International POPs Elimination Network

ENDOSULFAN IN WEST AFRICA: Adverse Effects, its Banning, and Alternatives

Pesticide Action Network (PAN) / International POPs Elimination Network (IPEN)

POPs Pesticides Working Group

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Preamble

The Sahelian Pesticides Committee (CSP) has decided to withdraw the authorization of all phytosanitary preparations containing endosulfan in the member states of the Comité Permanent Inter-Etats de Lutte Contre la Sécheresse dans le Sahel (CILSS or Permanent Interstate Committee for Drought Control in the Sahel). The CILSS member countries are Burkina Faso, Cape Verde, Chad, Gambia, Guinea Bissau, Mali, Mauritania, Niger, and Senegal. This report is primarily about the CILSS countries, but also includes information from Bénin and Togo. Bénin also banned endosulfan in 2008, Togo has not.

Many problems related to the use of endosulfan have been reported in the CILSS countries, and Bénin and Togo, justifying the prohibition of this pesticide.

It is important that steps be taken at the national level to enable the effective implementation of this ban within each country. Additionally, the CILSS countries must contribute to the implementation of international agreements to which they are signatories by supporting all initiatives of these agreements, including the review process for listing endosulfan under Article 3 of the Stockholm Convention on Persistent Organic Pollutants (POPs). For this to occur, our States' decision makers need to be aware of the problems of endosulfan in general and risks that this product pose to human health and the environment of our countries. It is in this context, together with assisting West African States to contribute to the POPs Review Committee process, that the Pesticide Action Network / International POPs Elimination Network (PAN/IPEN) Working Group on Pesticides decided to undertake a study of endosulfan in West Africa, including the reasons for the banning of endosulfan in CILSS, and alternatives to its use. It is hoped this information will also assist the listing of endosulfan in Annex III of the Rotterdam Convention on Prior Informed Consent.

This document is based largely on a 2008 report by Dr Demba Farba Mbaye, plant pathologist specializing in pesticides management. It also includes part of a 2009 report by the Bénin-based Group of Action for the Promotion and Protection of Flora and Fauna (GAPROFFA): "Perceptions of Producers on the Risks Related to the Use of Endosulfan in Bénin and Togo". Both reports were prepared for PAN Africa and IPEN. Additional material on organic cotton growing was provided by PAN UK and PAN Germany. It has been edited by Dr Meriel Watts of PAN Aotearoa New Zealand.

Executive Summary

Endosulfan is a highly toxic insecticide banned in 60 countries including, in West Africa, the 9 countries of the CILSS and Benin. It is still in use in Togo. It is under consideration by the POPs Review Committee for inclusion in the Stockholm Convention on Persistent Organic Pollutants, and by the Chemical Review Committee for inclusion in Annex III of the Rotterdam Convention on Prior Informed Consent.

Endosulfan is neurotoxin causing convulsions and death. It is an endocrine disruptor, a reproductive toxicant, and there is increasing evidence that it is genotoxic. Epidemiological studies have provided evidence of birth defects, intellectual and behavioural impairment, and disrupted sexual development.

Studies in West Africa have reported numerous poisonings and deaths amongst cotton farmers using endosulfan. The prevailing conditions of use, including inability to use suitable protective equipment, mean that endosulfan cannot be used safely in these countries. Environmental contamination and wildlife poisonings have also been reported. Endosulfan was registered only for use on cotton but there was evidence of its use also on vegetables. There is also concern about obsolete stockpiles of endosulfan.

There are many effective alternatives to endosulfan ranging from other chemicals, to biological controls, to IPM and organic production systems. Additionally, an analysis of production costs shows that endosulfan was placing a huge financial burden on growers, one that can be reduced by substitution of safer alternatives.

Constraints to the effective implementation of the ban on endosulfan in the West African countries include a lack of national regulatory measures, a lack of control and compliance systems, a lack of awareness of the problems caused by endosulfan, and difficulty in disseminating information about alternative methods because of inadequate extension and training services.

A number of recommendations are provided, including that national authorities:

- take regulatory measures to enforce the ban, put in place operational control and inspection mechanisms, strengthen monitoring capacities, and enforce the FAO guidelines and advice on the disposal and prevention of inventory accumulation;
- build awareness across society of endosulfan’s hazards and the ban on its use;
- expand research, and assist the dissemination of information on sound sustainable alternatives to endosulfan; and
- involve civil society organisations in the implementation of these measures.

Acronyms and Abbreviations

AND: Designated National Authority
ANCE-Togo: National Alliance of Consumers and Environment Togo (ANCE TOGO)
PMRA: Regulatory Agency of Health Pest Control Canada
ATSDR: Agency of Toxic Substances and Disease Registry
ECOWAS: Economic Community of West African States
CERES-Locustox: Regional Research Centre in Ecotoxicology and Environmental Safety (which became a foundation)
CILSS: Permanent Inter-State Committee for Drought Control in the Sahel
CMA/AOC: Conference of Ministers of Agriculture of West and Central Africa
CNGP: National Committee for Pesticides Management
CSAO: Sahel and West Africa Club
CSP: Sahelian Pesticide Committee
DPV: Department of Plant Protection
ENDA: Environment and National Development in Africa
FAO: Food and Agriculture Organization of United Nations
GAPROFFA Group of Action for the Promotion and Protection of Flora and Fauna
IARC: International Agency for Research on Cancer
IGR: Insect growth regulator
IPCS: International Programme on Chemical Safety
ISRA: Senegalese Institute for Agricultural Research
IITA: International Institute of Tropical Agriculture
LUBILOSA: Biological Control of Locusts and Grasshoppers
OBEPAB Organisation Béninoise pour la Promotion de l'Agriculture Biologique
PAN: Pesticide Action Network
PIC: Prior Informed Consent (Rotterdam Convention)
PR-PRAO: West African Pyrethroid Resistance Action Network
POPRC: Persistent Organic Pollutants Review Committee of the Stockholm Convention
POPs: Persistent Organic Pollutants
US EPA: United State of America Environmental Protection Agency
UNEP: United Nations Environment Programme
SENCHIM: Senegalese Chemical Group (subsidiary of Industries Chimiques Du Senegal)
SODEFITEX: Senegalese Company for the Development of Textile Fibres
WACIP: West African Cotton Improvement Programme
WHO/OMS: World Health Organization

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Introduction

Endosulfan is an organochlorine insecticide used against aphids, thrips, beetles, larvae that feed on leaf tissue, mites, borers, grey worms, cotton caterpillar, white flies and leafhoppers. In CILSS countries, endosulfan is mainly used on cotton. Illicit uses in vegetable growing have been reported in several countries of the sub-region. World production of endosulfan is estimated at 10,000 metric tonnes (UNEP/POPS/POPRC.3/5, 2007).

Endosulfan has been banned or severely restricted in 60 countries[1] because of its high toxicity to humans and animals and its persistence in the environment. It is for these reasons the European Union (EU) has proposed the inclusion of endosulfan in Article 3 of the Stockholm Convention on Persistent Organic Pollutants.

Because of its serious impact on health and the environment, endosulfan was voluntarily withdrawn from cotton production in West Africa in the 1980s and replaced by pyrethroids (Glin et al, 2006). But in the late 1990s, the West African Pyrethroid Resistance Action Network (PR-PRAO), a regional project on prevention and management of the cotton bollworm *Helicoverpa armigera* resistance to pyrethroids, recommended the reintroduction of endosulfan in the region (Glin et al, 2006), because of developing resistance to pyrethroids. Thus, endosulfan was reintroduced for cotton cultivation in 1998-1999 in Mali and Bénin, and in 1999-2000 in Senegal, Cameroun and Burkina Faso.

Since its reintroduction in the region, severe health problems and environmental concerns associated with the use of endosulfan have been observed. It is in this context that the CILSS banned the use of endosulfan in its member states. Bénin also banned it in 2008.

Although the withdrawal of the authorization of endosulfan formulations by the Sahelian Pesticides Committee (CSP) means that it is no longer allowed in CILSS countries, actions must be taken at the state level to enable the effective implementation of this ban. In order to take these actions, the CILSS member states' decision makers need to know the reasons which led the experts of the Sahelian Pesticides Committee to ban endosulfan.

This study therefore:

- reviews the toxicity and environmental characteristics of endosulfan;
- reviews problems associated with endosulfan in CILSS, Bénin, Togo;
- reviews regulatory aspects of the banning process;
- reviews the existing alternatives; and
- assess the potential socioeconomic impacts of the ban.

[1] Austria, Bahrain, Belgium, Belize, Benin, Bulgaria, Burkina Faso, Cambodia, Cap-Vert, Colombia, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Gambia, Germany, Greece, Guinea Bissau, Hungary, Indonesia, Ireland, Italy, Jordan, Kuwait, Latvia, Lithuania, Luxembourg, Malaysia, Mali, Malta, Mauritania, Mauritius, Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Poland, Portugal, Qatar, Romania, Saudi Arabia, Senegal, Singapore, Slovakia, Slovenia, Spain, Sri Lanka, St Lucia, Sweden, Syria, Tchad, the United Arab Emirates, United Kingdom.

I- Endosulfan

Endosulfan is used as a broad-spectrum, non-systemic poison to control a wide variety of insects and mites. It is a chlorinated hydrocarbon belonging to the cyclodiene sub-group of the organochlorine family of pesticides, and is composed of stereoisomers alpha and beta (α and β), in the proportions α/β = 70/30. The chemical name is 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,3,4-benzodioxathiepin-3-oxide) and the molecular formula is $C_9H_6Cl_60_3S$. It was developed in the mid-1950s.

Endosulfan is sold under a variety of trade names, including Caiman, Callisulfan, Cotofan, Endocoton, Mistral, Phaser, Plexus, Rocky, Thiodan, and Thiofanex.

1-1 Toxicity of endosulfan

Endosulfan is particularly neurotoxic for both insects and mammals, including humans. It was classified by the United States Environmental Protection Agency (US EPA) as Category Ib: "highly toxic", based on an LD_{50} of 30 mg/kg for rats (US EPA, 2002), while the World Health organization (WHO) put it in Class II "moderately hazardous", based on an LD_{50} of 80 mg/kg for rats (WHO, 2005). It is an antagonist of the chain of gamma-aminobutyric acid (GABA) receptors in the brain, reducing the uptake of chloride ions by neurons, which results in uncontrolled excitation (UNEP/FAO, 2007). It also inhibits calcium and magnesium uptake, and the enzyme ATPase. Both enzymes are involved in the transfer of nerve impulses. Among the most characteristic symptoms of poisoning by endosulfan are hyperactivity, tremors, convulsions, lack of coordination, dizziness, difficulty breathing, nausea and vomiting, diarrhoea, and in severe cases, impaired consciousness (ATSDR, 2000). Doses as low as 35 mg/kg have caused human death (IPCS, 2000). Chronic exposure to endosulfan can cause rashes and skin irritation among agricultural workers (US EPA, 2002).

A number of studies demonstrate the high toxicity of endosulfan and formulations of endosulfan to aquatic organisms, including invertebrates (US EPA, 2002). It has also been established that endosulfan affects reproduction and the assessments of many agencies and scientific studies designate it as an endocrine disruptor. The effects observed include harm to the development of amphibians, reduced cortisol secretion in fish, disruption of the development of the genital tract and hormones in birds, testicular atrophy and reduced sperm production in mammals exposed to endosulfan (UNEP/POPS/POPRC.3/5, 2007).

Endocrine disruption, reproduction and development

Many *in vitro* studies have demonstrated the oestrogenic activity of endosulfan and have concluded that endosulfan is an endocrine disruptor (Colborn et al, 1997; ATSDR, 2000; US EPA, 2002) causing, amongst other things the growth of human breast cancer cells (Soto et al, 1994). A recent *in vivo* study on rats found that endosulfan modulated oestrogen sensitive genes, causing statistically significant alterations in the levels of hormone receptors and mRNA, at dose levels 100 times smaller than the 'No Observed Effects Level' (NOEL) (Varayoud et al, 2008). Levels of luteinizing hormone, progesterone and oestradiol were found to be higher, and testosterone lower, in children in the village of Kasargod in Kerala, India, who had been exposed to endosulfan during the 20 years of aerial spraying of cashew nut plantations (NIOH, 2003).

Countless studies on animals have also shown toxic effects on development and reproduction, especially among males. It is not yet known conclusively if endosulfan is teratogenic (causing birth defects) in humans, although significant teratogenic effects have been observed in laboratory rats (Singh et al, 2007), as well as congenital malformations in female children in Kerala (NIOH, 2003).

Several studies have shown that endosulfan can affect development in humans. Indeed, an epidemiological study in Kasargod was able to establish a relationship between exposure to endosulfan and delayed sexual maturity among male children (Saiyed et al, 2003). One hundred and seventeen boys, aged between 10 and 19 years, were compared with a control group of 90 children who had never been exposed to the pesticide. The average serum levels of endosulfan were 5.5 times higher in the exposed group, and the sexual maturity index was inversely proportional to exposure to endosulfan. The study's authors concluded that exposure of male children to endosulfan may delay sexual maturity and inhibit the synthesis of sex hormones.

Increased birth defects of the male reproductive system, such as cryptorchidism, have also been linked to exposure to endosulfan (Damgaard et al, 2006).

A case study in California, USA, showed that women living near fields treated with endosulfan and dicofol, another organochlorine pesticide, during the first eight weeks of pregnancy were more likely to give birth to children with autism (Roberts et al, 2007). A significant level of neurodevelopmental effects was also observed in the endosulfan-exposed children of Kasargod, including intellectual disability, reduced IQ, and arrogant and aggressive behaviour (NIOH, 2003).

Endosulfan and cancer

Endosulfan has not been explicitly classified as carcinogenic by the US EPA or IARC, in part because there were no epidemiological studies which specifically link exposure to endosulfan and cancer in humans. However, numerous *in vitro* tests have shown that the substance can cause a proliferation of human breast cancer cells (e.g. Grunfeld et al, 2004), and a variety of genotoxic and mutagenic effects such as DNA damage (e.g. Jamil et al, 2004). Both the Office of Environmental Health Hazard Assessment and the Scientific Panel for California's Toxic Air Contaminants Program (USA) concluded that endosulfan is likely to be genotoxic (OEHHA, 2008; SRP, 2008). The ATSDR (2000) concluded "genotoxicity studies of endosulfan have provided evidence that this compound is mutagenic and clastogenic, and that it induces effects on cell cycle kinetics in two different mammalian species". The evidence of carcinogenicity of endosulfan in animals is still subject to discussion (ATSDR, 2000).

1-2 Environmental fate of endosulfan

Persistence

Based on laboratory studies, field studies, modelling, field monitoring and published papers, the US EPA concluded that endosulfan is a highly persistent chemical that can remain in the environment for a very long period, especially in acidic environment (US EPA, 2002).

Endosulfan is oxidized in plants and soils to form mainly endosulfan sulfate and endosulfan diol (Goebel et al, 1982). The formation of endosulfan sulfate is due mainly to the action of micro-organisms, while endosulfan diol is the main product of hydrolysis (UNEP/POPS/POPRC.3/5, 2007). Microbiological mineralization is generally slow. The US EPA (2007) identified the aerobic soil half life (DT_{50}) for the total endosulfan (α + β isomers + endosulfan sulphate) as 1336 days; and the US State of California provides estimates of up to 2162 days for combined residues (CDPR, 2008). Dissipation under field conditions also varies largely; the European Union assessment reported, for the temperate regions, field DT_{50}s ranging from 7.4 to 92 days for the α + β isomers. The field DT50 for total endosulfan is likely to be considerably higher given that the EU laboratory value for the sulphate is 3 times higher than those of the α + β isomers (UNEP/POPS/POPRC.3/INF/9, 2007). According to the criteria for persistence set by the Stockholm Convention, of a DT^{50} greater than 183 days, endosulfan is persistent in soils, especially when taken as the sum of the isomers and the sulphate.

The α and β isomers and endosulfan sulfate, are of low solubility in water, but are persistent, with half-lives varying from 35 to 187 days under anaerobic conditions (ATSDR, 2000) – the Stockholm Convention criteria for persistence in water is > 2 months.

Vapour pressure values of the α and β isomers, the calculated Henry's Law constant (H), and the available monitoring data, all confirm that endosulfan is semi-volatile, with the volatility and the partitioning or interchange between air and water ensuring that it can be transported in the atmosphere over long distances.

Endosulfan is mobile in the environment due to its volatility. Significant amounts of the pesticide volatilize from soil or the surface of leaves, especially immediately after application – field studies have shown an 89% lose over 48 hours from cotton foliage at 40^0C (UNEP/POPS/POPRC.3/INF/9, 2007). The high water/air partition coefficients favour subsequent deposit of volatilised endosulfan on lakes. Endosulfan has been detected in samples of air, water, snow and biota in remote places like the Arctic, as a result of long-range atmospheric transport (PMRA, 2007).

The persistence of endosulfan in the environment causes concern about the post-application exposure of workers returning to the treated sites to perform agricultural tasks that result in contact with the foliage (such as pruning, thinning, harvesting or detection of harmful organisms). A short to intermediary period of post-application exposure is possible (1 day to 6 months). The post-application risk is managed by determining the safety deadline for specific tasks. Pesticide residues dissipate or degrade over time, and the safety deadline corresponds with the required time for the return to the treated places to be associated with acceptable exposure levels. According to the assessment made by the Pest Management Regulatory Agency (PMRA), the safety deadlines for endosulfan are generally long, and compliance may be unrealistic for producers, even with the minimum application rate (PMRA, 2007).

Bioconcentration

Endosulfan has a clear potential for bioaccumulation in both aquatic and terrestrial ecosystems. The octanol-water partitioning coefficients (log K_{ow}) are respectively 4.74, 4.79 and 3.77 for the α and β isomers and endosulfan sulphate, indicating a high potential for bioaccumulation in aquatic biota. There is also lot of data on the bioconcentration of endosulfan in various species of fish and freshwater invertebrates. The estimated bioconcentration factors (BCF) vary widely, and they range from 1.97 to 11,583 for aquatic organisms (although the US EPA, 2000 re-evaluated the last figure to 5,670). A trophic biomagnification factor >1 was calculated for the Southern Beaufort Sea and Amundsen Gulf food webs including marine mammals (Mackay & Arnold, 2005).

Endosulfan has even higher octanol-air partitioning coefficients (Log K_{oa} = 10.29, 10.29, 5.8) meaning that bioaccumulation is greater in terrestrial animals than aquatic life (Kelly & Gobas, 2003). It has also been found to bioaccumulate in plant foliage (Landers et al, 2008).

II - Problems with endosulfan in West Africa

2-1 Impacts on human health

CILSS countries

Surveys conducted among 100 producers of the cotton growing area of Gourma (Burkina Faso) revealed that people applying pesticides suffered numerous adverse effects, immediately or a few days later. The most frequent symptoms were severe headaches (affecting 92% of respondents), followed by dizziness (83%), hand tremors (54%), nausea or vomiting (21%), blurred vision (21%), excessive sweating (13%), staggering (8%), and excessive salivation (8%). Most of these symptoms (46%) occurred a few hours to a few days after pesticide use. Some cases, however (13%) occurred during the actual application and these were the most serious incidents. Although surveys were not able to definitively identify the pesticides responsible for each symptom, it was clear that endosulfan, used by all cotton farmers in the area, was involved (Glin et al, 2006).

A survey in Mali in 2001, carried out by PAN Africa in 21 villages of the regions of Kita, Fana and Koutiala, found 73 pesticide poisoning cases and endosulfan was the main culprit (Glin & al, 2006).

A series of surveys carried out by PAN Africa in 2003-2004 in Senegal, mainly in the region of Velingara (cotton growing area per excellence), identified endosulfan as the cause of 31.2 to 39.9% of the 162 poisoning cases, including 20 deaths. Most of the cases (73.2%) occurred during endosulfan application (Glin & al, 2006).

Bénin and Togo

In Bénin, 37 people (producers and others) died between May and September 1999, while 36 others suffered severe poisonings from Callisulfan (endosulfan 350 g) in the Borgou department, according to the Regional Action Centre for Borgou Rural Development (Ton et al, 2000). These poisonings were either direct (while using endosulfan, mainly while treating cotton plants) or indirect (after consumption of contaminated food, mainly vegetables). In northern Bénin there were 100 cases of endosulfan poisoning with 20 deaths (PAN UK, 2003). Other sources in Bénin revealed 347 poisonings and 53 deaths in a single year (PAN UK, 2001; PAN Africa, 2002b; OBEPAB, 2003).

A recent study in the Tchaourou district in the centre of Bénin found that, between May 2007 and July 2008, 162 people had been admitted to hospitals and health centres with pesticide poisoning. Twelve people died. Endosulfan was incriminated in the poisonings (Assogba, 2009).

Studies conducted by ANCE-Togo in 2003, in Togo, indicated that more than 500 poisoning cases related to the use of endosulfan were recorded each year by the Public Hospital Toxicology Division of Lome-Tokoin (Kodjo, 2007).

In 2008, the Bénin-based Group of Action for the Promotion of Fauna and Flora (GAPROFFA) undertook a survey of 130 cotton producers, 50 in northern Bénin (Kandi), and 80 in northern Togo (Oti). Oti is known for cotton producing with intensive use of endosulfan. Kandi is important for biological management of cotton, as well as for the intensive use of endosulfan in conventional cotton growing. However of the producers interviewed in both countries, 60% in Bénin and 61% in Togo used endosulfan, the rest using biopesticides. Burning and irritation of the skin were the most frequently reported health effects, along with nausea and vomiting. Other effects reported included agitation, dizziness, tiredness, memory loss, loss of consciousness, respiratory problems, stomachache, with long term vision and sexual problems.

Inquiries carried out by OBEPAB in Dridji (Benin) on producers' perception about the effects of chemical pesticides on human and animal health and environment revealed that 67% of farmers recognized suffering from itches, burns, diarrhoea, miscarriage, food poisoning, as a result of exposure to pesticides (OBEPAB 2007a).

In northern and central Bénin community health centres in the cotton producing areas reported dermatoses, headaches, dizziness, and eye problems (Loumedjinon 2002; Fanou et al in press).

Other poisonings have resulted from the common practice of storing endosulfan in the house: in one case that occurred during the GAPROFFA survey, an old cotton producer confused the endosulfan bottle with milk stored in the same type of bottle. Without paying attention, he poured it out to use. He died before reaching the hospital. The OBEPAB survey revealed that chemical pesticides are sometimes used by farmers for treating human health problems like abscess and headlice (OBEPAB 2007b).

The GAPROFFA survey also identified that 95% of producers in Bénin and 99% in Togo were aware of the harmful effects of endosulfan, and 86% and 73% respectively wish to use biopesticides that do not have a harmful effect on people or the environment.

2-2 Conditions of use problems

The climatic conditions, particularly high temperatures, make the wearing of protective clothing and equipment a painful experience. The endosulfan application is often done after midday, the hottest time of the day. The cost is also a disincentive. Many producers eat, drink, or smoke without appropriate hand washing (Loumedjinon 2002). All though some people tend to blame the producer and householder for failure to adhere to first-world safety protocols, this is to ignore the conditions of use, which the people in these countries are not able to easily change. The majority of producers do not have formal education (90% in Togo and 58% in Benin). This is an important factor in understanding the risks related to the use of endosulfan, and many producers did not even understand the need for protective clothing. The also have problems reading instructions on the label.

The poverty-derived lack of first-world storage and washing facilities, and education and training, together with the high cost and climatic inadequacy of personal protective equipment, means that highly hazardous pesticides such as endosulfan are inappropriate for such situations, and it is their availability that is the *real* problem. The following study carried out in Gambia illustrates some of these problems, and the exposure to endosulfan that frequently results.

CILSS countries

A survey of cotton farmers in the Central and Upper River Divisions of Gambia found a low level of awareness of pesticide toxicity, very low literacy, leaking application equipment, and a failure to wear protective clothing (Kuye et al, 2007). The study revealed that endosulfan is frequently sprayed on cotton plants by the farmers, in this case using battery-operated, handheld rotary disc sprayers. Sixty-five percent of the sprayers spilled, splashed, dripped, or leaked when used.

All of the applicators reported having been trained on the safe handling of pesticides by the Agricultural Pesticide Management Unit of the Department of State of Agriculture and extension workers employed by the Gambia Cotton Company, but no applicator used any personal protective equipment, and all were inadequately dressed. Fifty percent sprayed in short-sleeved shirts, 30% in short pants, 60% wore sandals, 20% wore sneakers, 10% wore plastic slippers (flip-flops), and 10% resorted to spraying barefoot toward the end of the study because it rained. Sixty percent sprayed wearing woolly hats and 40% sprayed bare-headed. Seventy percent of the applicators reported pesticide spills during handling, mixing, and loading and 60% reported pesticide spills during application. The parts of the applicators' body that were mostly contaminated were the hands (90% during mixing and loading; 80% during application) and feet (70% during mixing and loading; 60% during application).

Laboratory analysis of the mixed formulation showed a wide range in the concentration of the pesticide solution among the farmer/pesticide applicators and dermal patch samples showed very high residues of endosulfan analytes on their body surfaces.

Bénin and Togo

In addition to inadequate storage facilities referred to in the previous section, the GAPROFFA survey also identified problems with the conditions under which endosulfan is being used. Only 23% of producers wear 'proper' protective devices in Bénin, but far fewer - just 2% - wear it in Togo. The description of 'proper protective clothing' is "suitable gloves, masks, scarf, glasses, clothing", but this falls well below the standards required in countries such as the USA and Australia which also use endosulfan on cotton. Other studies have found that in some areas, variously, only 9% of farmers wear protective clothing (shirt and trousers) and 22% carry masks and gloves (Adigoun, 2002). Studies carried out by OBEPAB in Zou department (Bénin) indicated that farmers have difficulty accessing proper protective clothing, mainly because of its unavailability and cost, and so do not wear it (OBEPAB 2008).

2-3 Environmental pollution

A small number of studies on the fate of endosulfan in soils, air and plants have been conducted in West African countries.

CILSS Countries

A study in Burkina Faso by the University of Ouagadougou showed that endosulfan could pose a risk to water resources if rain followed within two weeks of its application on a soil poor in organic matter (Sawadogo et al, 2006). Elevated levels of endosulfan in soils during the wet season pose a serious risk of contamination of water resources, because of both high runoff and seepage. In dry periods, the level of endosulfan residues declines, but residues persist all the same.

In a study in Côte d'Ivoire on the pollution of water wells by agricultural pesticides endosulfan was detected in 85% of all contaminated wells at rates exceeding the standards recommended for drinking water, of 0.1 ug/l. The maximum concentrations measured were 25.28 ug/l for α endosulfan, and 13.74 ug/l for the β isomer. The average residue levels in all contaminated water wells were 3.21 ug/l for α and 2.18 ug/l for β endosulfan (Traoré et al, 2006).

In Senegal, a study on POPs contamination of groundwater in the Niayes zone in Dakar where vegetable production occurs, found endosulfan residues in 7 samples out of 38, with concentrations up to more than 100 ug/l (Cissé et al, 2006).

There have been incidents of high fish mortality related to endosulfan. In 1995, after aerial spraying of endosulfan on tomato fields at Dagan in the Senegal River valley, fish died along several kilometres of the river's length (Glin et al, 2006).

Bénin and Togo

A study on the impacts of pesticides used in Bénin was undertaken in the Pendjari reserve and the biosphere reserve of the border region of “W”, which covers more than one million hectares in Bénin and Burkina Faso, and takes its name from the double bend of the Niger river. It found endosulfan in almost all water samples, 23-460 ng/l in the W reserve and 46-430 ng/l in Pendjari reserve (Soclo et al, 2003).
Another study carried out by OBEPAB in cotton producing areas of Central Bénin found alpha endosulfan residues in aquatic animal species in the rivers of Dridji, including *Clarias gariepinus* (fish), *Cardisoma armatum* (crab), *Bufo regularis* (toad) and *Xenopus muelleri* (frog), at levels as high as 75 ng/g (Glin & al, 2006).

The GAPROFFA survey found that more than half of the producers in Bénin (57%) and Togo (66%) think that endosulfan has a negative effect on soil fertility. Other environmental effects observed by the producers included death of worms, beneficial insects, birds.

2-4 Illicit traffic and use of endosulfan in vegetable growing

The use of pesticides in vegetable farming in West Africa is increasing. Many products are being used without adequate controls or application procedures.

CILSS countries

Two organisations in charge of plant protection, the International Centre for Soil Fertility and Agricultural Development and the Association of Private Irrigation Professionals and Related Activities, conducted a study on the use of pesticides in food preservation and urban and peri-urban vegetable farming in Burkina Faso (Bassole & Ouédraogo, 2007). The study found that more than 60% of pesticides used in vegetable farming are not suitable. Most of them, including endosulfan, are intended for use on cotton or grasshopper control (Bassole & Ouédraogo, 2007).

A socio-economic study of the use of pesticides in Senegal (Sow et al, 2004) revealed that since the early 1990s, risks from the use of pesticides in vegetable farming has tended to increase, and represents 50% of the total risk incurred by people and livestock from oral exposure to pesticides.

The use on vegetable crops also causes elevated risks to the aquatic environment: the degree of exposure to pesticides is 2.5 times higher from their use on gardening crops than in any other user sector.

Twelve pesticides are identified as particularly toxic: carbofuran, endosulfan, fenitrothion, methamidophos, chlorpyrifos, dimethoate, monocrotophos, lindane, deltamethrin, ethoprophos, methomyl, and thiram. Among these 12 highly toxic pesticides, six have already contributed to the mortality of people, birds and livestock in Senegal: carbofuran, endosulfan, monocrotophos, fenitrothion, lindane and thiram (Sow et al, 2004).

Bénin and Togo

A survey conducted by PAN Togo revealed the use of pesticides intended for cotton, including endosulfan, in vegetable farming at Davie, a town in the south of Togo (PAN Togo, 2005).

The GAPROFFA survey of Bénin and Togo also identified illegal use on cattle for skin parasites, and for fishing.

An OBEPAB survey found that cotton pesticides, including endosulfan, are used to treat and store foods crops like beans, maize, and vegetables (Fanou et al in press).

2-5 Foreseeable problems of obsolete stockpiles

Obsolete pesticides generally consist of pesticides abandoned after campaigns against plant pests or products prohibited for use for public health and environmental reasons. FAO has produced a series of guidelines and advice on the disposal and prevention of obsolete stocks accumulation that should be implemented.

CILSS countries

There are no reliable statistics on stocks of endosulfan in CILSS countries. If adequate measures are not taken, endosulfan will add to the obsolete pesticides problem in CILSS countries. Some agropharmaceutical companies, State and private services continue to hold large stockpiles of endosulfan. For example, SENCHIM, a pesticide formulations firm in Senegal, had at least 34 tonnes of endosulfan in its warehouses in late 2007(see Table 2).

It is important to know accurately the existing stocks in order to prevent management problems, including illegal use, after the end of the period of authorization for its use, December 31st 2008.

Table 1: SENCHIM's stock of endosulfan in Senegal

Year	Quantity (kg)
2005	24,084.34
2006	17,025.00
2007	33,917.90

Source: SENCHIM technical direction, 2008

Bénin and Togo

Bénin still had 576,000 litres stock of endosulfan in 2008. Unfortunately, it was recommended to use up this endosulfan on the cotton before replacing it with another product. The replacement that has been recommended is "THIAN 175-0.TEQ" (BENINHUZU: Cotonou, February 6th 2008), which contains the active ingredients flubendiamide and spirotetramat.

Bénin has further problems with implementing the ban on endosulfan: the GAPROFFA survey reported that, despite the prohibition by the Council of Ministers, the approved importing companies last year increased their stocks of endosulfan by 406,000 litres in addition to the residual stocks referred to above. The cotton sector is well organised, but the implementation of the ban is constrained by weak control systems and inspection of the importation and distribution of pesticides.

The replacement of endosulfan by another hazardous pesticide could cause additional environmental and health problems. The removal of endosulfan, therefore, should be complemented by a general reduction in pesticide use, and shift toward less toxic methods and products.

III – The banning of endosulfan in the CILSS States

The Minister Coordinating the CILSS, on the proposal of CSP, signed the Decision No 0691/MAE of November 13th 2007 which prohibits the distribution of endosulfan from November 13th 2007 and its use from December 31st 2008 *(see Annex 1).*

3-1 The Common Regulation of pesticides

Member states of the CILSS, aware of their limitations in financial resources and capacity to manage pesticides, established a system of common pesticides registration. In 1992, the CILSS adopted the 'Réglémentation commune aux Etats membres du CILSS sur l'homologation des pesticides'. This Common Regulation established the Comité Sahélien des Pesticides (Sahelian Pesticide Committee - CSP), the body in charge of pesticide registration for all Member States. The Common Regulation also directs Member States to set up National Committees for Pesticide Management (CNGP) in each state, responsible for implementing decisions of the CSP at the national level.

The objective of the Common Regulation is clearly expressed in Article I, second paragraph: 'The Common Regulation is meant to share experiences and expertise of Member States for the evaluation and registration of pesticides to ensure their rational and wise use and the protection of human health and the environment'.

By ensuring that all neighbouring countries have the same pesticides registered, this system should help prevent the major problem of illegal trade between the countries, which have very porous borders.

Articles, 24, 25, and 26 of the Common Regulation established further measures to manage post-registrational control of pesticides, maintain toxico-vigilance of products, and monitor compliance with the conditions of registration.

3-2 The reasons for the ban

The risks posed by endosulfan's high toxicity and environmental properties are enhanced in West Africa, where conditions of use mitigate against the responsible use of hazardous pesticides. It is in this context that the Sahelian Pesticide Committee banned the use of endosulfan in the Sahel.

The reasons for this decision can be summarized as follows:

- human poisonings and environmental concerns;
- absence or non-functioning of national toxico-vigilance committees;
- pest resistance to endosulfan;
- absence of systematic monitoring for adverse impacts of endosulfan;
- difficulties in compliance with safety measures recommended for Class lb pesticides under conditions of use in West Africa;
- socio-economic impacts including costs to farmers;
- unfavourable opinions by FAO, IFCS, European Union, etc;
- The existence of effective alternatives to endosulfan.

3-3 Implementation of the ban

The CSP, at its 19th session, made recommendations to Member States that regulatory measures should be taken nationally to make sure that there is no more supply or distribution of endosulfan after November 13th 2007 and any use after December 31st 2008. By October 2008, no regulatory action had been taken for the effective implementation of the ban at the State level.

Companies providing pesticides in the region (such as SENCHIM and SPIA) have already stopped producing endosulfan formulations, and cotton and horticultural sector organisations have stopped including it in pesticide procurement processes, tendering instead alternatives such as spinosad, profenofos and indoxacarb.

The main constraints delaying the implementation of the banning decision include:

- lack of national regulatory measures for the prohibition of endosulfan;
- weakness or lack of control systems and inspection of import, distribution and use of pesticides in all countries;
- low awareness / information of the main actors about endosulfan;
- difficulty in implementing alternative methods.

IV- Alternatives to endosulfan

A number of alternatives to endosulfan were listed for its various uses, including chemical options and non-chemical options such as biological control, biopesticides, and integrated pest and crop management.

As many of the chemical alternatives to endosulfan also pose risks to human health and the environment, first consideration should be given to non-chemical management methods, and chemical pesticides viewed only as a last resort. PAN does not endorse the chemical pesticides.

4-1 Chemical alternatives

The list of chemicals provided includes those registered in the EU for use on vegetable crops, to allow exporters to conform to EU import criteria.

On cotton

The repeated and prolonged use of pyrethroid insecticides against *Helicoverpa armigera*, the caterpillars of which cause the largest losses in cotton growing, has led to a loss of sensitivity of the pest to the insecticides. In order to expand the range of alternative products and replace endosulfan, other chemicals have been tested against *H. armigera* caterpillars on a schedule in which the first two or three applications are carried out with active ingredients belonging to families other than pyrethroids. These include the following active ingredients: chlorfluazuron, chromafenozide, flubendiamide, indoxacarb, isoxathion, lufenuron, malathion, profenofos, spinosad, spirotetramat, and thiodicarb. Other alternatives currently being tested in Senegal include emamectin benzoate. All these products are registered or in the process of being registered by CSP.

On vegetable crops

Numerous pesticides are registered in the CILSS countries for the control of pests on vegetable crops, in compliance with the CSP/PIP–COLEACP Convention to allow vegetable farmers to comply with EU regulations governing the use of pesticides on their exports.

4-2 Information on alternative methods of pest management

During the 40-50’s researchers attached great importance to traditional pest control methods, especially in cotton production in Africa. However, in the 60’s and 70’s, the promotion of chemical control took precedence over IPM. It was not until the late 1970s that African research turned anew toward alternative pest control methods (Van der Valk & Diarra, 2000).

In Senegal several alternatives are being developed, including biological control, biopesticides and IPM. The Senegalese Direction de la Protection des Végétaux (DPV) has eight research programmes on biological control.

Biological control

Biological control is increasing, with the introduction of beneficial insects, mostly parasitic wasps (refer Table 2). The absence of local units to produce beneficial insects is one of the current constraints for widespread adoption of biological control. Successful, large-scale biological operations include the following:

- controlling cassava mealybug with the parasitic wasp *Epidinocarsis lopezi*, with tangible results in the field, reflected in a good revival of cassava growing;
- combining biological control, using the weevil *Neohydronomous affinis,* with the salinization of infested artificial environments appears to have practically eradicating water lettuce (*Pistia stratiotes*);
- controlling the invasive aquatic fern *Salvinia molesta* with a weevil (*Cyrtobagus salviniae*).

The other programmes are mostly experimental and require the establishment of useful insect breeding and mass production units in Senegal. Most of these programmes are not yet indicative of the effectiveness of acclimatizing introduced beneficial insects.

Table 2: The DPV's Biological control projects

Programme	Targeted Pest	Beneficial Species Used	Observations
Cassava mealybug (ISRA – DPV)	Cassava mealybug *Phenacoccus manihoti*	Parasitic wasp *Epidinocarsis lopezi*	Extensive cassava farming revived; mealybug impacts notably reduced.
Cereal borer in pearl millet	Millet head miner *Heliocheilus alpipunctella*	Parasitic wasp *Bracon hebetor*	90 % reduction of residual chrysalis population
Mycopesticides (LUBILOSA – CILSS)	Locusts, grasshoppers	Entomopathogenous fungi - *Metarhizium flavoviride*, *M. anisopliae*	Successful tests were conducted in the Thiès area
Water lettuce (IITA in Bénin)	Water lettuce, *Pistia stratiotes*	Weevil *Neohydronomus affinis*	Water bodies of Djoudj Park and Lake Guiers were cleaned
Cochineal (IITA Bénin with FAO support)	Farinaceus (fruit) cochineal *Rastrococcus invadens*	Parasitic wasps *Anagyrus mangicola* and *Geraronoïdea tebygi*	Pest in Dakar on mango trees since 1995; preliminary tests conducted but no major large-scale administration
Whitefly	Whitefly *Aleurodicus dispersus*	Parasitic wasp *Encarsia haïtiensis*	Pest found on 44 plant species; preliminary tests successful
Potato tuberworm (DPV)	Potato tuberworm *Phthorimaea operculella*	2 parasites *Copidosoma koehleri* & *Apnatels subandinus*	Introduced in Senegal; satisfactory preliminary tests
Salvinia molesta.	Aquatic fern *Salvinia molesta*	Coleoptera Curculionidae *Cyrtobagous salviniae*	Accidentally introduced, 1999; all large colonies disappeared in 2003, but control must take place on possible refuges and the residual zones

Source: Direction de la Protection des Végétaux, Sénégal

Biopesticides

Laboratory work in progress includes the use of *Boscia senegalensis*, *Tephrosia* sp, and Neem (*Azadiracta indica*). Non-governmental organisations such as PAN Africa are making strenuous efforts to increase these, with the tapping of local natural resources. In Senegal, the SENCHIM firm developed an EC formulation of a neem-based biopesticide in 2003, marketed under the "Nemazal 1.2 EC" label. The LUBILOSA locust control project developed a biopesticide based on an oily formulation from the spores of a pathogenic fungus *Metarhizium anisopliae var. acridum*. The product is now marketed under the Green Muscle label and was extensively tested in Senegal for efficacy (DPV) and its environmental effects (CERES-Locustox). It is now produced in Senegal under the leadership of the Education Santé Foundation. At the same time organic cotton farmers in Bénin, supported by OBEPAB, themselves produce neem extract to fight against cotton pests (Vodouhê SD, OBEPAB pers comm., 2009).

Sources of information on non-chemical alternatives to endosulfan

There are now a number of economically viable and socially acceptable alternatives to endosulfan, that are less harmful to human and animal health and that better preserve and sustain the environment. Advice on agro-ecological methods of managing cotton pests can be found in three resources from PAN Germany:

- "Field Guide to Non-chemical Pest Management in Cotton”, published in 2005
- “How to Grow Crops without Endosulfan: Field Guide to Non-chemical Pest Management in banana, cabbage and other crucifers, cassava, citrus, coffee, corn, cotton and other fiber crops, cowpea, eggplant, forage crops, forest trees, garlic, lettuce, mango, mungbean, onion, ornamentals, peanut, pepper, pigeon pea, oil crops, ornamentals, potato, rice, sesame, sorghum, soybean, squash and other cucurbits, string bean, sweet potato, tea, tomato, and wheat production", published in 2008; and
- “Online Information Service for Non-Chemical Pest Management in the Tropics” (OISAT). OISAT provides web-based information, relevant for small-scale farmers in the tropics on how to produce key crops using affordable preventive and curative non-chemical crop and pest management practices. It provides information on agro-ecological management of a wide range of vegetables, pulses, and staples such as cassava and rice, as well as cotton.

All three resources are available free at http://www.oisat.org/.
Additional resources, including information on marketing organic cotton, can be found at PAN UK’s Organic Cotton Campaign website: http://www.pan-uk.org/Projects/Cotton/.

4-3 Programmes to promote alternatives to endosulfan

FAO’s Global Facility and CERES Locustox programmes on IPM

Integrated Pest Management (IPM) is defined in the International Code of Conduct on the Use and Distribution of Pesticides (FAO 2003) as “the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.” It relies on a variety of agronomic practices and uses chemical control only as a last resort.

IPM was developed and widely implemented in Asian irrigated rice farming through Farmer Farm Schools. The extension of the Asian experience to the Sahelian sub-region resulted in the FAO Global Facility for IPM and the CERES-Locustox Foundation initiating a 3-year sub-regional IPM programme in Senegal, Mali and Burkina Faso in 2001.

The programme aimed to train 25,000 farmers in three countries, including some 10,000 vegetable and rice producers in Senegal, as well as empower and encourage producers to form groupings and teach each other. While a thorough assessment of the impact of IPM is yet to be conducted in Senegal, the first results of these alternatives show significant improvements in reducing costs, increasing the yields and quality of products on a large number of sites.

Another FAO-coordinated IPM project, funded through the Global Environment Facility, is currently in its pilot phase in the Senegal River Valley. It is being implemented in the field by the CERES-Locustox Foundation, SAED and ENDA Tiers-Monde. The approach being taken is one of participatory research, with people living along the Senegal River, and is developing an environmental monitoring system, especially for water quality. This monitoring system in different areas of the valley (the delta, the middle and upper valleys) revealed multiple problems caused by pesticides:

- misuse and excessive use of pesticides, including POPs;
- pollution of water resources, particularly with persistent toxic pesticides including dicofol, lindane, and dieldrin;
- treatment of crops without knowledge of the hazards of the pesticides or alternative strategies;
- health problems related to the misuse of pesticides.

As a result, the pilot phase has resolved to implement alternatives to pesticides through IPM training, and to develop methodologies and tools to monitor and prevent pollution. Particular emphasis is laid on i) promoting alternatives to full-scale chemical pest control, ii) documenting agricultural practices and trends in the use of pesticides, iii) supporting communities in developing integrated practices for a healthier agricultural production; and iv) adopting better prevention measures in relation to their health.

PAN Africa's IPM programmes on cotton and vegetable crops

In the 2001-2004 period, PAN Africa conducted an Integrated Pest and Production Management training programme on cotton in the Vélingara county (Senegal). The programme has trained 583 producers from 72 villages belonging to 4 rural communities. Farmers were trained in the IPM methodology. The training programme was followed by pilot activities to apply IPM on the field in 2007. The programme was highly successful, with producers obtained large yields without using chemical pesticides. Instead they used a variety of method and products including solutions of neem, African dry zone mahogany, and pepper. Yields ranged from 1,120 kg/ha to 2,660 kg/ha, compared to the average 1,200 kg/ha in the previous year (PAN Africa, 2008).

PAN Africa's vegetable crop IPM focused on tomato, which is produced by women's groups in the Dakar region. The implementation of this approach faced several constraints, the major one being the absence of an IPM label with which to sell IPM products for a price higher than conventional farming produce. It is important to establish a good marketing strategy so that consumers and especially some key customers such as hotels, restaurants, and hospitals, can better understand the benefits of IPM. FAO is planning a market and feasibility study on this through its IPM/GEF Programme (PAN Africa, 2008).

Organic cotton projects in Bénin

Global organic cotton production is booming: there was a 49% increase in the global crop for the 2006/2007 season, with 58,000 tonnes of certified organic cotton produced (PAN UK, 2007). At the time of the study, there were 67 known active organic cotton farming projects around the world. Some of these are in West African countries.

During the 1990s and early 2000s, NGO groups set up a number of experimental organic cotton growing projects in Africa. Rain-fed organic cotton production began in Tanzania and Uganda in the 1994/95 season, Senegal and Zimbabwe the following season, and Bénin a year later. By 2002 more than 20,000 farmers and their families were involved in organic cotton production in these countries, producing 8,000 tonnes of seed cotton on 12,000 hectares of land. Most of these producers (88%) are based in Uganda. However, the effectively traded certified organic fibre volumes are divided between three countries: Uganda (39%), Senegal (31%) and Tanzania (26%). Bénin and Zimbabwe grew smaller volumes of organic cotton (Ton 2002).

Organic cotton experiments were started simultaneously, in central and northern Bénin, in the 1996/97 season. The project in central Bénin is run by the NGO Organisation Béninoise pour la Promotion de l'Agriculture Biologique (OBEPAB). In its early years, the project was supported financially by PAN UK. Since 1998/99, the OBEPAB project is funded by the Centre Béninois pour le Développement Durable (CBDD), a Beninese organisation that originates from the bilateral Dutch-Beninese Sustainable Development Treaty signed in 1994. The project expanded progressively and by 2002 encompassed almost 300 growers producing more than 70 tonnes of seed cotton or 30 tonnes of certified organic cotton fibre. The 1999/2000 cotton fibre was the first to be sold at an organic premium price (Ton 2002). By 2008, the area under organic cotton had grown to an estimated 1,800 hectares – a 360% increase since 2005 (PAN UK 2008).

Experiences with organic cotton production in sub-Saharan Africa are sufficiently encouraging to make scaling-up production a realistic objective (Ton 2002).

Table 3: Organic Cotton projects in West Africa, 2004/05

Country	**Initiative**	**Start Date**	**No of producers**	**Area (ha)**	**Yield (tonnes)**
Bénin	OBEPAB	1996/97	671	422	379
Burkina Faso	Helvetas	2003	75	30	18
Mali	Helvetas	1998	561	298	170
Senegal	AGROCEL	2004	253	98	30
Senegal	ENDA	1995/96	300	120	35

Source: Baier & Jaisli undated

Experiences with organic cotton production in sub-Saharan Africa are sufficiently encouraging to make scaling-up production a realistic objective.

Food spray initiatives jointly carried out by OBEPAB and PAN UK

With the help of an Australian researcher, OBEPAB and PAN UK are carrying research in order to develop attractive food for beneficial insects that combat *Helicoverpa armigera*. The project is identifying the appropriate food and the vegetable cycle stages at which to use it (Vodouhê SD, OBEPAB pers comm., 2009).

Fair Trade cotton programmes

There are Fair Trade cotton programmes in many CILSS countries, including Mali, Burkina Faso and Senegal. Fair trade is "a trading partnership based on dialogue, transparency and respect, that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions and securing the rights of marginalized producers and workers – especially in the South.

Fair Trade organizations (backed by consumers) are engaged actively in supporting producers, awareness raising and in campaigning for changes in the rules and practices of conventional international trade rules and practices. Fair trade shops and stores have been created for this purpose (http://www.fairtrade.net/faq_links.html).

West African Cotton Improvement Programme

USAID's West African Cotton Improvement Programme (WACIP) implements strategic interventions aimed at increasing cotton growers' and processors' incomes in the C-4 countries (Bénin, Burkina Faso, Cote d'Ivoire and Mali). WACIP serves as a catalyst to bring together technologies based on research, resources, technical advice and innovative ideas. A major objective of the project is to increase cotton productivity, cotton fibre quality, and producers' income from cotton and other crops alternated with cotton.

WACIP's technical programme is organized into nine different intervention areas usually reflecting the links in the cotton supply chain, including two areas of particular interest:

- expanding the use of good agricultural practices in cotton-producing areas, including addressing soil degradation and fertility problems, and improving pest control practices;
- strengthening capacities to manage technical issues, and implementing biosecurity and regulatory procedures for agricultural biotechnology.

Regional Project to Prevent and Manage Helicoverpa armegira Resistance to Pyrethroids in West Africa (PR-PRAO)

The project tested insect growth regulators, alone or combined with neonicotinoids, in Bénin, Burkina Faso and Mali. IGRs (novaluron, triflumuron, lufenuron) controlled fruit and leaf-eating Lepidoptera, but not aphids. However, their combination with neonicotinoids (imidacloprid, acetamiprid and thiametoxam) yielded results equal to endosulfan.

IPM programmes for *Bemisia tabaci* and *Helicoverpa armigera* in tomato crops in Senegal have been developed. Indian Rose is a strong attractant for *H. armigera*. Supervised chemical control and the use of nuclear polyhedrosis virus preparations, among others, provide good management of the pest complex.

V- Socio-economic effects of the ban on endosulfan

Understanding the socio-economic conditions of cotton growing, and possible effects of banning endosulfan, is important in ensuring that socio- economic conditions are enhanced. The POPs Review Committee, responsible for recommending the inclusion of chemicals in the Stockholm Convention, requires consideration of possible socio-economic impacts of classifying endosulfan as a POP.

5-1 The place of cotton in CILSS economies

Cotton plays an important role in economic growth and the development of rural areas in West and Central Africa, with regional production increasing fivefold over the past thirty years, from 445,000 tons in the early 70s to 2,373,588 tons in the 2001-2002 period (CMA/AOC, 2003).

Cotton therefore is a key foreign exchange earner and job provider. Between 2002 and 2004, cotton exports accounted for 30% of total export earnings for Bénin, Mali and Chad and 56% for Burkina Faso. West Africa is the third leading cotton exporter (on average one million tons over the 2000/01 to 2004/05, 13%), behind the USA (2.5 million tons or 37%) and Central Asia (1.2 million tons or 17%) (SWAC/OECD, 2006).

Between 2 and 3 million households in West and Central Africa cultivate cotton, and about 16 million people live directly or indirectly on the crop. Virtually all the cotton is produced by small family farms, almost exclusively as a cash crop, thus playing an important role in the Sahel where, historically, alternative cash crops are few (SWAC/OECD, 2005).

Table 4: Macroeconomic significance of cotton in West Africa

2000-2004 average	Cotton lint exports (million US$)	% of WA cotton exports	% of total country exports
Bénin	142.5	16%	30%
Burkina Faso	154	17%	56%
Cameroun	102.8	11%	7%
Côte d'Ivoire	147.7	17%	4%
Ghana	5.3	1%	1%
Mali	188.1	21%	30%
Nigeria	31.8	4%	-
Senegal	17.5	2%	9%
Chad	59.7	7%	30%
Togo	39.6	4%	8%

Source: FAO Statistics

5-2 Pest pressure in cotton farming and the role of endosulfan

Cotton crop losses due to pests average about 30% (arthropods 12%; pathogens 10%; weeds 7%) despite control measures, including endosulfan (Oerke & Dehne, 2004). Cotton-related entomological fauna is rich, diversified and relatively cosmopolitan. *Heliothis* and *Helicoverpa* species attack many crops that may be associated with cotton in various farming systems (Matthews & Tunstall, 1994).

The large population of cotton pests has led cotton companies to favour the use of synthetic pesticides. However, close study of the relationship between the presence of insects and their impact on cotton output reveals that only certain insects are actually harmful to production, and should therefore be regarded as real "economic parasites" (Ton, 2002). In the driest sub-Saharan African areas, i.e. where rainfall is below an average 1,000 mm per year, the three species to monitor and control are *Helicoverpa armigera* (Armigeri caterpillars), *Diparopsis* spp. (red or Sudan bollworm) and *Earias* spp. (spotted bollworm). In natural agricultural conditions (i.e. where there is no use of synthetic pesticides), all other insects that attack cotton generally face a sufficient number of predators to limit their populations. This is particularly true for aphids (*Aphis* spp.) and whitefly (*Bemisia* spp.). Other pests such as *Sylepta* spp caterpillars do not significantly affect output, although they may hamper the growth of cotton in parts of the farm. They can be easily controlled through manual techniques as required (Ton, 2002).

Endosulfan was mainly used in CILSS countries to fight leaf- and seed- eating insects, defoliators, caterpillars, whitefly, aphids and mites. Among cotton pests of economic importance targeted by endosulfan, only *Helicoverpa* and *Diparopsis* spp. can be a problem if not treated with endosulfan, but there are many alternatives now available without resorting to endosulfan. Furthermore, some cotton pests (*Helicoverpa* and others) have shown some resistance to endosulfan, reducing its efficiency. Therefore, pursuing its use on cotton production is unjustified.

5-3 The economic impact of endosulfan use

Plant protection products in general, and endosulfan in particular, significantly drain cotton income. In 2002, endosulfan accounted for 22% of cotton production costs incurred by southern Senegal producers (see Table 4). A study by the International Cotton Advisory Committee (ICAC) showed the costs of plant protection are 25-45% of total cotton production costs (Ferron et al, 2006).

Table 5 shows a substantial reduction in costs if endosulfan is replaced by another chemical pesticide. All of these proposed replacement pesticides also pose significant risks to both human health and the environment, although less than endosulfan. Their use is not endorsed by PAN, the figures are included here only to demonstrate that withdrawal of endosulfan actually can reduce farmers pesticide costs. Non-chemical pest management could be expected to further reduce the production costs.

Table 5: Operating account of a cotton producer in Southern Senegal

Inputs	Recommended quantity/ha	Value (CFAF)	Total costs (%)
NPK Fertilizer	200 Kg	38,400	53
Urea	50 kg	8,650	12
Supercal P fertiliser	2 l	7,530	11
Callisulfan	3.75 l	15,920	22
Seed	56 kg	1,600	2
Total Costs		**72,000**	**100**
Seed Cotton Production	1.2 T	182,000	
Net Income		**120,000**	

Source: PAN Africa (2002)

Table 6: Comparative financial cost of chemical alternatives[2]

Pesticides	Insecticidal action	CSP registered	Cost/ha (CFA)
Profenofos	caterpillars, suckers and biters, mites	Yes	7,500
Spinosad [iii]		No	
Indoxacarb	caterpillars	Yes	
Malathion EC. (880g)	caterpillars	Yes	5,000
Flubendiamide + spirotetramat	*Plutella xylostella* *Spodoptera litura* *Helicoverpa armigera* *Homona magnanima*	No	
Triazophos	caterpillars, mites	Yes	
Thiodicarb		No	

[2] These alternatives are the ones that sub-regional cotton companies plan to use to replace endosulfan, and which are contained in their tenders for 2008.

5-4 Potential impacts on cotton producers' productivity

The manner in which cotton farming is organized in West Africa, around technical production relays, will enable farmers to effectively use alternatives to endosulfan without risking significant losses of output.

Cotton outfits have established a network of coaches in villages, in charge of supporting producers. Cotton Producer Groupings (CPG) - the basic structures responsible for organizing individual producers - were set up in each village and are headed by a board consisting of a chairperson, a secretary, a treasurer and a delegate, who are all democratically elected. The team is completed by two non-elected village technicians chosen by consensus among the literate members of the CPG – a Cotton Production Technical Relay and a Manager. The former is responsible for popularizing the cotton technical roadmap in his/her CPG while the latter manages the CPG's credit matters (AOPP, 2004). In West African production, this network plays a key role in access to and ownership of innovations, opening access to technological innovation and improving farmers' productivity (Lagandre, 2007).

Implementing alternatives to pesticides is often hampered by the lack of effective dissemination of information, including extension and training services.
It is anticipated that the well organised cotton sector has a good structure to ensure that this happens. However it also requires the will to ensure it happens, on the part of the government and the cotton sector.

Conclusion and Recommendations

- Endosulfan's intrinsic chemical, physical and toxicological properties, has resulted in its widespread contamination of the environment, including in remote environments through long-distance atmospheric transport. This, together with its high toxicity, has brought about a need for global measures to prevent further damage. In this vein, a committee of world experts, who decided that endosulfan poses an *unacceptable hazard to workers' health and the environment*, has recommended that endosulfan be added to the Prior Informed Consent Procedure (PIC) watch list of the Rotterdam Convention.

- The POPS review Committee of the Stockholm Convention decided in 2008 that endosulfan meets the screening criteria for a Persistent Organic Pollutant.

- Endosulfan is now banned in 60 countries.

- There are adequate alternative chemical and non-chemical pesticides and non-chemical products, as well as management techniques that are economically viable, socially acceptable, less toxic to humans and animals and better sustain the environment, to manage the pests for which endosulfan has been used in West Africa.

- There is no longer any possible rationale for using endosulfan in CILSS countries, since there are a number of products and agro-ecological management practices capable of effectively controlling the major pests of cotton and vegetable crops.

Therefore the decision to ban endosulfan in the CILSS Member States is in accord with best international opinion and practice.

National Pesticide Management Committees are responsible for implementing CSP decisions at the national level in CILSS Member States, and this has yet to happen. A joint mission of the CSP and Rotterdam Convention experts in the CILSS countries expressed deep concern about the weakness or absence of systems to control and inspect the importation, distribution and use of pesticides in the countries visited. Effective control is essential to ensure the sound management of pesticides in general, and that endosulfan use is not continued in contravention of the ban.

Suggestions for facilitating the enforcement of the ban include:

- national authorities take regulatory measures to enforce the ban in each country;
- national authorities put in place operational control and inspection mechanisms;
- Designated National Authorities (ANDs) and National Committees for Pesticide Management (CNGPs) build the awareness of stakeholders, including pesticide exporters, importers and producers, customs inspectors, farmers, students, civil society organisations and the general public about the hazards of, and ban on, endosulfan;
- raise public awareness about the problem of pesticide residues in food, particularly because post-application/pre-harvest intervals are frequently not observed with subsequent poisoning of consumers;
- CNGPs establish or strengthen national monitoring and inspection capacities;
- Member States enforce the FAO guidelines and advice on the disposal and prevention of inventory accumulation;
- Member States seek, identify and widely disseminate sound sustainable alternatives to endosulfan, train farmers in such alternatives, and strengthen the capacity of organisations to deliver them;
- Member States strengthen networks monitoring pests and adverse effects of pesticide use;
- continue efforts to expand the research on alternatives; establish a monitoring and evaluation network to demonstrate successful methods; transfer information on these to farmers through training, strengthening technical institutions, and providing marketing and advice on alternatives.

It is vital to involve civil society organisations in the implementation of these measures.

Finally, it is recommended that WHO reflects the international understanding of the hazardous nature of endosulfan by reclassifying it as a Class Ib (highly hazardous pesticide.

References

Adigoun FA (2002). Impact des traitements phyosanitaires du niébé sur l'environnement et la santé des populations: cas de klouekanmey et de la basse vallée de l'Oueme. Mémoire de maîtrise professionnelle. FLASH / UAC, Aboumey-Calavi, Cotonou.

Assogba MR (2009). Contribution à la réduction de intoxications dus aux pesticides chimoiques de synthèse dans la Commune de Tchaourou. Mémoire pour la Licence professionnelle en agronomie. Abomey – Calavi.

ATSDR (2000). *Toxicological Profile for Endosulfan*. Agency of Toxic Substances and Disease Registry.

Baier A, Jaisli I. Undated. Organic Cotton Projects in Africa. PAN Germany.

Bassole D, Ouédraogo L (2007). Problématique de l'utilisation des produits phytosanitaires en conservation des denrées alimentaires et en maraîchage urbain et périurbain au Burkina Faso. Un Centre International pour la Fertilité des Sols et le Développement Agricole, et Association des Professionnels de l'Irrigation Privée et des Activités Connexes (IFDC – APIPAC).

CDPR. 2008. Endosulfan Risk Characterization Document: Executive Summary. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento. May 2008. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/endosulfan/exec_sum.pdf.

CMA/AOC (2003). Évaluation du préjudice subi par le secteur coton des pays d'Afrique de l'Ouest et du Centre du fait des subventions à l'agriculture pratiquées aux Etats-Unis, en Europe et en Chine. Par Saliou Diouf et Louis Gore. Conférence des Ministres de l'Agriculture de l'Afrique de l'Ouest et du Centre.

Colborn T, Dumanoski D, Meyers JP (1997). *Our Stolen Future: How We Are Threatening Our Fertility, Intelligence and Survival*. Plume, New York.

Damgaard IN, Skakkebaek NE, Toppari J, Virtanen HE, Shen H, Schramm KW, Petersen JH, Jensen TK, Main KM, Nordic Cryptorchidism Study Group (2006). Persistent pesticides in human breast milk and cryptorchidism. *Environ Health Perspect* 114(7):1133-8.

Fanou JS, VODOUHE SD, ASSOGBA G (in press). Les processus de prise de décisiondans le choix des cultures et l'utilisation des produits chimiques de synthèse à Dridji. Article accepted by Annales des Sciences Agronomiques, FSA/UAC. Cotonou, Benin.

FAO (2003). International Code of Conduct on the Distribution and Use of Pesticides (Revised Version). Adopted by the Hundred and Twenty-third Session of the FAO Council in November 2002. Food and Agriculture Organization of the United Nations, Rome.

Ferron P, Deguine J-P, Ekorong à Mouté J (2006). Évolution de la protection phytosanitaire du cotonnier: un cas d'école. *Agricultures* 15(1):128-34.

Glin LJ, Kuiseau J, Thiam A, Vodouhe DS, Dinham B, Ferrigno S (2006). *Living with Poison: Problems of Endosulfan in West Africa Cotton Growing Systems*. Pesticide Action Network UK, London.

Goebel H *et al* (1982). Properties, effects residues and analysis of the insecticide endosulfan. *Residue Rev*. 83:1-165. Cited in ATSDR (2000).

Grunfeld HT, Bonefeld-Jorgensen EC (2004). Effect of *in vitro* estrogenic pesticides on human oestrogen receptor alpha and beta mRNA levels, *Toxicol Lett* 151(3):467-80.

IPCS (2000). *Endosulfan (Poison Information Monograph 576)*. International Programme on Chemical Safety, World Health Organization.

Jamil K, Shaik AP, Mahboob M, Krishna D (2004). Effect of organophosphorus and organochlorine pesticides (monocrotophos, chlorpyriphos, dimethoate, and endosulfan) on human lymphocytes in-vitro. *Drug Chem Toxicol* 27(2):133-44.

Kelly BC, Gobas FAPC. 2003.An Arctic terrestrial food-chain bioaccumulation model for persistent organic pollutants. *Environ Sci Total* 37(13):2966-74.

Kodjo EA (2007). ANCE fights for the prohibition of the use of Endosulfan in Togo. International POPs Elimination Network, November.

Kuye RA, Donham KJ, Marquez SP, Sanderson WT, Fuortes LJ, Rautiainen RH, Jones ML, Culp KR (2008). Pesticide handling and exposures among cotton farmers in the Gambia. *J Agromedicine* 12(3)57-69.

Lagandre D (2007). Le secteur cotonnier en zone franc, entre succès et dépendance. Agence Française de Développement, Direction de la stratégie, Département de la recherche.

Landers DH, Simonich SL, Jaffe DA, Geiser LH, Campbell DH, Schwindt AR, Schreck CB, Kent ML, Hafner WD, Taylor HE, Hageman KJ, Usenko S, Ackerman LK, Schrlau JE, Rose NL, Blett TF, Erway MM (2008). *The Fate, Transport, and Ecological Impacts of Airborne Contaminants in Western National Parks (USA).* EPA/600/R-07/138. U.S. Environmental Protection Agency, Office of Research and Development, NHEERL, Western Ecology Division, Corvallis, Oregon.

Loumedjinon S (2002). Impact des traitements phytosanitaires du niébé sur l'environnement et la santé au Bénin: perception des paysans dans les départements du Borgou et de l'Alibori. Mémoire de fin de formation pour l'obtention du Diplôme d'Ingénieur des Travaux. CPU/ UAC, Abomey-Calavi, Bénin.

Mackay N, Arnold D (2005). Evaluation and Interpretation of Environmental Data on Endosulfan in Arctic Regions. Draft Report for Bayer CropScience Report Number CEA.107.

Matthews GA, Tunstall JP, eds. (1994): *Insect Pests of Cotton*. CAB International, Wallingford.

NIOH. 2003. Final Report of the Investigation of Unusual Illnesses Allegedly Produced by Endosulfan Exposure in Padre Village of Kasargod District (N Kerala). National Institute of Occupational Health, Indian Council for Medical Research, Ahmedabad.

OBEPAB (2003). Rapport d'enquête sur l'effet de l'utilisation des pesticides chimiques sur les producteurs de coton au Bénin.

OBEPAB (2007a). Plaidoyer et lobbying pour le retrait de l'endosulfan de la production agricole au Bénin.

OBEPAB (2007). Rapport d'activités sur l'information et sensibilisation des producteurs et autres acteurs de développement sur les dangers liés à l'utilisation de l'endosulfan en production agricole au Bénin.

OBEPAB (2008). Rapport d'enquête sur l'effet de l'utilisation des pesticides chimiques sur les producteurs de coton au Bénin.

OEHHA. 2008. Revised findings on the health effects of the active ingredient: endosulfan. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento. June 4, 2008. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/endosulfan/memo_findings060408.pdf.

Oerke EC, Dehne HW (2004). Safeguarding production – losses in major crops and the role of crop protection. *Crop Prot* 23:275-85.

PAN Africa (2002). Pesticide Poverty and Livelihoods Project: Lutte contre les ravageurs, sécurité alimentaire et coton biologique au Sénégal. Pesticide Action Network Africa, Dakar.

PAN Africa (2002b). Rapport d'enquête sur l'effet de l'utilisation des pesticides chimiques sur l'homme au Mali et au Cameroun. Pesticide Action Network Africa, Dakar.

PAN Africa (2008). Project EuropeAid/ENV/2004-83378 "Pesticides & Poverty: Implementing Chemical Conventions for Safe and just development", a narrative report of the project, prepared by Henry Rene Diouf. Pesticide Action Network Africa, Dakar.

PAN Togo (2005). Etude d'impact socio-économique, sanitaire et environnemental de l'utilisation des POPs à Davié au Nord de Lomé (Région Maritime) Togo.

PAN UK (2001). Rapport d'enquête sur l'effet de l'utilisation des pesticides chimiques sur l'homme en Afrique de l'Ouest. Pesticide Action Network UK, London.

PAN UK (2003). *Effects of pesticides on the health of cotton-growing families in West-Africa,* Comic Relief Mid-term report. Pesticide Action Network UK, London.

PAN UK (2007). Wear Organic Newsletter – November 2007. Pesticide Action Network UK, London. http://www.pan-uk.org/Projects/Cotton/Newsletter/nov2007.htm.

PAN UK (2008). Wear Organic Newsletter - March 2008. Pesticide Action Network UK, London. http://www.pan-uk.org/Projects/Cotton/Newsletter/mar2008.htm#5.

PMRA (2007). Évaluation préliminaire des risques et de la valeur de l'endosulfan. Octobre. Agence de réglementation de la lutte antiparasitaire, Santé Canada.

Roberts EM, English PB, Grether JK, Windham GC, Somberg L, Wolff C (2007). Maternal residence near agricultural pesticide applications and autism spectrum disorders among children in the California Central Valley. *Environ. Health Perspect* 115(10):1482–9.

Saiyed H, Dewan A, Bhatnagar V, Shenoy U, Shenoy R, Rajmohan H, Patel K, Kashyap R, Kulkarni P, Rajan B, Lakkad B (2003). Effect of endosulfan on male reproductive development. *Environ Health Perspect* 111(16):1958-62.

Sawadogo PW, Traoré O, Topan M, Tapsoba KH, Sedogo PM, Bonzi-Coulibaly LY (2006). Variation de la teneur en résidus de pesticides dans les sols de la zone cotonnière du Burkina Faso. *J Africain Sciences de l'Environnement* 1:29-39.

Singh ND, Sharma AK, Dwivedi P. Patil RD, Kumar M (2007). Citrinin and endosulfan induced teratogenic effects in Wistar rats. *J Appl Toxicol* 27(6):589-601.

Soclo HH, Azontonde AH, Dovonon LF, Djibril R, Sagbo, AU (2003). Etude de l'impact de l'utilisation des engrais chimiques et des pesticides par les populations riveraines sur les écosystèmes (eaux de surface, végétaux et faune) des Aires Protégées (Parcs Nationaux et Zones cynégétiques) du Bénin, Rapport Final. World Bank, Global Environment Facility, Ministère de l'Agriculture, de l'Elevage et de la Pêche, Centre National de Gestion des Réserves de Faune, Parcs nationaux due Bénin (CENAGREF), Programme de conservation et de Gestion des Parcs Nationaux.

Soto AM, Chung KL, Sonnenschein C. 1994. The pesticides endosulfan, toxaphene, and dieldrin have estrogenic effects on human estrogen-sensitive cells. *Environ Health Perspect* 102(4):380-3.

Sow M, Marone S, Ndiaye S (2004). Etude socio-économique de l'utilisation des pesticides au Sénégal. Fondation Ceres Locustox – Facilité Mondiale pour la Lutte Intégrée-FAO – Institut du Sahel,Rome et Dakar.

SRP. 2008. Findings of the Scientific Review Panel on Toxic Air Contaminants on the Proposed Identification of Endosulfan as a Toxic Air Contaminant. Scientific Review Panel on Toxic Air Contaminants, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento. May 16, 2008.

Stumpf K *et al* (1989). Metabolism of 14C-labelled Endosulfan in five soils. Hoechst AG Doc. No. A53618, unpublished report.

Ton P (2002). Organic cotton production in sub-Saharan Africa: the need for scaling-up. A report for PAN UK's Pesticides Poverty and Livelihoods project. Pesticide Action Network UK.

Ton P, Tovigan S, Davo S (2000). Intoxications et morts au Bénin par l'endosulfan. In Pesticides & Alternatives. Pesticide Action Network Africa Newsletter. N° 10 – April.

Traoré SK, Mamadou K, Debmble A, Lafrance P, Mazellier P, Houenou P (2006). Contamination de l'eau souterraine par les pesticides en régions agricoles en Côte d'Ivoire (centre, sud et sud ouest). *J Africain Sci Environn* 1:1-9.

UNEP/POPS/POPRC.3/5 (2007). Endosulfan Proposal. Stockholm Convention on Persistent Organic Pollutants. Persistent Organic Pollutants Review Committee. Third Meeting.

UNEP/POPS/POPRC.3/INF/9 (2007). Additional Information for Endosulfan. Stockholm Convention on Persistent Organic Pollutants. Persistent Organic Pollutants Review Committee. Third Meeting.

US EPA (2002). *Reregistration Eligibility Decision for Endosulfan*. EPA 738-R-02-013. Pollution, Pesticides and Toxic Substances (7508C), United States Environmental Protection Agency. http://www.epa.gov/oppsrrd1/REDs/endosulfan_red.pdf.

US EPA (2007). Addendum to the Ecological Risk Assessment of Endosulfan. October, 31st, 2008. Available in the public docket at http://www.regulations.gov under docket ID No. EPA-HQ-OPP-2008-0262-0063.
http://www.cdpr.ca.gov/docs/emon/pubs/tac/finaleval/endosulfan.htm.

van der Valk H, Diarra A. 2000. Pesticide use and management in the African Sahel—an overview. *Sahelian Studies Res* 4–5:13–27.

Varayoud J, Monje L, Bernhardt T, Munoz-de-Toro M, Luque EH, Ramos JG. 2008. Endosulfan modulates estrogen-dependent genes like a non-uterotrophic dose of 17B-estradiol. *Repro Toxicol* 26(2):138-45.

WHO (2005). *The WHO Recommended Classification of Pesticides by Hazard*. World Health Organization, Geneva.

Appendix 1: The text of the decision to ban endosulfan in the CILSS states

COMITE PERMANENT INTER-ETATS DE LUTTE CONTRE LA SECHERESSE DANS LE SAHEL

PERMANENT INTER-STATE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL

اللجنة الدائمة المشتركة لمكافحة آثار الجفاف في الساحل

CILSS

N° -1-0691 / MAE

Nouakchott, le 13 NOV 2007 : انواكشوط في

Le Ministre Coordinateur الوزير المنسق

DECISION N° / MC/ 2007
INTERDICTION DE L'ENDOSULFAN

Vu la version révisée de la Réglementation Commune aux États membres du CILSS sur l'Homologation des Pesticides issue de la Résolution n°08/34/CM/99 prise par le Conseil des Ministres du CILSS en 1999 à N'Djamena, Tchad.

Soucieux de la protection de la santé humaine, animale et de l'environnement ;

Sur proposition du Comité sahélien des pesticides en sa séance de travail du 08 mai 2007 à Bamako.

L'endosulfan est interdite en agriculture dans les Etats membres du CILSS pour les raisons énoncées dans le document joint en Annexe.

En tenant compte des spécificités agricoles et des délais d'utilisation des stocks existants, cette décision d'interdiction prise par le Ministre Coordonnateur sur recommandation du Comité sahélien des pesticides prend effet pour compter de sa date de signature pour la distribution et le 31 décembre 2008 pour l'utilisation.

La présente décision sera communiquée partout où besoin sera.

Nouakchott, le

Le Ministre Coordonnateur du CILSS

Issagha Correra
Ministre de l'Agriculture et de l'Elevage
République Islamique de Mauritanie

Ampliations

- Secrétariat Exécutif du CILSS (Original)
- Institut du Sahel (CSP)
- Centre Régional Agrhymet