PAN Germany

Paraquat exposure and Parkinson's Disease

Numerous studies reveal possible links between exposure to the pesticide paraquat and the development of Parkinson's Disease

Pesticides are often extremely toxic. The consequences of its use are far-reaching and incalculable. Basic human needs —food, clothes, housing— can be satisfied without the use of pesticides. PAN Germany provides information on pesticide risks and campaigns for alternatives.

Fact Sheet 2003

Paraquat and the „Stop paraquat" campaign

The non selective herbicide paraquat - a pesticide that kills a broad range of weeds - is sold by Syngenta and other producers in more than 100 countries mainly under the brand name Gramoxone. It is extensively used on bananas, cocoa, coffee, cotton, palm oil, pineapple, rubber, and sugar cane, both on plantations and by small-scale farmers. Paraquat is highly acutely toxic, with no known antidote. Less than one teaspoon, if ingested, is fatal. It is also blamed for causing severe acute and long term health problems such as severe dermatitis, kidney failure, respiratory failure, rapid heart rate, second degree burns, skin cancer and Parkinson's disease.

Due to these facts paraquat is part of the Dirty Dozen List. PAN International launched the Dirty Dozen campaign in 1985 to target a list of extremely hazardous pesticides for banning or more strict controls, and to advocate their replacement with safer and more sustainable pest control methods. In order to accelerate the phase-out of paraquat, several non-governmental organisations (NGOs) from Asia, America and Europe (including PAN Germany) launched the "Stop paraquat" campaign in 2002. This campaign, which urges Syngenta to stop paraquat production, has already achieved some remarkable results, Malaysia banned paraquat in August 2002 – one of the first Asian countries to do so - and Chiquita decided to ban paraquat from all its banana plantations.

What is Parkinson's disease?

Parkinson's disease (PD) is a disorder of the central nervous system that effects more than four million people world-wide – and this is a cautious estimate (Austrian Parkinson Society 2000).

The average age of onset is in the mid-50s, though up to 10 percent of patients develop symptoms before the age of 40.

Although doctors do not know exactly what triggers the disease, they certainly do know that Parkinson's results in the degeneration of cells in a part of the brain called the *substancia nigra*. This region produces dopamine, a substance that allows people to move normally. People with PD have a shortage of dopamine. The hallmark symptoms are tremors, rigidity, slowness of movements and postural instability.

Causes of Parkinson's

A link between environmental causes and the outbreak of PD has been suggested for over 20 years now, especially since there is no longer any compelling proof that PD is hereditary. Numerous scientists therefore are of the view that environmental factors play an important role in the development of PD. A steady stream of studies from around the world have shown again and again "that a common thread among victims of PD is a history of exposure to insecticides and herbicides" (Montague 1999).

Early reports identified a consistent

Pestizid Aktions-Netzwerk e.V. (PAN Germany) • Nernstweg 32 • D-22765 Hamburg
Tel. +40-399 19 10-0 • Fax -390 75 20 • info@pan-germany.org • www.pan-germany.org

link between rural life or a history of farming in general, and the incidence of PD (e.g. Hertzmann et al. 1990). While still a developing area of research, a remarkably consistent pattern of association between PD and pesticide exposure has emerged in the medical literature. In a study in Canada in 1992, a population-based case control study of 130 persons with confirmed PD and 260 randomly selected age- and sex matched community controls aimed to determine whether agricultural work or the occupational use of pesticide chemicals was associated with an increased risk for PD. Their 'results support the hypothesis that the occupational use of herbicides is associated with an increased risk for PD (Semchuk et al. 1992). Other studies also confirmed this hypothesis by reporting a significant association between pesticide use and the development of PD (Hubble 1993; Seidler 1996).

Parkinson's disease and paraquat

The controversial non-selective herbicide paraquat, along with other pesticides, plays an important role in this context.

Studies on the link between PD and pesticides began in the early 1980s, when it was discovered that users of the heroin substitute MPTP, which is chemically similar to paraquat, developed PD.

In 1990, Hertzmann already found a significant association between PD development and paraquat exposure by comparing personal histories of 57 cases and 122 age matched controls (Hertzmann et al. 1990).

A case-control study in Taiwan from 1996 came to the conclusion that:

"the PD risk was greater among subjects who had used paraquat and other herbicides than those who had used herbicides other than paraquat" (Liou et al. 1997, p.1583).

Environmental factors, in particular the exposures to paraquat and other herbicides, may therefore 'play an important role in the development of PD in Taiwan' (ibid). Sommerfeld (2002) also revealed similar results in her article, by presenting research results from US scientists who suggest exposure to paraquat, maneb, rotenone and dieldrin may be linked to the development of PD. For this study, 20.000 farmers in Iowa and North Carolina – 55 of whom reported having PD – were surveyed in the mid-1990s about their health history and exposure to specific pesticides.

McCormack's research work revealed unquestionably that 'selective dopaminergic degeneration, one of the pathological hallmarks of PD, is also a characteristic of paraquat neurotoxity" (McCormack et al. 2002, p. 119).

Additional threats: synergism

Most scientists think it is unlikely that exposure to paraquat (or other pesticides) cause Parkinson's on it's own, but it probably does contribute to the development of PD. There is agreement that a combination of genetic susceptibility and environmental agents may be involved in the disease. Within this context more attention has to be directed to the problems caused by synergism. The exposure to a combination of pesticides has different health implications from exposure to an individual pesticide or as Prof. Cory-Slechta points out: 'It's a huge problem to start thinking about a nearly infinite array of mixtures of chemicals, instead of the risk that a single chemical might pose' (Lazaroff 2001). The most recent studies about synergism showed that combined exposure to paraquat and the widely used fungicide maneb resulted in potentiated effects. This obvious synergism supports the hypothesis of a multiple-hit environmental contribution to PD (Thiruchelvam et al. 2000; Thiruchelvam et al. 2000a; Thiruchelvam et al. 2002).

Conclusion

Although it is still not comprehensively explained what effect paraquat exposure has on the development of PD, the trend appears to be toward illuminating rather than disproving this link. But despite numerous indications for this fatal link it needs to be pointed out that there are also voices that deny any link between pesticide exposure in general and the development of PD (BgVV 2001). However the facts presented in this paper should give an adequate justification for a phase- out of paraquat.

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For more information on the „Stop paraquat" campaign and on paraquat see the homepages of the organizations that support the „Stop paraquat" campaign:

Erklärung von Bern (Schweiz); www.evb.ch; Banafair e.V. (Deutschland); www.banafair.de; Bio Suisse (Schweiz); www.bio-suisse.ch; Central American Institute for Studies on Toxic Substances (IRET); Costa Rica; Fédération genevoise de coopération (Schweiz); www.fgc.ch; Foro Emaus (Costa Rica); www.foroemaus.org; Swedish Society for Nature Conservation; www.snf.se; Pesticide Action Network Asia Pacific; www.panap.net; Pesticide Action Network Europe; www.pan-europe.net; Pesticide Action Network Germany; www.pan-germany.org; Pesticide Action Network Latin America (RAP-AL); www.rap-al.com; Pesticide Action Network North America; www.panna.org; Pesticide Action Network UK; www.pan-uk.org; Red de Accion sobre Plaguicidas y Alternativas en México (RAPAM)