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Message in a Bottle

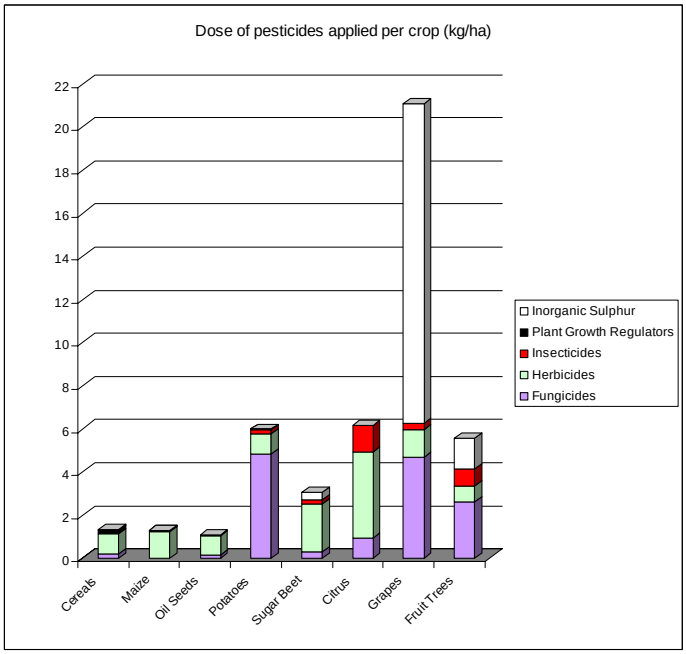
Supporting Information

Pesticides Applied to Grapes Grown in the EU

Agricultural production accounts for 105 million hectares of cropland within the European Union[1] – an area 25 times the size of Netherlands. The area under grapes is comparatively small at just 3.7 million ha.[2] Yet despite accounting for 3.5% of the total EU agricultural area, grapes receive around 15% of the synthetic pesticides (active substances) applied to major crops – a larger share than any other crop except cereals.[3]

The intensity, or dose, at which pesticides (active substances) are applied to grapes amounts to 21.4kgAS/ha.[4] Much of this figure relates to applications of inorganic sulphur – a relatively non-hazardous chemical used to protect against powdery mildew. But in addition to sulphur-based fungicidal treatments, grapes receive substantial doses of synthetic fungicides averaging at 4.7kgAS/ha: a higher dose of synthetic fungicides than is received by any other crop except potatoes. [5]

Major synthetic fungicides applied to grapes include substances known to present substantial hazards to human health. For example, the dithiocarbamates, a family of chemicals which accounts for 49% of the synthetic fungicides applied to grapes, includes the pesticides maneb and mancozeb – both EU classified carcinogens and endocrine disruptors. Other fungicides applied in smaller quantities, such as procymidone, iprodione, folpet and iprovalicarb also present recognised hazards to human health.



Source: The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)

[1] FAOSTAT, Food and Agriculture Organisation of the United Nations (2006)
[2] FAOSTAT, Food and Agriculture Organisation of the United Nations (2006)
[3] The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)
[4] The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)
[5] The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)

A Growing Problem: grape farmers are shifting towards synthetic fungicides

The cultivation of grapes is exceptional in being associated with substantial amounts of inorganic sulphur – a relatively non-hazardous chemical used to protect against powdery mildew. In 2003, 52,000 tonnes of sulphur were applied to EU vineyards accounting for roughly 75% of the total anti-fungal treatments applied to grapes.

However, over the last decade the use of inorganic sulphur in European grape production has declined substantially – falling by 39% since 1993.[6] This trend does not represent a move towards more sustainable pest management strategies. Instead, European grape farmers are abandoning inorganic sulphur in favour of hazardous synthetic fungicides. Between 1993 and 2003 the dose of synthetic fungicides applied to grapes increased by 22%.

In addition to using greater volumes of synthetic fungicides, European grape producers are also adopting new synthetic fungicide compounds never before applied to grapes grown in Europe. Morpholine fungicides (i.e. dimethomorph), strobilurine fungicides (i.e. azoxystrobin), anilide fungicides (i.e. fenhexamid), carbamate fungicides (i.e. iprovalicarb), and phenylpyrrole fungicides (i.e. fludioxonil) have all been incorporated into European grape production over the past 15 years.[7] Furthermore, the use of pyrimidine fungicides (i.e. cyprodinil, fenarimol, pyrimethanil) has increased by a factor of 30 over the same time period.

<u>New pesticides, new contamination</u>

Over one third of the total residues detected in PAN Europe's analysis of 40 bottles of wine purchased in Europe, relate to fungicides recently adopted by European grape producers. Prior to 1992 these pesticides did not contaminate European wines as they were not applied to grapes grown in Europe. A further third of residues identified relate to classes of fungicide whose use in grape production has escalated substantially over the past decade. The presence of these pesticides in conventional wines confirms the link between the escalating use of synthetic fungicides in European grape production and the changing nature of wine contamination. 94% of the pesticide residues detected relate to synthetic fungicides.

[6] The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)

[7] The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)

Pesticide Residues in Grapes Sold in the EU

Grapes rank among the most heavily contaminated items in the European food chain. Of the 24 different food items analysed under the annual EU coordinated food monitoring programmes of 2001-2005, grapes showed the 4th highest incidence of maximum residue limit exceedances, ranking worst among the 7 fruit items tested.[8] Grapes also showed the 4th highest level of overall contamination after pears, oranges and strawberries.

Of the 2,163 grapes samples assessed under the EU coordinated food monitoring programme of 2003, 57% tested positive for at least one pesticide.[9] An additional 5% of samples contained pesticides in excess of legal limits. A little over one third of grapes samples tested were pesticide free.

Among the most common residues detected were several synthetic fungicides: procymidone, a dicarboximide fungicide, was present in 22.41% of grape samples assessed, iprodione, an imidazole fungicide, was detected in 16.26% of grape samples assessed, and residues of maneb group pesticides, a family of dithiocarbamate fungicides were present in 14.33% of grape samples tested.

Some of the pesticides detected most often in grapes analysed under the European Community's coordinated food testing programme (2003)

Pesticide	**Percentage of grape samples contaminated**	**Carcinogen**	**Developmental or Reproductive Toxin**	**Endocrine Disruptor**	**Neurotoxin**
Procymidone	22.41	√ 1	√ 2	√ 3	
Chlorpyriphos	17.33				√ 4
Iprodione	16.26	√ 1			
Maneb	14.33	√ 1		√ 3	
Captan/ Folpet	5.03	√ 1			
Methamidophos	4.44				√ 4

KEY:
1) Classified as a carcinogen under the EU Directive on Dangerous Substances
2) Classified as a reprotoxin under the EU Directive on Dangerous Substances
3) Classified as an endocrine disruptor (category 1) under EU COM(1999)706
4) A cholinesterase inhibitor

Source: Community monitoring programme (2005)

[8] Annual EU-wide Pesticide Residues Monitoring Report – 2001-2005, European Commission (2007)
[9] Annual EU-wide Pesticide Residues Monitoring Report – 2003, European Commission (2005)

French Ministry of Agriculture re: transfer of pesticides into wine

In 2005 the French Ministry of Agriculture published a 14 year study incorporating data from French wine producers operating in all 13 wine producing regions in France.[10] 1,316 grape samples entering in the wine making process were assessed for the presence of pesticides. Once wine production had been completed, wines derived from the grape samples were then analysed for pesticides also.

The French study concluded that 30% of pesticide substances included within the analysis could be transferred into wines; identifying 15 pesticides 'systematically' detected in both grapes and the resultant wine samples. These 15 pesticides include seven synthetic fungicides linked with specific hazards to human health (see table below).

All wine producers included within the French study were known to follow 'Good Agricultural Practice' in producing grapes. Furthermore the substantial majority of grape samples used in preparing the wines did not contain pesticides at concentrations exceeding legal limits. Given that 5% of grape samples tested within the EU *do* exceed legal limits on pesticide concentrations, the French study represents something of a 'best case scenario'. Even so, significant levels of pesticides present in the grapes were nonetheless transferred to the wines.

The active substance with the highest rate of transfer was iprodione which was detected in 100% of wine samples made from grapes contaminated with the pesticide. Procymidone (93%), azoxystrobin (90%), iprovalicarb (86%) and pyrimethanil (85%) also showed a high presence among wine samples prepared from contaminated grapes.

Some of the 15 pesticides which the French Ministry of Agriculture reported being systematically transferred from grapes into wine

Pesticide	**Carcinogen**	**Developmental or Reproductive Toxin**	**Endocrine Disruptors**	**Rate of Transfer**
iprovalicarb	**Likely**[4]			86%
oxadixyl	**Possible**[5]			53%
azoxystrobin				90%
iprodione	√[1]			100%
procymidone	√[1]	√[2]	√[3]	93%
vinclozolin	**Possible**[5]			36%
pyrimethanil	**Possible**[5]			85%

KEY:
1) Classified as a carcinogen under the EU Directive on Dangerous Substances
2) Classified as a reprotoxin under the EU Directive on Dangerous Substances
3) Classified as an endocrine disruptor (category 1) under EU COM(1999)706
4) Listed as a 'likely' carcinogen under the US EPA (Pesticide Programs) Carcinogen List
5) Listed as a 'possible' carcinogen under the US EPA (Pesticide Programs) Carcinogen List

[10] Cugier et al. 'Plan de surveillance résidus en Viticulture (Campagnes viticoles 1990-2003)', Direction Générale de l'Alimentation, Ministère de l'Agriculture, de l'Alimentation, de la Pêche et de la Ruralité (2005)

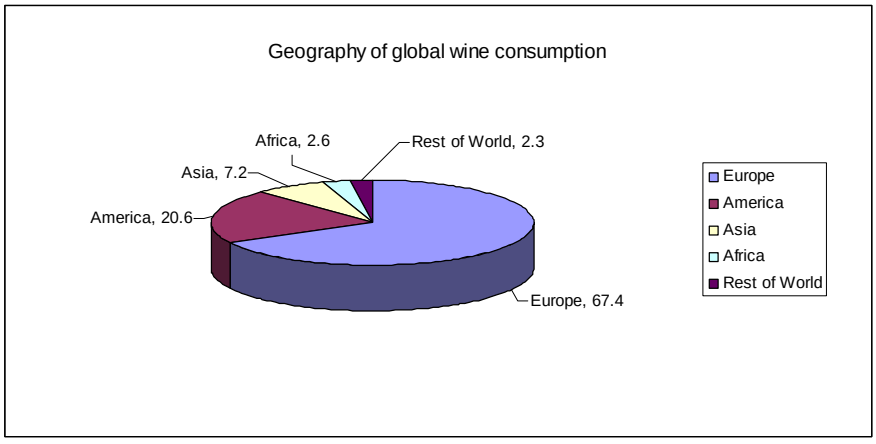
EU Dominance of Global Wine Production & Consumption

Over the past decade the EU has overtaken the US as the world's leading agricultural exporter with total food exports of around US$ 73 billion per year.[11] The growth of European agricultural exports has been achieved by emphasising lucrative products including wine, liquor and cheese rather than cheap commodities. Extra EU wine sales accounts for 11.6% of total EU agricultural exports.

The world of wine is dominated by Europe: a continent which produces and consumes over two thirds of global supply. Global wine production generates around 28 billion litres of wine each year – of which 68.6% is produced in Europe.[12] Italy, France and Spain are the world's leading wine producing countries accounting for over 50% of global production. Germany also ranks among the world's top 10 wine producers.

Wine consumption follows a similar pattern with Europe accounting for 67.4% of the global total.[13] France, Italy, Germany, Spain, UK, Romania and Portugal rank among the world's top 10 wine consuming countries, while the French drink more wine per head of population than any other country; averaging over 1 litre per week. Per capita Europeans drink five times more wine than people on any other continent.[14]

European trade in wine is also substantial. Italy, France, Spain are the world's major exporters selling around 64% of all wine traded internationally.[15] Germany and UK are the world's largest importers and are destinations for around one third of international wine sales. In 2006 extra EU wine exports generated €5.5 billion in revenues for the European Union.[16] Wine imports into the Community stood at €2.4 billion with Australia (35.9%), Chile (18.1%) and South Africa (15.7%) enjoying the largest shares to the EU import market. The EU trade balance for wine generated a surplus of €3.1 billion.



[11] 'Europe's New Herd Mentality', Newsweek, March 24 (2008)
[12] World Statistics, International Organisation of Vine and Wine, 2007
[13] World Statistics, International Organisation of Vine and Wine, 2007
[14] GEMS/WHO Regional Diets, Regional per Capita Con Regional per Capita Consumption Of Raw and Semi-processed Agricultural Commodities, Food Safety Department, World Health Organisation
[15] World Statistics, International Organisation of Vine and Wine, 2007
[16] European business: facts and figures, Eurostat, European Commission (2007)

Widespread contamination of the EU Food Chain

In October 2007 the European Commission published an analysis of over 62,000 food items purchased throughout the European Union, Norway, Iceland and Liechtenstein. Each food sample had been tested for the presence of pesticides. The results showed comprehensive contamination of the European food chain.

In total the food products tested contained 349 different pesticides.[17] 41.0% of food items contained pesticides. An addition 4.7% of food samples – almost one item in 20 – contained pesticides at concentrations in excess of legal limits.

Fresh fruit, vegetables and cereals accounted for 92% of the food samples assessed, within which one quarter of items contained two of more different pesticides. The most contaminated food sample showed traces of 23 different agrochemicals. Over 5% of fruits, vegetables and cereals contained five of more different pesticide residues. More than ten different pesticides were detected most frequently in sweet peppers and grapes.

Many of the most widespread EU food contaminants are among the most hazardous pesticides approved for use within the Community. This is particularly true of fungicides. Procymidone, for example, is an EU classified carcinogen, reprotoxin and endocrine disruptor, and is among the most common food contaminants in 19 EU member states. Iprodione, an EU classified carcinogen, is among the most common food contaminants in 14 EU member states. While maneb, an EU classified carcinogen and endocrine disruptor, is among the most common food contaminants in 22 EU member states.

Pesticides in EU Agriculture

The presence of high levels of pesticide residues in the European food chain is the direct result of reliance on pesticides in conventional agriculture. Every year over 220,000 tons of pesticides are released into the European environment: most are directly applied to food produce growing in the fields. [18]

Annual EU pesticide use includes 108,000 tonnes of fungicide, 84,000 tonnes of herbicide, 21,000 tonnes of insecticide, and 7,000 tonnes of growth regulators – amounting to roughly half a kilo of active substances for every man, woman and child living within the European Union.

[17] Annual EU-wide Pesticide Residues Monitoring Report – 2005, European Commission (2007)
[18] The use of plant protection products in the European Union: Data 1992-2003, European Commission (2007)

A list of hazardous pesticides commonly identified in food items purchased in the European Union

Pesticide	Carcinogen	Developmental or Reproductive Toxin	Endocrine Disruptor	Neurotoxin	Found most commonly in food samples tested from following countries
Maneb	√[1]		√[4]		BE, CZ, DK, DE, EE, EL, ES, FR, IE, CY, LT, LU, HU, NL, AT, PL, PT, SI, SK, FI, SE, UK
Procymidone	√[1]	√[3]	√[4]		BE, CZ, DK, DE, EE, EL, ES, FR, IE, IT, CY, LV, LT, HU, NL, AT, SI, SK, FI
Iprodione	√[1]				BE, DK, DE, EE, El, FR, IE, IT, MT, NL, AT, SI, SK, SE
Imazalil	**Likely**[5]	√[3]			BE, CZ, DK, EE, ES, LV, LT, LU, HU, MT, NL, PT, SK, FI, UK
Captan	√[1]				EE, EL, IE, LT, PL, PT, SE, UK
Deltamethrin			√[4]		DK, EE, ES, FR, IE, PT, SE, UK
Malathion				√[6]	BE, DK, DE, EL, ES, FR, IE, IT, CY, LT, NL, PT, SI, SK, FI, SE, UK

KEY:
1) Classified as a carcinogen under the EU Directive on Dangerous Substances
2) Classified as a mutagen under the EU Directive on Dangerous Substances
3) Classified as a reprotoxin under the EU Directive on Dangerous Substances
4) Classified as an endocrine disruptor (category 1) under EU COM(1999)706
5) Listed as a 'likely' carcinogen under the US EPA (Pesticide Programs) Carcinogen List
6) A cholinesterase inhibitor

All of the above chemicals are among the 28 pesticides most commonly found in EU food items.
Source: Annual EU-wide Pesticide Residues Monitoring Report – 2005, European Commission (2007)

Health Impacts on Vineyard Workers

Published scientific analysis suggests that those exposed to pesticides in grape production suffer a higher incidence of allergic rhinitis, respiratory problems, cancers, and chromosomal and nuclear abnormalities, as well as lower neurological capacities.

In 2001, trained psychologists conducted mental aptitude tests on 528 vineyard workers employed in Bordeaux.[19] On average the men had 22 years of direct exposure to pesticides – mostly via mixing and spraying in the vineyards. The psychologists also assessed 173 vineyard workers who reported only indirect exposure to pesticides through contact with treated leaves, and a control group of 216 agricultural workers who had never been exposed. Workers exposed to pesticides demonstrated significantly lower ability mental capacities (selective attention, working memory, information processing and abstract analysis). In two tests those directly exposed to pesticides were over three times more likely to score badly when compared to controls. While the control group gained the best results on all mental aptitude tests, those indirectly exposed to pesticides performed almost as poorly as those directly exposed.

Vineyard workers may also demonstrate an elevated prevalence of allergic rhinitis: a condition characterised by the inflammation of the lining of the eyes and nose, and associated with headaches, sore throats, permanent colds, a blocked stuffy nose and poor concentration. Researchers conducting a cross-sectional study of 120 grape farmers based in northern Crete found that vineyard workers were up to three times more likely to suffer with allergic rhinitis than the background population.[20] A further study conducted by US-based researchers showed a higher incidence of respiratory problems among 174 vineyard and orchard workers than compared with 115 controls.[21] Workers employed for more than 10 years had the highest prevalence of the most acute symptoms.

A 1998 study which assessed mortality rates among vineyard workers in 89 geographical locations in France found a significantly higher incidence of brain cancer among those exposed to pesticides compared with the French population.[22] A separate study by the same authors showed a positive correlation between the degree of exposure to vineyard pesticides among French agricultural workers, and the risk of bladder cancer.[23] While another French study involving assessments of white blood cells taken from vineyard workers both before and after the spraying season found a significantly elevated level of chromosomal and nuclear abnormalities following exposure to pesticides.[24]

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[19] Baldi et al. 'Neuropsychologic effects of long-term exposure to pesticides: results from the French Phytoner study', Environmental Health Perspectives, 109 (8): 839-844 (2001)
[20] Chatzi et al. 'Association of allergic rhinitis with pesticide use among grape farmers in Crete, Greece', Occupational and Environmental Medicine, 64: 417-421 (2007)
[21] Zuskin et al. 'Respiratory function in vineyard and orchard workers', American Journal of Industrial Medicine, 31(2): 250-5 (1997)
[22] Viel et al. 'Brain cancer mortality among French farmers: the vineyard hypothesis', Archives of Environmental Health, 53 (1): 65-70 (1998)
[23] Viel et al. 'Bladder cancer among French farmers: does exposure to pesticides in vineyards play a part?', Occupational and Environmental Medicide, 52: 587-592 (1995)
[24] Joksi et al. 'Cytogenetic monitoring of pesticide sprayers', Environmental Research, 75 (2): 113-118 (1997)