

Economic costs of pesticide reliance

Why do farmers continue to spend their scarce cash on expensive pesticides? PAN UK's recent research revealed the growing dependency on pesticides by African smallholder farmers, despite rapidly rising input costs. Stephanie Williamson explores the economic costs of chemical control strategies and the benefits of investing in Integrated Pest Management training for farming communities and society.

In Benin, West Africa, cotton farmers interviewed by PAN partners expressed serious concerns about the rising costs of pesticides and the low rate of return on cotton investment. Cotton prices remained static

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between 2000-2001, while average insecticide treatment costs rose by 80%. Farmers from Kpako village estimated they spent US\$97 per hectare on insecticides and applied 8-12 treatments per season, instead of the recommended six¹. Some farmers incurred net losses on their cotton operations, and almost all those using pesticides have experienced poisoning incidents. Kpako villagers have observed a cumulative decline in earthworm populations in sprayed fields, disruption of termite and ant colonies, and accidental poisoning of vertebrate predators and domestic animals. These farmers are keenly aware of the health and environmental effects of pesticides and highly critical of the way cotton companies supply inputs, which removes much of the decision-making power from farmers themselves. Yet they continue to rely exclusively on insecticides for controlling pests in cotton.

The real costs of pesticides

Assessing the true costs and benefits of pesticide use is much more complicated than for technologies such as fertiliser application or new crop varieties. There are two important consequences of pesticide use

which do not feature in conventional economic analysis of pesticides:

- the disruption or elimination of natural pest control by the killing of predators and parasites by pesticides
- the development of resistance among target pests as a result of regular application of particular products or chemical groups.

A related problem is that secondary pests can increase their status when pesticides deplete the populations of natural enemies. It is not easy to observe these biological and ecological processes taking place at field level without training. Resistance problems or decline in natural enemy populations may take many years to emerge and even longer to be quantified. This future cost to sustainability of production systems through current pesticide use is not included in standard cost-benefit analyses.

Natural control processes can be considered as 'biological capital', and may be a non-renewable resource that is not well understood by farmers or policy-makers. Chemical control often creates a serious imbalance in agro-ecological systems that sooner or later can lead to unsustainable pest control².

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Reliance on pesticides as the main control strategy is not only unsustainable, but also extracts penalties in terms of human and environmental health. These penalties are sometimes borne by pesticide users themselves, but in many cases, it is other sectors of society who may be adversely affected. These 'externalities' result in economic costs which are not reflected in the price of pesticides and there is therefore no direct market incentive for users to change their pest control practice to reduce these costs. Only since the early 1990s have researchers tried to estimate some of these external costs. Table 1 summarises findings from assessments in a range of countries and cropping systems, revealing multi-million dollar costs for those externalities that can most readily be quantified.

Africa's proportion of global pesticide use is tiny, at only 2% of market value. Researchers and decision-makers often refer to the low volume of pesticides applied per hectare in comparison with intensive agriculture in the North but this should not be equated with low risk or low external costs. Products used are generally among the most toxic (World Health Organisation (WHO) Classes I and II – Extremely, Highly or Moderately Hazardous) and pesticide handling and storage practices are highly hazardous. A recent socio-economic assessment looked at the substantial increase in pesticide imports to Mali in the last decade, of which 80% is used by small-scale cotton farmers. Total annual indirect and external costs of pesticide use were estimated very conservatively at almost US\$10 million. This is equivalent to roughly 40% of their current market value¹⁰. The two most important costs were human health effects and insect

Table 1. External cost assessments of pesticide use

Country	External costs estimated per year (in US\$)
Sri Lanka ³	Ill health costs to farmers from pesticide exposure = 10 weeks' income
USA ^{4,5}	Work lost due to poisoning = 1.76 million Non-hospital treatment = 17 million Environmental and public health costs of recommended usage = 9 billion
Germany ⁶	DM 0.25 borne by society for each Deutschmark spent on pesticides
Thailand ⁷	Health costs from around 40,000 farmer poisonings = 300,000 Health, monitoring, research, regulation and extension = 127.7 million
Philippines ⁸	61% higher health costs for farmers exposed to pesticides than those not exposed
Ecuador ⁹	Each poisoning of a potato farmer costs about 6 worker days
Mali ¹⁰	Annual indirect and external costs of pesticide use = 10 million

Box 1 The Farmer Field School (FFS)

ADULTS LEARN best from experience, which in the case of farmers means from observations in the field. First-hand knowledge is superior to information received from others. The term 'field school' implies that the field is a learning ground.

The FFS is a weekly gathering of a group of farmers and their facilitator to learn to observe and understand the dynamics of their crop's ecosystem. In an exercise called 'agro-ecosystem analysis' participants depict their observed field variables and make comprehensive decisions on how to manage the crop over the next week. Additional hands-on experimentation stresses the strong tolerance of rice plants to leaf or stem damage, which normally triggers much unnecessary spraying by farmers, and the importance of conserving beneficial organisms in rice. The training is participatory in that farmers take observations, do analysis and draw conclusions. Moreover, group dynamic exercises encourage learning from peers, and strengthen communicative skills and group building. The facilitator avoids instructions or lectures but provides the opportunities for first-hand experience by the participants. He or she introduces an activity, explains the process and sets the farmers to work. Shortcuts to the learning process are seen as missed opportunities. During group discussions the facilitator fills in with questions rather than solutions.



Farmer presenting her results of field observations and agro-ecosystem analysis during weekly Farmer Field School sessions, Kendewa village, Anuradhapura District, Sri Lanka, 2002.
Photo: Henk van den Berg

pest resistance and development of secondary pests, estimated at US\$0.82 million and US\$8.6 million, respectively. Mali is ranked the tenth poorest country in the world by per capita Gross Domestic Product. Pesticide management costs US\$120,000 per year and disposal of obsolete stocks US\$193,000 while there was no data to quantify the costs of reduced biodiversity and soil fertility or the environmental pollution.

Obsolete pesticide disposal is another major cost to be added into the externalities equation. To clear up the estimated 50,000 tonnes of obsolete pesticides in Africa will cost around US\$150-175 million, with a further US\$100 million on measures to prevent more stocks accumulating in the future¹¹.

Uneconomic pesticide policies?

Many policy makers and some donors regard pesticides as indispensable for agriculture and continue to promote their use. Direct and indirect subsidies on pesticides encourage their application at unsustainable rates and discriminate against safer and more sustainable forms of pest management. In Costa Rica, for example, the government has exempted pesticides from all taxes and duties. Government revenue foregone approximated US\$6 million based on 1996 figures, constituting a substantial

incentive for pesticides imported that year, valued at US\$102 million¹².

Another factor hindering a more rational approach to the economic costs and benefits of pesticides is the over-emphasis on minimising crop losses by crop protection departments and agricultural policy makers. Generalisations of 30-100% crop losses are frequently employed to justify the use of pesticides for food security and poverty alleviation, without any attempt at needs assessment. Focusing on preventing potential yield loss without considering the economics of pest control methods or the external costs is a frequent mistake in crop protection programmes¹³.

In Ethiopia, policymakers, crop protection researchers and farmers are beginning to question the economic wisdom of agricultural intensification strategies which rely on high external inputs. In theory, these can produce excellent yields and good income, but a succession of price crashes for staple food produce and drought periods have left many resource-poor farmers highly

indebted, often spending more than half their total income on debt repayment for inputs. PAN UK research with the Safe Environment Group in Amhara Region showed how pesticide costs, including the time spent in procuring and transporting them, represent a significant burden for farmers¹⁴. In Zenzelima n, farmers in the poorest wealth rank spent an estimated US\$38 per household on pesticide costs, amounting to over 50% of their total cash outlay for production. This is a huge sum to spend for households whose net cash income is well under the international poverty line of US\$1 per day. To make things worse, these farmers complained how their increased use of pesticides has failed to solve their pest problems. Chickpea is no longer grown in Zenzelima because of weed and termite problems. Noug oil seed and flax are virtually abandoned and beans and peas rarely grown because of termites, while a new maggot pest recently appeared in maize cobs.

Incorporating pesticide externalities

There is an urgent need for an agricultural production model which starts to internalise the external costs of pesticide use and incorporates the prevention of ill health, environmental contamination and the conservation of biological capital into production processes and markets. A first step is to raise awareness of the economic costs of current policy and practice. This requires a serious effort to reach decision makers, donors and investors, as well as pressure on governments from civil society. In Central America, for example, considerable evidence is now available on the consequences of pesticide exposure but so far this data has had little impact on regulatory policies in the region¹⁵. Elimination of WHO Class Ia and Ib pesticides – Extremely and Highly Hazardous – known to give rise to huge

Table 2. Some pesticide reduction figures from FFS training projects

Crop	Country	Pesticide reduction
Cotton	Pakistan	At least 68%
Vegetables, rice, plantain	Ghana	Up to 95%
Cabbage	Philippines	55-80%
Pistachio nut	Iran	From six, down to one or zero sprays per season
Rice	Bangladesh Vietnam Philippines	Up to 100%
Tomato	Kenya	92% in insecticides 42% in fungicides

Source: IPM in Developing Countries and Lessons for Europe, S. Williamson, Paper presented at the MRDGF/PAN Europe colloquium on Alternatives for Reducing or Eliminating the Use of Synthetic Pesticides in Agriculture: IPM and Organic Farming, 30 May 2003, Beauvais, France.

external costs, has been called for in South America, following detailed studies of their impact (see PN55 pp3-6).

Sustainable agriculture offers a philosophy and a set of practices to reduce pesticide impacts. One of the most successful ways to address both the economic costs of pesticide reliance and the health and environmental externalities is through participatory Integrated Pest Management (IPM) training for farmers and extension staff. When run well and adequately funded, Farmer Field School (FFS) (see Box 1) and similar programmes have a proven track record in reducing pesticide use, usually by more than 50% (Table 2). Assessment of IPM training programmes in cotton in India and vegetables in Kenya showed that trained farmers reduced their pest management costs by 27-89% compared with untrained farmers¹⁶. Participating farmers in IPM projects generally shift to less toxic and less persistent products and a much greater reliance on physical, biological and other control methods. Most FFS programmes have enabled farmers to increase their net income, often by improving yields or quality, and farmers in several programmes have found new and more reliable markets, sometimes selling pesticide-free or organic produce. Box 2 describes the different benefits of IPM training as expressed by Ghanaian farmers growing vegetables, plantain or rice.

Investing in IPM makes economic sense

Economics of environmental benefits were assessed for an IPM training programme with onion growers in the Philippines, studying risks to human health, beneficial insects and wildlife before and after the training. The study found that 60-64% of pesticide risks were avoided following training, with estimated benefits per person per season of US\$33 for the five villages involved. Farmers also benefited from savings in pesticide expenditure¹⁷.

The health benefits of IPM training were proven among Nicaraguan maize farmers who suffered less exposure to cholinesterase-inhibiting pesticides than did untrained farmers¹⁸, while a Philippines study found that spontaneous abortions and birth defects were significantly more common among conventional pesticide farm households than in those practising IPM¹⁹.

Effective IPM training requires investment of financial and human capital. Several commentators have criticised the FFS approach for being too costly compared with traditional message-based extension methods²⁰. Just comparing training costs alone is misleading – a proper comparison needs to assess the benefits accruing to participating farmers over time and whether beneficial practices spread to other farmers. On this basis, savings made on agrochemical inputs by trained farmers and those with whom they shared their knowledge in a pilot coffee and vegetable FFS project in Kenya were estimated to

Box 2. Benefits to farmers of FFS training in Ghana

Farmers in Ghana benefiting from training substantially increased their income, and were able to improve their housing conditions, pay school fees, buy new clothes, contribute to church and social funds and improve family food security. An impact assessment of the programme with a sample of 250 FFS graduates showed that on average they increased yields by over 50%, raised seasonal profits by 30% and reduced pesticide use by 95%.

Intensification of plots was a specific benefit mentioned by farmers, since yields from a small plot under ICPM practice were much higher than those from a larger plot under traditional practice. Some farmers have expanded their farm operations with their added income and turned a mainly subsistence livelihood into a more business-oriented enterprise. Farmer participants in the savannah zone reported that they now produce enough crops to store food throughout the lean season, while those in the more food secure districts were able to afford more meat and fish in their diet. Farmers valued highly the health benefits from reduced pesticide poisonings and found that vegetables produced under ICPM methods were tastier and had a longer shelf-life than those grown with high levels of agrochemical inputs. Training of women extension staff and women farmers has strengthened their organisational ability, leadership skills and self-esteem. The farmer group approach has also created better demand-pull on local government and district agricultural offices for community development.

Impact Assessment of Integrated Crop and Pest Management Farmer Field Schools on Rice, Vegetables and Plantain Farming at Five Sites of the FAO/UNDP National Poverty Reduction Programme in Ghana, FK Fianu and K Ohene-Konadu, FAO Regional Office, Accra, Ghana, 2000.

repay the initial project investment within two years²¹. Investing in participatory training and research programmes for IPM, broader crop, soil and water management and for farming community empowerment in rapidly changing markets makes good economic sense, in the short as well as the longer term. With the current trend in donor funding towards transparent markets and economically sound food production strategies, it is high time that pesticide externalities were addressed through practical training with farmer-based organisations.

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