure of the industry and the marketing arrangements that allowed inter-firm trading between the importing and distributing firms.

4.2 Current Pricing

In 1993, the Government removed foreign exchange and price controls as part of the economic structural adjustment programme. Importation of agricultural chemicals was put on the open general import licence. Importing companies were no longer required to apply for foreign exchange as they would access foreign exchange through the market. This process opened up the market and trading of imported chemical as firms were free to source and trade in agricultural chemicals.

4.3 Trend in Pesticide Prices, 1989-1995

The removal of price controls entailed that pricing of agricultural inputs would be determined by market forces.

The concern with the current situation is whether the pricing arrangements and the opening of the market would lead to cheaper prices thereby encouraging increased use of pesticides. Appendix 3 shows that the trend in pesticide prices over the period 1989-1995 has generally been upward in local currency. There was a massive increase in the 1990-91 season mostly due to the 17 percent devaluation of the Zimbabwe dollar at the onset of the structural economic adjustment programme.

5. Government's Role and Involvement in the Pesticide Industry

Prior to the market reforms and decontrol in 1991, the Zimbabwean government to some extent had a direct role in the importation and marketing of agricultural chemicals. One aspect of the role was and still is through the registration and regulation process intended to ensure that the right types of chemicals are imported and safely used in Zimbabwe. This is discussed in detail in section 6.

The second aspect was through price control and foreign exchange rationing. Although, the private firms were responsible for the sourcing and distribution of the pesticides, the government had some influence through the process of allocation of foreign currency. The importation of chemicals was subject to import controls as a way of effecting foreign exchange rationing and control that was characteristic of the macro-economic management policies of the 1965 to 1991 era of foreign exchange shortages. The Agricultural Chemical Industry Association, acting on behalf of its members, compiled a list of the required ingredients and chemicals to be imported and worked out the foreign currency requirements. The list was submitted to the Ministry of Lands, Agriculture and Water Development for presentation to the Agricultural Inputs Priority Committee (AIPC), through the Agricultural-chemicals Sub-Committee. This sub-committee was chaired by the Ministry of Lands, Agriculture and Water Development, and included representatives of the Ministry of Industry and Commerce, Commercial Farmers Union, Zimbabwe Farmers Union, the Department of Research and Specialist Services, and the Tobacco Research Board. In considering foreign exchange requests and allocations, the sub-committee took four factors into account (CHIKANDA, 1990). One was to ensure that the right quality of agricultural chemicals were imported. The second was to have these available for use at the right time. The third, intended to protect the industry and farmers, was that the structure of the industry and the foreign currency allocation system did not lead to overpricing, shortages, or importation of unsuitable or inferior quality chemicals. The fourth was that a large proportion of the chemicals was imported in active ingredient form. This was in order to maximise employment creation and save on the limited foreign currency.

6. The Pesticide Regulatory Environment and Information System

This section draws heavily from the Zimbabwe Guidelines on the Registration of Pesticides (MINISTRY OF AGRICULTURE, 1983), the Pesticide Regulations, 1971 (RHODESIA GOVERNMENT GAZETTE, 1991) and the Hazardous Substances and Articles (Protective Clothing: General) Regulations, 1984 (ZIMBABWE GOVERNMENT GAZETTE, 1984).

All chemical products imported into Zimbabwe must conform to certain health regulations and environmental standards. They may not be sold in Zimbabwe or distributed for sale throughout the country unless they have been registered by the Ministry of Lands, Agriculture and Water Development in terms of the Pesticide Regulations of 1977 under the provisions of the Fertiliser Farm Feeds and Remedies Act, (CAP III) and placed in Group II or III of the Hazardous Substances and Articles Act (CAP 322). All agricultural chemicals have to be registered with the Plant Protection Research Institute, which comes under the Department of Research and Specialist Services. To be registered a chemical should have been passed by the Hazardous Substance Control Board and the Drugs Control Board (MINISTRY OF AGRICULTURE, 1983).

6.1 Objectives of Pesticide Regulation

The overall objective of pesticide regulation and registration is to ensure that the right types of chemicals are imported and safely used in Zimbabwe. To achieve this objective, a number of acts/regulations have been enacted to ensure that standards are met and adhered to. The Ministry of Lands, Agriculture and Water Development, through the Department of Research and Specialist Services, in conjunction with the Ministry of Health and Child Welfare, are accountable and responsible for ensuring that new pesticide products are tested for their efficacy and toxicity for a period of three years before registration. The registration relates to the formulation of product and not simply to the active ingredient. Registration is intended to have a record of the toxicity of the chemical. The information so obtained is used to provide information for remedial action in the event of an accident.

The registration process is largely concerned with hazard assessment and concerns for human and environmental safety. Thus, the main focus is on determining whether candidate pesticide chemicals meet the minimum environmental and health safety standards. Health safety standards refer to

safe use, storage and disposal. Registration is done to ensure safe and efficient use of pesticides in the interests of:

- The user - who is concerned with the efficacy of the material and its hazards in handling.
- The consumer - who is concerned with possible residues in food.
- The general public - who is concerned with such hazards as drift, contamination of water ways and loss of wild life.
- The vendor - who should be protected from unsound or unfair claims for competitive products.

6.2 Registration and Regulation Instruments Governing Pesticide Use

There are two Acts of Parliament that form the regulatory environment for pesticide regulation in Zimbabwe. One is the **Fertiliser, Farm Feeds and Seeds and Remedies Act (Chapter 186, Section 24)**. This Act is administered through the Ministry of Agriculture with the Plant Protection Research Institute, in the Department of Research and Specialist Services, as the regulatory agency. Under this Act there are a set of regulations, the **Pesticide Regulations 1977**, that define and establish the regulations and process of registration, experimentation, storage, distribution, labelling, and selling of pesticides.

The second Act is the **Hazardous Substance and Articles Act (Chapter 322, Section 47)**. This Act is administered through the Ministry of Health. The regulatory agency is the Drugs Control Council. In terms of the Act, Statutory Instrument 313 of 1981 on Hazardous Substances and Articles (Group II: General) Regulations, 1981 is intended to ensure the safe use of pesticides. The emphasis is on proper labelling, proper use of hazardous substances and proper handling. This registration ensures that only the right types of chemicals are imported into Zimbabwe. Statutory Instrument 263 of 1984 of the Act sets two regulations. The **Transport by and Labelling of Road Tankers Regulations** specifies and defines the conditions and process of transporting hazardous substances and articles. The second set of regulations come under the **Protective Clothing: General Regulation, 1984**. These define and specify the conditions for safe use, application and handling of pesticides.

For the purpose of regulation and registration the term pesticide is used to include all chemicals used primarily for the control of

- Insects and other invertebrate or vertebrate pests.
- Diseases of plants.
- Weeds.
- Growth regulators and growth inhibitors.

6.3 Registration Process

The application for registration should be made by the representatives of the company manufacturing the chemicals who will then market the product in Zimbabwe in accordance with the regulations. Every application for the registration of a pesticide is submitted in triplicate to the registering officer. Attached to the applications should be (where applicable):

- Three copies of the proposed label.
- The text of any advertisement to be used to promote the sale of the pesticide.
- Two samples of the pesticide - the amount being specified by the Registering Officer.
- Information on efficacy and toxicity.

The proposed label supplies information on the chemical and this claim is assessed by the Registering Officer. The Registration Officer also has other information on the chemical from published sources of literature and these data will also be used in assessing the validity of claims. The labels are printed in Shona, English and Ndebele, the three official languages used in Zimbabwe.

Information on physical properties and toxicology may be accepted from recognised published sources. Claims for the control of agricultural and horticultural pests accepted by the agricultural department in countries of similar climates to Zimbabwe will also be considered. Experimental data in support of claims is derived from experimentation stretching over at least two and preferably three different climate conditions of Zimbabwe and especially where the pesticide is likely to be used. Claims for the control of greenhouse and household pests may be substantiated by work in this country or data used from other countries provided the species and climatic conditions are identical with those in Zimbabwe.

If the weight of composition of the active ingredient or any other component of the pesticide is altered in any way from the declaration on the original registration form, then re-registration becomes necessary.

Registration is completed when the applicant is issued with a Certificate of Registration. The Registering Officer may in addition impose additional conditions as she/he thinks fit.

It is also statutory that no person shall import any experimental pesticide into Zimbabwe unless one has the authority to do so. Any pesticide thus imported for such purpose should be brought to the attention of the Registering Officer within **seven** days of its arrival. Only those people, authorised by the Registering Officer, can carry out experimentation on any pesticides. Experimental pesticides imported into the country shall not be distributed without prior permission from the Registering Officer and it is mandatory that it is clearly marked with the words "FOR EXPERIMENTAL PURPOSES ONLY NOT FOR SALE".

If the applicant disagrees with the decision of the Registering Officer he/she would be free to appeal requesting the Registering Officer to provide reasons for refusing the application. The applicant may appeal in writing to the Minister of Lands, Agriculture and Water Development within **fifty** days of being notified of the refusal.

The Registering Officer assigns a colour code to each commercially available pesticide based on the mammalian toxicity as indicated by:

- Acute oral LD₅₀ of the technical material - this data will be taken from the Pesticide Manual published by the Crop Protection Council. The oral LD₅₀ is that single dose expressed in mg/kg of body weight which when given by mouth kills 50% of the animals under test.
- The strength of the formulation.
- The persistence of the material after application.
- Other relevant data.

Green pesticides

These are formulations with an acute oral LD₅₀ of over 2001 mg/kg of body weight. These can be used without danger in the homes or where stated as admixture to grain or other stored produce for human or animal consumption. They can be sold by any shop or store and the word "Caution"

appears within a green triangle and the words "Harmful if Swallowed" beneath the base of the triangle.

Amber pesticides

This is for formulations with an acute oral LD₅₀ of between 501 and 2000 which could be used without danger in home gardens and for external use about the home. The word "Danger" with a symbol of one skull and crossbones appear within the amber triangle and the word "Poison" beneath the base of the triangle.

Red pesticides

This is assigned to formulations with an acute oral LD₅₀ of between 100 and 500. Their use should be generally restricted to horticultural, agricultural, health or industrial pest control operations. These may be sold by a licensed dealer, with a special part of premises set aside for the storage and sale of dangerous substances. The word "Danger" with one skull and crossbones symbols appears within the red triangle with the words "Dangerous Poison" beneath the base of the triangle.

Purple pesticides

These are formulations with acute oral LD₅₀ of up to 100. These may only be sold to persons whose business, profession or trade require them. They may only be offered for sale by licensed dealers where part of the premises is set aside for the sale of dangerous substances. The dealer must keep a person register of all sales of this group of pesticide, each sale being countersigned by the purchaser or his nominee and the firm's license number noted. The word "Danger" with one skull and crossbones symbol appears within purple triangle and "Very Dangerous Poison" beneath the base of the triangle.

6.4 Pesticide Use Information System, Safety and Health Education

Companies in the agricultural chemical industry promote the safe use of agricultural chemicals through courses for end-users, publication of pamphlets and posters on new chemical products. The Agricultural Chemical Industry Association liaises with the Government in policing safety

rules designed to protect the target users of agricultural chemicals as well as consumers of agricultural products. The training courses educate agricultural chemical users to become safety conscious. Government encourages the individual companies to simplify posters as regards formulation, application rates, safety precautions including storage and procedures to be followed in case of poisoning. The companies are urged to publish this information in the three major languages namely English, Shona and Ndebele.

Sales representatives of agro-chemicals and agricultural extension workers are the major sources of information on pesticide products and use for farmers in Zimbabwe (KUJEKE, 1994). Other sources are printed materials, pesticide labels and mass media. Most of the information is provided through product promotion that involves on-farm demonstration, field days and direct sales promotion. For the Communal Area farmers, most of the promotion is effected through the field days and training programmes organised by the extension service. In the large-scale farming sector, promotion and information are provided through direct contact with the product sales representatives.

7. Emerging Issues for Pesticide Use and Policy Research

This section raises some issues regarding pesticide use and policies that require further research.

7.1 Past Pricing and Marketing Arrangements

The pricing and marketing arrangements in place up to 1991 evolved over time to make maximum use of limited foreign exchange resources and protect the farmers. The marketing system was structured to allow inter-trading between importing and distributing firms. It was considered to be advantageous to the farmers in several ways. It appears, that it enabled distributing firms to offer farmers a full range of agricultural chemicals, eliminating the need for the farmer to deal with more than one firms. This was an advantage for farmers buying on credit. As importing and non-distributing companies did not have to develop their own distribution networks, this reduced transaction costs that could have led to higher prices for agricultural chemicals. It is possible that the arrangement did not allow monopolistic tendencies that would have arose if a firm were to import and market a product. The firm could exploit that monopoly position and overcharge particularly when there was a shortage.

One other advantage could have been that farmers would not receive biased technical advice about the pesticide to use which is possible when distribution is done by importers. In general, importing companies did not have to have a large advertising budget. This possibly reduced overhead costs which would have led to lower final product price to the farmer. The distributing companies were able to concentrate on providing technical advisory services at field level through their sales representatives. They did not have to carry overhead for direct importation of chemicals.

The marketing arrangement had some weakness and disadvantages. One is that the farmers did not benefit from buying final products directly from importers, thus avoiding unnecessary price increases from additional margins which are added when chemicals exchanged hands between firms. By not buying directly from the importers, farmers were not able to get price discounts which were to the distributing firms. The distributing firms were allowed trade discounts as opposed to farmers because they have to meet the costs of breaking the bulk, repacking and further distribution.

Another drawback of the marketing arrangement was that importing but non-distributing companies were not able to develop their own distribution networks which would have created the much needed competition. Such competition could have resulted in better services and prices being offered to the farmers. Importing and formulating companies by not being able to distribute their products are therefore not able to give farmers first-hand advice on use of their chemicals.

It appears the past pricing and marketing system may have created a monopoly environment in the agro-chemical market. It favoured established importing firms and restricted entry of new firms. As a result there could have been limited competition in the chemical input market for years and farmers could have been disadvantaged by limited options. It is also possible that the system resulted in lower prices than would have been formed through a more competitive market system. This could have allowed farmers to use more pesticides than was necessary. Research is needed to establish the impact of the past pricing and marketing arrangements on pesticide use.

7.2 Implications of the Liberalisation of the Input Market

The Economic Reform Programme has resulted in the liberalisation of both product and input markets. The placement of agricultural chemicals,

including pesticides, on Open General Import Licence could have both positive and negative effects on the pesticide use, market and the overall agricultural sector.

On the product market, the reform could induce changes in the cropping pattern that would impact on the demands on different pesticide inputs, with some increased in use, whilst others decline. An assessment needs to be done to identify demand of various pesticides as a result of the potential changes in the cropping patterns.

The liberalisation of the agricultural chemical input market would promote entry by newly established firms which were failing to enter into the market because of the foreign currency control and allocation system which favoured established companies. This would induce a more competitive input market which may lead to lowering of prices of pesticides. The assertion that prices would fall needs to be followed up.

It could facilitate timely procurement of the imported raw materials and formulated chemicals to ensure that farmers purchase and plan ahead of the production season. A liberalised market would determine the quantities of product to be imported and each company would import commodities from any reputable source. There is a need to study how this would affect the two farming sub-sectors.

A liberalised agro-chemical marketing system could create its own problems which are different from those in the controlled system. Some of the problems could be:

- Possible decline in investment into the industry as more final inputs would be sourced from abroad. This may have a negative effect on employment creation.
- Increases in transaction costs may result in prices exceeding import parity, which could result in local formulation being more expensive than buying already formulated products from external sources.
- Entry of more firms in the market could result in breaches in the Code of Conduct that could have been enforced by the past import licensing system. The import controls allowed an element of tacit monitoring that ensured that only quality products were imported. The opening of the market to more competing firms could mean that packaging standards, quality control, registration and laws regarding crop chemicals might be

ignored or side-tracked. This could result in banned chemicals entering the country which would endanger human and environmental safety.

The main concern relates to the capacity of the regulatory agencies to control and monitor the importation and distribution of pesticides. The entry of new players in the pesticide trade, particularly individuals and new entry firms would entail more vigorous screening and scrutiny of imported products as well as monitoring of the post-registration process. There is likelihood of direct importation of end-use pesticide products. There is potential of more hazardous and banned substances being imported and disregard of laid-down safety regulations. Prior to the liberalisation regulatory activities were easy due to the small number of firms involved. These firms were also conditioned by goodwill behaviour to safe-guarding the market and relationship with the distributing companies. This calls for research to be done to study the implication of the liberalisation of the pesticide market.

7.3 Impact on Agricultural Productivity

Over the past two years, due to the devaluation of the Zimbabwe dollar, the cost of importation has been going up. This has contributed to an increase in input costs and the resultant increase in the production costs. There are concerns that this increase may result in farmers, particularly the small farmers, reducing chemical input use. This would result in output losses and reduced productivity. The implication on pesticide use by the two farming sub-sectors will have to be assessed. One aspect would be to study the potential of alternative pest management practices that farmers could adopt to maintain productivity levels.

7.4 Health and Environmental Concerns

Traditionally, agricultural policy has been concerned with increased economic growth by boosting agricultural productivity. Since independence in 1980, there has been a substantial expansion and diversification in the agricultural sector. Consequently, policy was meant to ensure adequate supplies of inputs at low cost through pricing and trade policies. This situation increased the use of agricultural chemicals. Though, Zimbabwe has had well-laid down legislation and regulations on safe use of chemicals, it appears that there is little information on the actual quantities imported and applied by farmers. Such information is considered confidential company

information. Not much work has been done to assess the risks and quantitatively measure the health and environmental impacts of pesticide use.

The country is phasing out the use of pesticides that are no longer accepted as safe health-wise and environmentally sound. These include ethylene dibromide (EDB) and methyl bromide used as soil fumigants in tobacco production. These are considered highly carcinogenic and mutagenic by the U.S. Environmental Protection Agency. Some study on the impact of past use would be necessary. A related study would look at the implications of the withdrawal of use on the economics of tobacco production and the economy that is dependent on foreign exchange earned by tobacco.

The intensive and continued use of pesticides has its own side-effects or externalities. It threatens sustainability of crop production that it seeks to achieve. Pests and weeds become more difficult and expensive to control when they develop resistance to the pesticide on the market. There are concerns that excessive reliance on weekly dipping to control ticks could create two possible situations. One situation could be that ticks would develop resistance to the acaricide. The other and more serious situation is that absence of some form of tick disease could create a potential dangerous situation whereby cattle would not develop some natural immunity. This would lead to serious epidemics in the event of tick-borne disease coming up.

A good number of the small farmers and farm labourers on large-scale commercial farms may come into direct contact with pesticides and other agricultural chemicals due to poor knowledge on pesticide safety as well as unsafe working conditions. There is a need to quantify the health cost impact at both household and national levels.

There has been an increase in large-scale production of vegetables to meet the growing demand in the urban areas. A substantial amount of the pesticides are used in this sector. There are two concerns. One concern is the amount of residual pesticides that end up on the dining tables. The second concern is the amount of pesticides that drain into the water supply systems.

7.5 Impact of International Pesticide Bans and Restrictions

Worldwide, especially in Europe and the United States, there has been an increased awareness of the health and environmental hazards of agro-

chemical use. This situation has resulted in increased restrictive legislation on chemical use. Proponents for increased restrictions argue that legislation will improve food quality and safety. However, those who oppose the legislation argue that reduced use of chemicals will result in increased cost of food production and reduced output leading to increased cost to the consumer. For Zimbabwe, the concern is on the implication for horticultural exports to Europe. The concern is that use of alternative pest and disease control strategies could make horticultural exports non-competitive. Zimbabwe exports close to US\$ 80 million worth of horticultural commodities annually, mainly to Europe. Strict regulations on pesticide use will affect the industry's competitiveness and foreign exchange earning capacity. Some analysis has to be done to quantify the potential loss.

The restrictions affect many stakeholders with conflicting interests, namely: producers, chemical companies, agribusiness firms and consumers. Yet there seems to be little research on the welfare effects of restricting chemical use on these actors.

8. Conclusions

This paper has described the state of pesticide use, industry, marketing and regulatory arrangements in Zimbabwe. Pesticides are vital for sustaining the contribution of the agricultural sector to Zimbabwe's economy in terms of food security, foreign exchange generation, employment and source of raw materials for the manufacturing sector. It is vital that the sector's performance be enhanced if the country is to benefit from the structural adjustment and take advantage of opportunities offered by the new international trading environment. This calls for research to be done to study how agricultural productivity and performance could be enhanced without continued use of harmful pesticides.

The pesticide industry is well established and has the capacity to service the needs of the farming sector. The challenge is to provide a conducive environment for expansion. One such an environment would be sound pesticide regulations that allow firms to operate without undue regulatory controls but without endangering public health and the environment. The Government needs to maintain its testing and registration system for new chemical products to ensure that Zimbabwe does not suffer from the dumping of inferior and banned products.

Although it is asserted that Zimbabwe has a proud record of safe use of pesticides because of excellent co-operation between the chemical manufacturers, retailers and consumers and the officials responsible for the legislation (MUCHENA, 1991), there is need to study the economic, health and environmental impacts of continued use of some pesticides. There is limited information on the total quantities of pesticide used in the agricultural sector.

The issues raised in the paper, though not exhaustive, provide some indicators of further research that needs to be done for a detailed analysis of pesticide use and policies in Zimbabwe.

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Appendix 1

Quantity of Pesticide Product Sales (1986-1994)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	Annual Average
Insecticides	2867	2599	2641	2586	3075	3382	3551	3374	3205	3031
Herbicides	1007	800	924	876	1037	1140	1197	1138	1081	1022
Fungicides	402	339	416	410	450	495	520	494	494	447
Others	446	398	470	363	536	590	620	589	559	529
• Rodenticides	24	21	25	28	83	91	95	91	86	81
• Plant Growth Regulators	422	377	445	335	454	488	524	498	473	447

Quantity of Insecticide Product Sales 1986-1994 ('000 kg)

	86	87	88	89	90	91	92	93	94
Chlorinated hydrocarbons	28	13	11	27	23	25	26	25	24
Organophosphates	218	197	219	198	239	263	276	263	249
Carbamates	290	222	193	184	256	281	295	280	266
Pyrethroids	54	20	21	25	34	38	40	38	36
Mineral Oils (kilo/ litre)	37	31	38	42	42	47	49	47	44
Others	2277	2148	2197	2153	2523	2775	2914	2768	2630

Appendix 2

Value of Pesticide Product Sales (Z\$ million)

	86	87	88	89	90	91	92	93	94	Annual Average
Insecticides	50,3	39,3	46,4	53,2	54,4	59,8	62,8	78,5	102,1	60,8
Herbicides	29,3	26,1	32,4	33,7	34,9	38,4	40,4	50,5	65,6	39,0
Fungicides	10,5	7,6	12,3	14,6	12,9	14,2	14,9	18,7	24,3	14,4
Others	4,9	4,7	5,7	6,3	6,2	6,8	7,12	8,9	11,6	6,9
- Rodenticides	0,2	0,2	0,2	0,4	0,3	0,3	0,3	0,4	0,5	0,3
- Plant Growth Regulators	4,8	4,6	5,4	5,9	5,9	6,5	6,9	8,6	11,1	6,6

Source: CSO and estimates from unpublished data, Ministry of Lands, Agriculture and Water Development and ACIA

Exchange Rate

	1 Z\$ = x US\$
1986	0,596
1987	0,601
1988	0,515
1989	0,439
1990	0,379
1991	0,198
1992	0,182
1993	0,144
1994	0,119

Appendix 3

Pesticide Prices and Percentage Increases for the Period 1989 -1995

		Z\$/Unit of Measurement (kg or litre)						% Change in prices				
	Pack Size	89	90	91	92	93	95	89-90	90-91	91-92	92-93	93-95
Herbicides												
Atrazine 80%	20 kg	6,85	17,36	17,15	17,36			153%	-1%	1%		
Atrazine 50 FW	20 lt				31,85	34,20	38,00				7%	11%
Banvel	5 lt		76,00	91,10	194,00	272,00	276,00		20%	113%	40%	1%
Basagran	20 lt	36,17	34,60	48,84	112,70	112,70	140,00	-4%	41%	131%	0%	24%
Bladex	20 lt	18,02	18,02	29,52	69,68		92,35	0%	64%	136%		
Cotoran 80Wb	20 kg	30,01	33,75	38,00	92,84	118,00	156,25	12%	13%	144%	27%	32%
Diuron 80%	25 kg	22,32	22,32	32,44	66,50	82,50	110,60	0%	45%	105%	24%	34%
Dual 720 EC	20 lt	33,99	45,00	59,55	66,00	79,00	103,49	32%	32%	11%	20%	31%
Gramoxone	5 lt	19,00	23,50	35,31	64,90	72,10	82,00	24%	50%	84%	11%	14%
Igran 500FW	5 lt	22,67	22,67	48,37	66,00		95,00	0%	113%	36%		
M.C.P.A.	20 lt	8,80	10,19	10,19	38,00	41,50	43,20	16%	0%	273%	9%	4%
Sencor 480SC	10 lt					177,00	177,00					0%
Tillam	20 lt	16,90	19,37	50,07	61,82	74,20	74,00	15%	158%	23%	20%	0%
Trifluralin	20 lt	13,96	13,96	23,27	40,70		48,90	0%	67%	75%		
Insecticides												
Agrithrin	20 lt		86,15	84,80	175,00	124,00	138,00		-2%	106%	-29%	11%
Cabaryl 85%	25 kg	16,72	16,75	35,01	62,52	88,00	84,00	0%	109%	79%	41%	-5%
Chlorpy- rifhos	20 lt	44,47	57,00	73,05	137,52	134,50	137,00	28%	28%	88%	-2%	2%
Dimethioate 40	5 lt	13,34	17,15	23,87	45,25	48,00	47,50	29%	39%	90%	6%	-1%
Dipterex 2.5%	25 kg	0,90	0,90	1,85	3,50	4,75	8,16	0%	106%	89%	36%	72%
Dipterex 95	25 kg		23,92	36,00	36,00	130,00	140,00		51%	0%	261%	8%
Hostathion	5 lt	48,45	51,20	79,60	161,85	185,70	161,00	6%	55%	103%	15%	-13%
Fanvelarate	5lt						136,00					
Metasystox	5 lt	22,00	24,50	34,00	64,00	64,90	78,00	11%	39%	88%	1%	20%
Monocrophos	20 lt	17,26	33,19	41,09	62,25	77,00	88,00	92%	24%	51%	24%	14%
Tedion	20 lt	10,60	10,60	14,20	25,25	29,16	36,48	0%	34%	78%	15%	25%
Thiodan MO35	5 lt	16,16	21,05	27,07	56,50	88,00	74,30	30%	29%	109%	56%	-16%

Decis	5 lt					113,59							-100%
Dursban	20lt						136,00						

Pesticide Prices and Percentage Increases for the Period 1989 -1995

(continued)

		Z\$/Unit of Measurement (kg or litre)						% Change in prices				
	Pack Size	89	90	91	92	93	95	89-90	90-91	91-92	92-93	93-95
Seed Dressing												
Baytan 15%	2 kg		128	200	290	290	293		56%	45%	0%	1%
Brassicol	25 kg		23,12	51,64	98,75	98,75	150,00		123%	91%	0%	52%
Gaucho	125g						2496					
Innoculant	unit	1,50	1,50	2,00	2,00	2,00	2,00	0%	33%	0%	0%	0%
Rizolex	50 kg				59,66	248,00	180,00				316%	-27%
Thiram	25 kg	8,13	17,32	19,36	33,36	39,75	45,24	113%	12%	72%	19%	14%
Vitavax Plus	20 lt				80,09	110,00	112,80				37%	3%
Soil Fumigants												
EDB ec	20 lt	12,25	14,62	20,50	34,50	33,00	41,00	19%	40%	68%	-4%	24%
Methyl Bromide	680g	6,20	11,21	12,27	17,30	33,82	44,12	81%	9%	41%	95%	30%
Fungicides												
Bacemul	5lt					10,00	20,00					100%
Benomyl	50 kg	61,66	61,66	98,94	211,10	377,78	350,00	0%	60%	113%	79%	-7%
Bravo	20 lt	19,30	22,20	22,20	89,74	93,40	115,00	15%	0%	304%	4%	23%
Copper Oxychloride	25 kg	5,31	6,20	7,08	9,95	10,83	15,77	17%	14%	41%	9%	46%
DithaneM45	4 kg					400,00	410,00					3%
Folicur 250EC												
Other												
Molasses	per lt	0,50	0,47	0,48	0,86	3,75						

Source: CFU (1995)

Also available in this series:

S. Agne, G. Fleischer, F. Jungbluth, H. Waibel: Guidelines for Pesticide Policy Studies - A Framework for Analyzing Economic and Political Factors of Pesticide Use in Developing Countries (1995), The Pesticide Policy Project Publication Series No. 1.