PAN Europe reveals highest ever levels of pesticides in foods


metro

Madonna et Guy Ritchie divorce

Record de pesticides dans nos fruits et légumes

PAN Europe findings hit the headlines in Brussels

Fruits, vegetables and cereals sold throughout the European Union contain record levels of pesticides – according to an official EU report scheduled for publication later this year. Almost half of fruits, vegetables and cereals are now contaminated with pesticides – a substantial increase on the level seen just 5 years ago. Five of the pesticides most common in the food chain are classified as carcinogenic, mutagenic, or disruptive to the hormonal system.

While the forthcoming EU food monitoring report has still yet to be published, the study's major findings were pre-announced by PAN Europe just days before politicians in Brussels met to debate new EU pesticide legislation. Thanks to the collaborative efforts of several PAN Europe network members the story gained widespread coverage by the mainstream media – including the front page news head line of the Brussels Metro.

'These are the worst pesticide results we've ever seen', said Elliott Cannell, Coordinator of PAN Europe. 'A record proportion of fruits and vegetables are contaminated, while 23 pesticides were detected at levels high enough to present an acute risk to public health – according to the EU's own risk calculations.'

'The need to reduce exposure to hazardous pesticides is more urgent now than ever. Politicians in Brussels must back the removal of the worst pesticides from the food chain, and ensure that hazardous pesticides are replaced with safer alternatives wherever possible.'

An advance copy of the forthcoming EU food monitoring report, seen by PAN Europe, shows:

- Forty nine percent of fruits, vegetables and cereals contain pesticides. This is the highest ever level of pesticide contamination recorded in the EU and represents an increase of around 20% over the past 5 year period.
- In total, 4.7% of fruits, vegetables and cereals contain pesticides at concentrations above maximum legal limits, while over 10% contain 4 or more different pesticide residues.
- Five of the pesticides found most often in food products sold in the European Union are classified as carcinogenic, mutagenic, toxic to reproduction, or disruptive to the hormonal system.
- Twenty three pesticide substances were detected at levels high enough to present an acute risk to public health – according to the EU's own risk calculations.
- Food products sold in the EU now contain 354 different pesticides – the highest total ever recorded.
- For the first time, imidacloprid – a controversial pesticide banned in France due to links with mass bee deaths – has been listed among the most common pesticide residues in foods.
- Worst affected foods include grapes (71% contaminated), bananas (56% contaminated) and peppers (46% contaminated), while one in 25 aubergines tested contained pesticides above maximum legal limits. **(EC)**

PAN Europe press release, 15 October 2008

Pesticides in grapes: illegal, unauthorised and unsafe

Analysis of table grapes purchased from 18 major food retailers across Europe revealed illegal, unauthorised and unsafe pesticides hidden in grapes on sale to consumers. Ninety nine percent of grapes contained pesticides. On average seven pesticides were detected per sample. One third of grapes were classified as 'Not Recommended' for consumers owing to critical levels of pesticide contamination.

Six grape samples contained pesticides at concentrations above EU maximum legal limits. These were purchased from Auchan, Carrefour and ALDI in France, from Esselunga in Italy, and from the wholesale fruit and vegetable market in Hamburg, Germany (Großmarkt Hamburg).

Two samples of Italian-grown grapes contained the banned insecticide endosulfan. Use of endosulfan has been illegal since 31 December 2007 following the announcement of an EU-wide ban in 2005. Both samples of affected grapes were purchased from ALDI in France.

Grapes sold by food wholesaler Metro in Germany contained the carcinogenic fungicide 'procymidone' at levels above the ARfD according to standards established by the German Federal Institute for Risk Assessment and World Health Organisation. Worryingly, while the pesticides present in this grape sample exceeded recognised safety levels, they did not breach EU legal limits.

In total 38 of the 124 grape samples (30.6%) received 'Not Recommended' status according to evaluation protocols pioneered by Greenpeace. The Greenpeace system takes into account residue levels exceeding the maximum residue levels, the Acute Reference Dose (ARfD), and the Acceptable Daily Intake (ADI), as well as multiple exposure and the special sensitivity of children.

Despite widespread pesticide contamination some supermarkets performed much better than others. The best grapes were sold by LIDL – the German discount retailer, which beat leading quality brands such as Carrefour, Albert Heijn, and Super de Boer. 'LIDL's success is interesting because it proved consumers can have higher standards at lower prices,' said Elliott Cannell, Coordinator of PAN Europe. Dutch retailers C1000 and Coop also did well.

The results also gave the first opportunity to assess the impact of new EU legislation introduced in September 2008 which substantially increased many of the maximum residue limits (MRLs) for food products sold in the EU. While only six samples of grapes breached MRLs at the time of purchase in October 2008, 37 samples would have exceeded legal limits had the grapes been purchased in 2005. These figures demonstrate the dramatic relaxation in EU food standards over the past three years.

The supermarket testing analysis was conducted by six European environmental organisations: Greenpeace (Germany), Milieudefensie (Netherlands), Mouvement pour les Droits et le Respect des Générations Futures (MDRGF) (France), Legambiente (Italy), Levego (Hungary) and Pesticide Action Network Europe. All grape samples were analysed by the same fully accredited laboratory specialising in pesticide residue analysis. All participating organisations published coordinated press releases on 24 November designed to inform consumers in their own respective countries where to shop for the best grapes. **(EC)**

PAN Europe press release, 24 November 2008

Flowers – a tale of beauty and the beast

*Global flower trade is expanding dramatically, with Europe and the US increasingly sourcing from low-cost producers in developing countries. **Barbara Dinham** explores the use and impact of pesticides in a trade that depends on delivering the perfect product, and asks whether ethical consumption can influence production practices.*

Flowers provide beauty and pleasure, express thoughtfulness and act as a peace offering. Few births, deaths and marriages pass without flowers to celebrate or provide solace. Flowers adorn houses, offices, public buildings and spaces, and are central to many cultural traditions. Over half are bought as a gift, truly reflecting the catchphrase 'say it with flowers'. It is difficult to imagine a world without their power to uplift and comfort.

Flower sales are highly dependent on a perfect, blemish-free product that reaches the market in peak condition. Achieving this will almost certainly require large amounts of chemical pesticides. But beneath the production of beauty and perfection are fields and greenhouses heavily reliant on insecticides, fungicides, nematicides, plant growth regulators, soil sterilizers and synthetic fertilizers. The agriculture workers and pickers who bring flowers to the table are regularly exposed to toxic chemicals, and often poorly rewarded for their labour.

The largest part of the global floriculture industry is made up of fresh cut flowers[1]. Over 125 varieties are grown commercially worldwide (the most important being roses, carnations and chrysanthemums)[2]. But the business also includes foliage, bulbs, pot plants and bedding plants. More than 90 countries are active in floriculture, and their steadily expanding sales reached US$36.3 billion in 2004, up from US$34.2 billion in 2002[3]. The trade is dominated by larger growers because of the level of investment required; but for smallholders the high value crop can substantially boost income.

This article looks at the current size, growth and structure of the floriculture industry. It identifies some of the chemicals used and associated problems, and asks what the industry is doing about their health and environmental impacts.

Scale of production and trade

Figures on production value of flowers are approximate, with one estimate in 2003 of US$60 billion[4] and one in 2004 of US$75 billion[5]. However the main producers and sales trends are reasonably indicative. Leading flower-growing countries are the Netherlands, the US and Japan. The trade flows can be broadly grouped into three centres: Europe-Africa, the Americas and Asia-Pacific. Markets can be categorised as countries with:

- high demand but largely self-sufficient such as the US, Japan, India and China
- high demand and high production, being both an importer and exporter, where the most significant example is the Netherlands
- high demand mainly met by imports, for example Germany, UK, France, Italy, Spain
- production primarily for export, for example in Latin America (mainly Colombia, Ecuador and Guatemala), and in Africa (Kenya, Ethiopia, Uganda, Zimbabwe, Tanzania, Uganda, Zambia)

Europe is the biggest single market for flowers (Figure 1), served by a large intra-European trade as well as imports. The Netherlands dominates both production and trade with over 8,241 ha in floriculture crops, of which 69% are grown in glass houses[6]. Netherlands is a major destination for floriculture products from both around the globe and elsewhere in Europe. It pioneered auctions which have historically been the hub of wholesale and retail trading in Europe. In 2004, for example, sales of cut flowers (domestic production and imports) through just four main Dutch flower auctions totalled €2,329 million[7]. Wholesale markets are important in other European countries, particularly Germany, UK and France[8].

Auctions and wholesale markets are increasingly bypassed by supermarkets, which are establishing direct trade with growers and import agencies. This trend is likely to continue as interest grows in demonstrating to consumers that flowers were grown in a socially responsible manner. But direct sales do not yet dominate the market and between 2002 and 2004 several countries increased their sales of cut flowers through the Dutch flower auctions: Kenyan sales of €188.7m were an increase of 27%; Ecuador increased by 31% and Uganda by 35%[9].

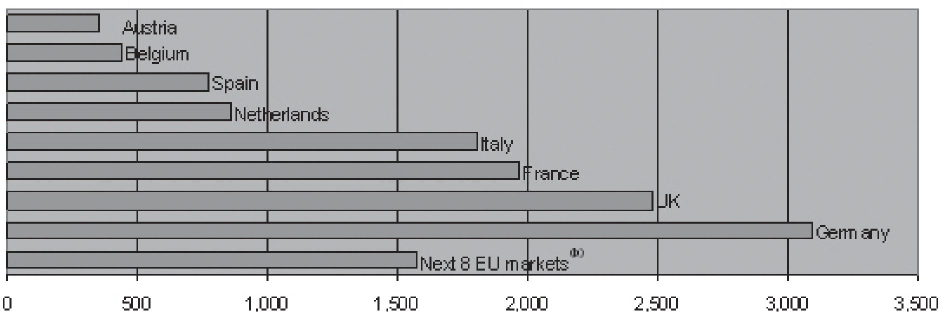
Trade from developing countries

In many developing countries flowers, as a high value crop that boost export earnings, are targeted for investment. Kenya entered the field early and since 1970 has built up one of the largest floriculture industries. In 2007 it contributed 38% of imports to Europe from non-EU sources, followed by Colombia with 17% and Israel 16%. Table 1 shows the main countries exporting to Europe in 2003, however since this date it is likely that the share from Zimbabwe has fallen as a result of the political situation there (for example its sales through the Dutch auctions fell by 38%, or €26m, between 2002 and 2004)[10]. Tanzania has increased its exports. Ethiopia has rapidly become a major force as the government has attracted investment by offering favourable packages and low cost land on lease, and exports rose from $660,000 in 2001 to $120 million in 2007[11]. Firms from the Netherlands, Germany, India and Israel have secured licences there for developments covering 1,700 ha of land in the central region[12].

While the US is the biggest market for Latin American producers (Table 2), particularly for Colombia and Ecuador, Spanish and Portuguese economic links boost European sales. Colombia is by far the major grower in the region, and exports almost entirely as cut flowers, making these its fourth foreign exchange earner after petroleum, coffee and bananas[13]. No African countries are significant exporters to the US.

Asia-Pacific countries have the largest area of floriculture production globally but mostly grown for domestic markets. Compared with the Netherlands, China (75,000 ha) and India (65,000 ha) have enormous tracts of land cultivating flowers, and both countries are now looking to expand their export markets. Other Asian producers with some export floriculture, mainly to Japan, include Thailand, Malaysia and Indonesia.

Figure 1. Total EU consumption of cut flowers and foliage (€ million) 2003 [(a)]



(a) 2002 consumption in the case of Germany, Spain, Poland, Hungary
(b) Next eight EU markets in descending order: Sweden, Poland, Denmark, Greece, Finland, Portugal, Hungary, Ireland (pre-expanded EU market)
Source: Yunjian Xia et al, Table 2, p338.

Table 1. Top 30 countries exporting to the EU in 2003* (€1,000)

Countries exporting to EU	Total (flowers, foliage, plants, bulbs)	Flowers and foliage
Total EU trade in 2003	7,946,987	3,930,600
Internal EU trade	6,896,418	3,076,778
% internal EU trade	87%	78%
Netherlands share of EU trade	68%	80%
Kenya	241,066	209,493
Zimbabwe	57,748	56,834
South Africa	39,603	29,804
Uganda	24,371	17,537
Zambia	16,981	16,981
% EU imports from Africa	4%	8%
Colombia	99,780	99,535
Costa Rica	92,175	53,420
Ecuador	73,469	73,355
Guatemala	40,202	28,398
Brazil	13,844	2,675
Mexico	12,276	11,402
% EU imports from Latin America	4%	7%
% EU imports from Asia (China, Thailand, India)	1%	1%
% EU imports from other countries (Mainly Israel, USA, Turkey, Canada)	3%	5%

** Some important changes have taken place since 2003. Imports from Zimbabwe have fallen; Ethiopia has become a significant exporter, though partly to Japanese markets; Tanzania exports to the EU.*
Source: Yunjiang etc, based on Eurostat 2003 and USDA and adapted.

Employment and pesticide use

There has been a marked growth of flower production in Southern countries, which is accelerating because of low labour and production costs. A 2002 report indicated that floriculture employed about 190,000 people in the developing world[14], but the number is now certainly higher. In 2007 the workforce in Colombia was estimated at 110,000[15] and in Kenya 70,000 at peak periods[16]. In Colombia women make up 65% of the workforce, and in Kenya 75%[17].

In many instances the floriculture industry provides steady jobs that can pay above minimum wages where work is scarce. Nevertheless, there are many part time and casual workers with insecure jobs, and permanent workers may have to work long hours for low pay. A 2007 War on Want report[18] found that women flower workers in Colombia were paid less than 50 pence per hour – half the living wage, and in Kenya flower workers could receive as little as £23 a month, about half what is required to cover basic needs of food, housing, transport, education and medical bills. Overtime can be mandatory, and workers in Kenya and Colombia both reported working overtime for no extra pay.

The high value, monoculture production of flowers and need for perfection leads to both intensive pesticide use and application of many different products. This has inherent dangers for health and the environment, which could be increased by a number of issues, for example:

- as flowers are not a food crop, Maximum Residue Limits (MRLs) are not established, thus removing one check on levels and standards of application
- lack of MRLs and poor implementation of regulations could lead to use of pesticides not registered in the country, a major problem in Tanzania[19] and Ethiopia[20] and likely to be found in other countries
- pesticide dealers in developing countries are not equipped to provide accurate advice to customers, as confirmed in a 2007 United Nations study in Nepal where neither flower growers nor dealers were aware of pesticide application requirements
- personal protective equipment (PPE) is often lacking or inadequate, and spray operators receive inadequate or no training

Many products used are highly toxic or associated with chronic effects. A Tanzanian study[22] found that flower workers were unaware of inherent dangers, ignorant of the identity and hazards of the chemicals used, and had no access to the standard material safety data sheets. Workers did not have first aid information on dealing with splashes and spillages and with a few exceptions the health services available to workers did not differ from those of the general population. A report in Colombia confirmed a similar situation where workers are often not given appropriate PPE or training on how to use protective gear that is provided; nor are they educated about the types of pesticides being used, how to handle the pesticides properly and potential risks[23]. A survey of 84 farms between 2000 and 2002, found only 16.7% of its members respected pesticide manufacturer recommendations to prevent workers for 24 hours from re-entering greenhouses sprayed with the most toxic of pesticides[24].

Exposure is not only an issue for those whose job involves pesticide application, as workers can be exposed when they transplant crops, prune, and cut or pack flowers. Greenhouse production is common in developing countries as well as in Europe (over 87% of Colombia's 8000 ha of flowers are grown in greenhouses[25]) and workers will dust and spray pesticides in these enclosed spaces. Interviews indicate that it is common to expect other workers to remain at work during spraying, or return before a safe re-entry period[26,27].

Implications for health

These poor conditions and widespread exposure to pesticides give rise to a range of adverse health effects, both acute poisoning and chronic impacts.

Symptoms of acute poisoning such as headaches, skin rashes, respiratory difficulties, eye problems and even miscarriages are frequently identified by workers. Most instances of ill-health will not reach the public eye, but occasional instances are reported. In November 2003 about 200 Colombian flower workers, mainly women, experienced symptoms such as strong headaches, nausea, swelling, rashes, diarrhoea and sores inside and around the mouth shortly after arriving at work at Flores Aposentos, north of Bogotá. The workers were taken to hospital but the pesticides responsible were not identified[28]. The Colombian National Institute of Health indicated that women flower workers suffer skin lesions, allergies, respiratory problems, fainting spells, headaches, eye problems and chronic asthma, as well as congenital malfor-

Table 2. Top 10 countries exporting to the US in 2003 (US$1m)

Countries exporting to the US	Total	Flowers and foliage
Total of top 10 exporters to US	931,551	607,380
Colombia	347,544	347,150
Ecuador	105,964	105,865
Costa Rica	44,858	34,173
Mexico	39,464	25,945
Guatemala	19,534	3,957
% US imports from Latin America	60%	85%
% US imports from Canada	35%	11%
% next four exporters to US (Taiwan, China, Israel, New Zealand)	5%	4%

Source: Yunjiang etc, based on Eurostat 2003 and USDA and adapted.

mations[29]. In Costa Rica a study of occupational health in floriculture indicated that 50% of respondents who worked in fern/flower farms reported at least one of the symptoms of pesticide exposure[30]. In Ecuador, a 16 year old working for six months as a spray operator indicated that he does not wear a mask or gloves in spite of working with pesticides all day, and suffered from an inflamed throat, cough, fatigue, headaches and personality changes[31]. In Mexico, a study of greenhouse sprayers which included eight men found that they sprayed pesticides once or twice a day[32].

A study of greenhouse flower workers in Denmark, although published in 1992, remains highly relevant. It found that effects on cholinesterase levels from exposure to organophosphate and carbamate pesticides persisted for weeks beyond application. This indicates chronic uptake of these pesticides orally and through dermal absorption, which was therefore not prevented by wearing gloves[33].

Given the high level of flower production in greenhouses, a recent review has revealedsome disturbing facts. It showed that greenhouse workers had an increased risk of respiratory disorders, sensitization to allergens and skin reactions. Exposure to dust, bacteria, allergens, fungi and gases may cause or exacerbate asthma, asthma-like syndrome, mucous membrane irritation, chronic bronchitis and dermatitis. It highlighted impacts on sperm concentration and time to pregnancy, with some indications that greenhouse work may contribute to musculoskeletal and neurobehavioral disorders. Some studies present evidence for the carcinogenicity of the pesticides used in greenhouses. These results imply a necessity to increase an awareness of the possible adverse health effects among greenhouse workers occupationally exposed to pesticides, biological agents or other factors of their specific work environment[34].

Chronic health effects from pesticide exposure are more difficult to identify because of the time between cause and effect. But many workers are anxious about the long-term consequences: A Colombian woman indicated that: ‘I know we’re left with the consequences; insecticides and fungicides are being passed through our skin.’ Her colleague noted, ‘Not everyone’s built the same and some people are harmed while others aren’t. But we’re always going to have the risk of contamination with fungicides.’[35] A range of studies confirms the risks to flower workers. Another worker interviewed, Carmen Elvita, was diagnosed by the Toxicology Department of the National University in May 2005 as having major mobility problems and loss of sensation, after 10 years as a floriculture worker. More than a year later she had only partially recovered from these disabilities[36]. In a 2005 interview, the secretary general of the Ecuador flower workers union, who has worked on flower plantations for 22 years, said ‘Pesticides are used every day. When workers are not well protected, they have immediate reactions such as headaches and vomiting. If it is a strong chemical, sometimes they faint.’[37].

Insecticides are widely used in Southern flower production and these, particularly organophosphates and carbamates, kill insects by interfering with the nerve function. This means that agricultural workers face neurotoxicity hazards. In Ecuador a study found that greenhouse workers show a very high neurotoxic impact, with nearly 60% of the workers manifesting nervous system symptoms, including headaches, dizziness, hand trembling, and blurred vision.[38]

Doctors in flower-producing regions of Colombia report up to five cases of acute poisoning per day, and a study by the Colombian National Institute of Health found an elevated rate of miscarriages, premature births, and congenital malformations among flower workers[39]. In the flower-growing area of Mexico, a medical centre in Tenancingo (Centre for Psychopedagogical Attention to Children and the Family) has recorded at least 800 cases of congenital abnormalities in neighbouring municipalities. While close family relations, lifestyle habits and diet may contribute, doctors at the centre believe that the pesticides commonly sprayed, such as methamidophos, monocrotophos and aldicarb (see box for World Health Organisation [WHO] hazard categories), contribute to the problem. Other concerns are a high incidence of spontaneous abortion and stillbirth[40].

In Ecuador, a study of 79 children and their mothers in an area in the North of the country with intensive floriculture found that maternal occupational exposure to pesticides during pregnancy may adversely affect brain development which can leave permanent impacts. A statistically significant number of children performed poorly on a standard test. The women were exposed to dimethyl and diethyl metabolites of organophosphates[41].

A study of 1,767 female workers in flower greenhouses in Denmark suggest that the women may have reduced ability to become pregnant after ceasing to use contraception, and that exposure to pesticides may be part of the causal chain. Risk factors included long hours handling plants, not using gloves, and operating pesticide sprayers – all conditions which are extremely common in flower production in Southern countries[42]. A study on male ornamental-flower greenhouse workers conducted at the same time found that sperm count was 40% lower among men with more than 10 years of greenhouse experience than those with less than five years' experience[43].

A recent study in flower growing areas of Ecuador found that exposure to organophosphate and carbamate pesticides was associated with poorer neurobehavioral development in children even after controlling for major determinants of delayed development[44].

A 1999 study of workers in Mexican greenhouses where application of pesticides is uncontrolled found evidence of genotoxic effects, with a three-fold increase in several markers of DNA damage. The 22 women participating in the study showed acute poisoning, occasional cephalea, skin and mucosa irritations and nausea when in contact with pesticides[45].

A study of the genotoxicity of pesticide exposure on flower greenhouse workers in Italy found that DNA adduct formation (chemical complexes between potential carcinogens) in the white blood cells was significantly higher in flower workers than in the control. A specific adduct pattern, with up to six different spots, was observed in 60% of the flower workers, which may represent an early stage of carcinogenesis[46] .

Environmental impacts

Few studies have addressed the environmental impacts of pesticides used in floriculture, however poor handling of chemicals leads to poisoned waterways and groundwater and subsoil pollution. A case study of the Lake Naivasha region in Kenya[47] identified negative impacts from flower production due to worsening environmental conditions affecting fishing, local food security (declining fish stocks) and community health from water pollution and over-abstraction.

The ozone-depleting chemical methyl bromide is still widely used to sterilize soil. It is applied to soil before planting and then covered with plastic tarpaulins; once these are removed part of the gas will enter the atmosphere[48]. A study in Nepal found use of methyl bromide even though it has been banned by the government[49].

Levels of pesticide application

While difficult to find specific statistics on pesticide use some studies and anecdotal comments suggest spraying takes place on an almost daily basis on large farms, though not on the same flowers. It is clear that pesticide application on flowers is high, whether a large or small producer. A study[50] of 910 women in 34 greenhouse flower growing enterprises in Italy noted the high levels of application to which they were exposed. Seven insecticides were sprayed 20-25 times a season, five were sprayed 15-20 times and one was sprayed 8-10 times. Two fungicides were sprayed 25-30 times a season, another six sprayed 10-20 times while one was sprayed 8-10 times.

The director of Asocolflores in Colombia has pointed to efforts of its members to improve worker safety and welfare, which includes reducing pesticide use. The association reports that usage has been reduced by 38% since 1998 to an average of 97 kg / ha of active ingredient per year[51]. Another report on Colombia suggested the figure was 200 kg / ha of flowers under cultivation[52]. (It should be noted that reductions in weight of pesticide application may reflect use of newer pesticides which are more active at lower doses.) An older survey of 8000 workers in flower plantations near Bogotá found that workers were exposed to 127 different pesticides, three of which are considered extremely toxic by the WHO[53]. Of the 134 pesticides approved for use in the Colombian flower industry, seven are considered by the government to be extremely toxic, and the Director of Asocolflores admitted in 2005 that 36% of the pesticides still applied by Florverde (the association's certification scheme on social and environmental standards) farms were listed as extremely or highly toxic by the WHO[54]. A Mexican study indicated that flower greenhouses in Morelos State applied 36 different chemicals[55]. In the 1990s, rose and carnation producers in Ecuador used on average six fungicides, four insecticides, and several herbicides[56].

Improving standards

There is increasing awareness of the problems of pesticide use and poor conditions of work in the flower industry. Major flower producers are linked through a trade association, Union Fleurs[57], which was established in 1959 to lobby on behalf of members. Issues of fairness and safety have slowly encroached on the industry with some countries' producers and exporters now adopting voluntary codes[58].

Possibly the most advanced voluntary codes are the Kenya Flower Council's (KFC) and Florverde, the Colombian flower exporters' scheme, but both lack independent verification. A study has shown that the cost of complying with standards for pesticides and fertilisers makes up the largest non-managerial component for KFC growers. This element includes improvements to stores, worker safety during and after pesticide application and chemical disposal[59]. An investigation into the flower industry in Kenya found that improvements could be made in implementing standards, including stricter controls on pesticide spraying and training, through monitoring and dialogue with players in the flower supply chain[60]. Nevertheless, there are major limitations of voluntary codes: plantations can be given advance notice of inspections, coach their workers about what to say, and do not allow workers to speak to auditors without a supervisor present[61].

To raise standards and encourage independent certification, a group of trade unions and NGOs have developed a voluntary International Code of Conduct for the Production of Cut Flowers (ICC)[62]. There is a small emerging market for certified organic and fair trade flowers. There is also some pressure from supermarkets that want verifiable standards to demonstrate to consumers through labelling schemes that they have met social and environmental standards. The ICC includes a demand to reduce pesticide use, along with the right to a living wage, a ban on child labour, the right to form unions, and health and safety standards. Efforts to produce and sell flowers and plants in an ethical and sustainable manner, and for independent monitoring, have been boosted by the recent establishment of Fair Flowers Fair Plants (FFP). This independent foundation is managed by producers, trade, trade unions and NGOs with equal 25% voting rights[63].

All studies that interview flower workers stress the importance of continuing to buy flowers to protect their jobs. In doing this, consumers can ask their suppliers for ethically produced flowers. Consumer awareness of the impacts of their purchases is making a difference in the supply chain, but the codes and certification systems need to be greatly strengthened and expanded. In particular, codes need to demand pesticide reduction and occupational safeguards against exposure to hazardous pesticides.

Pesticides used in floriculture

The specific pesticides used on flowers are rarely identified in studies. The list below is drawn from reliable sources published within the last 10 years but is not comprehensive either in pesticides used or country coverage. Active ingredients underlined are listed in WHO classes Ia (extremely hazardous) or Ib (highly hazardous), and those in italics are WHO class II (moderately hazardous). The Code of Conduct suggests prohibition of import and sale of WHO Ia and Ib[64], and FAO recommends that class WHO II should be avoided where conditions cannot protect workers.

Colombia
Nematicide: aldicarb[65]. Soil fumigant: dichlorpropene. Residues of the organochlorine lindane have been found in dangerously high levels in groundwater[66].

Ecuador
Residues in the soil and leaves of fenarimol, metalaxyl, penconazole and permethrin. were found. Residues were found of aldrin (now globally banned) and carbofuran[67].

Ethiopia
Flower farms have imported 96 types of insecticides and nematicides and 105 types of fungicides; of these, 37 have not been registered in the country[68].

Greece
Gerbera production in greenhouses: the insecticides *chlorpyrifos, diazinon, dimethoate*[69]

Italy
Three studies noted names of target pesticides:
Insecticides: methomyl (carbamate). Soil fumigant: dazomet. Herbicide: glyphosate[70]
Insecticides: *endosulfan* (organochlorine); monocrotophos, methamidophos, methyl parathion, ethoprophos, methidathion, omethoate (organophosphates); zineb, dazomet, aldicarb, mancozeb, methomyl, ethiofencarb (carbamates); benomyl, carbendazim, thiophanate methyl (benzimidazoles); *deltamethrin* (pyrethroid). Fungicides: captan, folpet, vinclozolin, dodemorph, bupirimate. Plant growth regulator: daminozide. Herbicides: *paraquat*[71].
Insecticides: abamectine, acephate, methiocarb, methomyl, cyromazine, *alpha-cypermethrin*, *propoxur*, *dimethoate*, mexaflumuron, *imidacloprid*, dichlorvos. Fungicides: mancozeb, metalaxyl, captan, procymidone, thiophanate methyl, tolclofos methyl, *pyrazophos*, zineb, benomyl. Acaracides: acrinathrin, propargite[72].

Mexico
Insecticides: methamidophos, monocrotophos. Nematicide: aldicarb[73].
Insecticides: *BHC*, lindane, *endosulfan* (also noted were the persistent organochlorines aldrin, dieldrin, endrin, which are now globally banned, and DDT widely banned for use in agriculture); azinphos-methyl, *diazinon*, diclorvos, disystox, ethyl parathion, malathion, metasistox, methamidophos, methyl parathion, monocrotophos, omethoate, (all organophosphates); *carbaryl*, carbofuran, methomyl, *pirimicarb* (carbamates); *cypermethrin* (pyrethroid). Fungicides: benomyl, captan, chlorothalonil, mancozeb, metalaxyl. Herbicides: Tordon (picloram and *2,4-D*), *2,4-D*, atrazine, ametryn, *bifenthrin*, diuron[74].

Tanzania
Insecticides: aldicarb (nematicide), *carbaryl, cypermethrin, diazinon, endosulfan, lambda cyhalothrin, permethrin, profenofos*. Fungicides: mancozeb, triforine[75].

Thailand
Pesticides sprayed by small-scale (average growing area 0.16 ha) chrysanthemum growers in northern Thailand included 33 products containing primarily the active ingredients: Insecticides: hexythiazox, mancozeb, methomyl, propargite, methyl parathion, monocrotophos; Herbicides: mainly *paraquat*[76].

UK
In 2001 a detailed study[77] noted: 13% of flowers for cutting were untreated; 50% of pesticides applied were fungicides, 26% insecticides and nematicides, 22% herbicides. By weight, soil sterilants accounted for 83% of use and herbicides for 8%. It noted active ingredients used as: Insecticides: *chlorpyrifos* (18%), *dimethoate* (76%). Fungicides: azoxystrobin, benomyl, carbendazim, chlorothalonil, mancozeb, prochloraz, thiabendazole, vinclozolin. Herbicides: bentazone, *cyanazine, diquat*, glyphosate (71%), linuron, *paraquat* and metamitron. Disinfectant/fumigant: formaldehyde.

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Barbara Dinham is an independent researcher working on pesticide issues; barbara.dinham@googlemail.com