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REPORT OF THE EXPERT GROUP

Under the Chairmanship of Dr. C.D. Mayee

**For Pesticides Reviewed for their continued use
or otherwise in the country.**

Part I

Submitted to
The Registration Committee

**MINISTRY OF AGRICULTURE
DEPARTMENT OF AGRICULTURE AND COOPERATION**

2006

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EXECUTIVE SUMMARY

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The Registration Committee on the directives of the Inter-ministerial Committee constituted a group under the Chairmanship of Dr. C.D. Mayee, Chairman, Agricultural Scientists Recruitment Board (ASRB), Indian Council of Agricultural Research, Krishi Anusandhan Bhawan, Pusa, New Delhi to review toxicity persistence, safety in use and substitute available of 36 pesticides and monocrotophos (List of at Annexure I)and make recommendations for their continued use or otherwise in the country. The group undertook the review and has made the following specific recommendations w.r.t. pesticides reviewed in the first phase.

1. Acephate

1. Use of Acephate should be continued.

2. Atrazine

1. Use of Atrazine should be continued.
2. It may be used with caution in the areas where the ground- water level is high.

3. Butachlor

1. Use of Butachlor should be continued.
2. The label and leaflet should bear the safety precaution that it should not be used in the areas where pisciculture/aquaculture is practiced along with rice cultivation.

4. Carbendazim

1. Use of Carbendazim should be continued.
2. The impurities 2,3 diaminophenazine (DAP) and 2-amino-3-hydroxyphenazine (HAP) should not be more than be 0.003g/Kg maximum and 0.0005g/Kg maximum as prescribed in the FAO specification.
3. In view of the fetotoxic and the teratogenic potential the following warning statement should be included on the label and leaflet:-
4. Pregnant women should avoid contact with carbendazim formulations.”

5. Dichlorovos(DDVP)

1. Use of Dichlorovos should be continued .
2. The manufacturing unit should be asked to monitor permissible exposure limit of 1 mg dichlorovos per cubic meter of air (1 mg/ m³) for an eight hour work day , 40 Hrs work/ week
3. Efforts should be made by the industry to develop safer formulations of Dichlorovos.

6. Fenitrothion

1. Use should be banned in Agriculture
2. May be permitted for locust control in scheduled desert area and public health . ✓

7. Mancozeb-

1. Use of Mancozeb should be continued .
2. The basic manufactures should ensure that the ETU content of the technical and formulation should not be more than 0.5%. The Registration Committee may prescribe the below mentioned storage condition to maintain the ETU content within the permissible level of 0.5% . "All products containing mancozeb should be stored in cool and dry conditions"
3. To investigate that whether effect of mancozeb on iodine metabolism affect the thyroid profile of the workers , a multilocation study(minimum 3 locations) be carried out as per the protocol approved by the Registration Committee in the workers of the manufacturing unit by the basic manufacturers of mancozeb under the supervision of National Institute of Occupational Health (NIOH,) Indian Council of Medical research Ahmedabad.
4. The caution prescribed by the Registration committee for incorporation on the label & leaflet regarding protective clothing / equipment should be continued.

8. Monocrotophos

1. Use of Monocrotophos should be continued .
2. The ban for use on vegetables should be continued .
3. Considering the endocrine disruption effects reported internationally the studies should be undertaken to show that there are no endocrine concerns under Indian conditions by the concerned manufacturers within a period of 5 years.

9. Pendimethalin

1. Use of Pendimethalin should be continued.
2. The label and leaflet should bear the safety precaution that it should not be used in the areas where pisciculture /aquaculture is practiced along with rice cultivation.

10. Quinalphos-

1. Use of Quinalophos should be continued
2. The label and leaflet should bear the safety precaution that it should not be used in the areas where pisciculture/aquaculture is practiced along with rice cultivation.
3. The group suggested that the studies be undertaken by the registrants to confirm that it does not have neurotoxic concern.

PREAMBLE

PREAMBLE

Background regarding the composition of the expert group

In pursuance to the order of the Supreme Court in its judgment in the case of the writ petition No. 1094 of 1988 a Committee [Interministerial Committee (IMC)] has been constituted with the Secretary, Department of Agriculture & Cooperation as Chairman and Secretary, Department of Chemicals & Petrochemicals , Secretary, Department of health and Secretary , Ministry of environment and forest as members to review the use of Insecticides and Chemicals found Hazardous to health and take suitable remedial measures in this regard. In the 25th meeting of IMC a list of pesticides which have been banned/ restricted in other countries but being used in India and the statement containing the review status of those pesticides was put up for deliberation. The Committee decided that the Registration Committee should take up the review of the remaining pesticides within a stipulated time frame .Based on the decision of Inter Ministerial Committee, the Government of India, Ministry of Agriculture (Department of Agriculture & Cooperation) decided to undertake review of 36 pesticides (decision in the 26th IMC meeting)and monocrotophos through Registration Committee (RC) to consider their continued use or otherwise in the country. For the purpose, a Group was constituted by the RC in its 252nd - 253rd meeting under the Chairmanship of Dr. C.D. Mayee, Chairman, ASRB, Indian Council of Agricultural Research. .The terms of reference for the group were laid down in the 254th meeting (copy at Annexure II)The constitution of the group is as under :


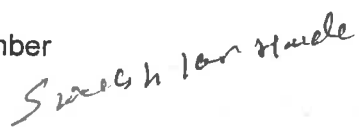




1. Dr. C.D. Mayee,
Chairman ASRB,
Indian Council of Agricultural Research Institute ,
Krishi Anusanshan bhavan-1 ,
PUSA, New Delhi
2. Dr P.S. Chandurkar
Plant Protection Adviser
to the Govt. of India,
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3. Shri P.N. Maji,
Additional Industrial Advisor,
Representative from Deptt. of Chemicals
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Chairman





Member

Member

4. Dr. O.P. Dubey
ADG(OP),
Indian Council of Agricultural research
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10. Dr. R.A. Tripathi
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12. Dr. L.S. Barar
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PAU, Ludhiana
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13. Dr. (Mrs.) Sandhya Kulshrestha,
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- Member Secretary 

The group Co-opted the following members :-

1. Dr. T. P. Rajendran
ADG (PP)
Indian Council of Agricultural research
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Co-opted Member

2. Dr. A.K. Majumdar,
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5. Dr. N.T. Yaduraju,
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**MODALITIES FOR THE
FUNCTIONING OF THE
GROUP AND
PREPARATION OF THE
REPORT**

MODALITIES FOR THE FUNCTIONING OF THE GROUP AND PREPARATION OF THE REPORT

The list of pesticides reviewed in first phase is as under :-

S.No.	Name of Pesticides
1.	Acephate
2.	Atrazine
3.	Butachlor
4.	Carbendazim
5.	Diclorvos (DDVP)
6.	Fenitrothion
7.	Mancozeb
✓ 8.	Monocrotophos
9.	Pendimethalin
10.	Quinalphos

✓ The group met five times to deliberate the modalities to be adopted, and to discuss the information received from various quarters viz. - State Agriculture University, State Department of Agriculture, Pesticide Industry/ Associations, Farmers Associations, various Stake holders and Non Government Organizations (NGO) for the pesticides which were reviewed in the first phase. ✓ The Group reviewed the literature and prepared the base papers on each of the pesticides under review. The base paper were deliberated. The presentation made by the industry are at Annexure III, (IIIA- IIIIE). .After a detailed discussion with the industry and among the members and based on the scientific information ✓, the Group decided to have certain general recommendations apart from specific recommendations. The group decided to give the general recommendation in the final review report .

CONCLUSIONS
&
RECOMENDATIONS

PRODUCT SPECIFIC RECOMMENDATIONS

PRODUCT SPECIFIC RECOMMENDATIONS

1. ACEPHATE

Acephate is slightly hazardous organophosphorus insecticide as per WHO recommended Classification of Pesticides by Hazard 2004.

1.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is banned in Norway because of uncertainty of the toxicology and no major need.

1.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

1.2 (a) PESTICIDE CONSUMPTION IN INDIA

440 MT Technical grade (2003- 04)
(Source States / UT's)

1.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS.

Acephate 75% S.P:--Safflower, Cotton and rice.

1.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The group noted that Acephate is slightly hazardous organophosphorus insecticide as per WHO recommended Classification of Pesticides by Hazard 2004. It is banned in Norway because of uncertainty of the toxicology and no major need. Considering all the information and the data available the group noted that there are no safety concerns with acephate and therefore the group recommended the following :-

1.4 RECOMENDATIONS

1. Use of Acephate should be continued.

2. ATRAZINE

Atrazine is a herbicide and is unlikely to present acute hazard in the normal use (U) as per WHO recommended Classification of Pesticides by Hazard 2004

2.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is banned in Sweden, Germany, Denmark Norway, and restricted in Austria, SLO. The substance was suspended due to its high mobility in soil and potential for contamination of water

* SLO – Slovakia

2.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA.

2.2 (a) PESTICIDE CONSUMPTION IN INDIA

315 MT Technical grade (2003- 04)

(Source States / UT's)

2.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS.

Atrazine 50% W.P.: -Maize, Bajral, Sugarcane and Potato . . .

2.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The group noted that the use of Atrazine is suspended in some countries due to high mobility in soil and has potential for contamination of ground water. It has shown to cause serious effects in frog at much lower levels in water bodies in United States.

The group considered information provided by industry that US EPA, based on a comprehensive evaluation of the available studies (in the open literature along with studies submitted by registrant) regarding the potential effects of Atrazine on amphibian, gonadal and laryngeal development in frogs, have concluded that the current line of evidence did not show that Atrazine produced consistent reproducible effects across a range of exposure concentrations and amphibians species tested.

The group critically analyzed the information submitted by the industry (copy of the Presentation made by the industry at Annexure – III- A) regarding reasons of ground water contamination in Sweden, Germany, Denmark ,Norway, and restricted in Austria and * SLO. The high persistence of the compound in these countries is because of high soil organic compounds and dry low temperature. Considering the climatic conditions of our country (In India temperature is quite high in major part of the year) which favour degradation in soil and such high concentration level of persistence is not likely to be achieved. Therefore, this herbicide has

not detected in the monitoring studies in sugarcane areas of Karnataka ,Tamil Nadu and Andhra Pradesh . Hence, the group recommended the following :-

2.4 RECOMEN DATIONS

1. Use of Atrazine should be continued.

3. BUTACHLOR

Butachlor is a herbicide and is unlikely to present acute hazard in the normal use (U) as per WHO recommended Classification of Pesticides by Hazard 2004

3.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

The group noted that in Korea restriction is imposed for use near fish farm, waterways and lakes because of high fish toxicity.

3.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA.

3.2 a PESTICIDE CONSUMPTION IN INDIA

1520 MT Technical grade (2003- 04)
(Source States / UT's)

3.3 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

Butachlor 5% GR:-Rice (Transplanted)
Butachlor 50% EC:- Paddy (Transplanted)
Butachlor 50% E.W.:-Transplanted Rice

3.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The toxicological properties of Butachlor closely resembles Alachlor and Alachlor has been shown to be associated with poor semen quality in men.

The group noted the information submitted by the industry on this aspect (Presentation made by the industry at Annexure – III- B) that there is only one study with alachlor. Further , though there is positive association with Alachlor but negative correlation with acetachlor, another analogue and Survey on the manufacturing workers of Alachlor carried out by Monsanto , the primary manufacturers of product does not show any findings suggesting this effect. Further , Industry submitted that Korean regulation stipulate - avoiding extensive use of butachlor i.e. do not use more than recommended concentration in paddy .The group also considered the industry view that the concentrations in the environment do not reach toxic

level for fish in reality. However it was felt that that there may be certain areas in India where pisciculture/aquaculture and rice cultivation are undertaken simultaneously and this aspect need to be considered. Considering the facts the group recommended the following :-

3.4 RECOMENDATIONS

1. Use of Butachlor should be continued.
2. The label and leaflet should bear the safety precaution that it should not be used in the areas where pisciculture/aquaculture is practiced along with rice cultivation.

4 . CARBENDAZIM

Carbendazim is widely used fungicide and is unlikely to present acute hazard in the normal use (U) as per WHO recommended Classification of Pesticides by Hazard 2004..

4.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is restricted in Sweden due to Genetic and fetal disturbances in experimental animals and increase in tumor incidences in mice.

4.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

4.2 (a) PESTICIDE CONSUMPTION IN INDIA

514 MT Technical grade (2003- 04)
(Source States / UT's)

4.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

(i) Carbendazim 50% WP :- Paddy, ,Wheat, Barley, Tapioca, Moong, Cotton,Jute,Groundnut,Sugar beet,Peas,Cluster Beans ,Cow pea, Chillies, Brinjal, ,Apple,Grapes,Tobacco,Walnut,

(ii) Carbendazim 46.27%:- Rose, Ber Grape,Mango.

(ii) Carbendazim12% + Mancozeb 63 % WP :- paddy

4.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

It has come to the notice of the group that there are some international information regarding the reproductive toxicity and teratogenic effect of Carbendazim.

The group considered the information submitted by the industry that it has been evaluated by toxicologically Joint Meeting of the FAO panel of Experts on Pesticide Residues in Food and the Environment and the WHO Core Assessment. In 1973, 1977, 1983 and 1985. Again in 1995 Carbendazim was evaluated toxicologically by the JMPR in which ADI of 0.03 mg/kg b.w was established on the basis of no-effect level of 2.5 mg/kg per year study in dogs and safety factor of 100. The resultant ADI when compared with the LOAELs in the studies and CD-1 mice, provides an adequate level of safety.

The group was concerned with the information that the carcinogenic effect of Carbendazim in some studies is shown to be related to impurities mainly HAP and DAP. The group debated in length and examined the original data sheet "(WHO/FAO Data Sheets on Pesticides No. 89). http://www.inchem.org/documents/pds/pds/pest89_e.htm (date of issue July, 1996)." Considering the facts the group recommended the following :-

4.4 RECOMENDATIONS

1. Use of Carbendazim should be continued.
2. The impurities 2,3 diaminophenazine (DAP) and 2-amino-3-hydroxyphenazine (HAP) should not be more than 0.003g/Kg and 0.0005g/Kg (as prescribed in the FAO specification) in the technical grade pesticide.
3. In view of the fetotoxic and the teratogenic potential the following warning statement should be included on the label and leaflet:-
4. "Pregnant women should avoid contact with carbendazim formulations".

5 DICHLORVOS (DDVP)

Dichlorvos is volatile, highly hazardous (IB) organophosphorus insecticide and has limited use in agriculture .

5.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

Dichlorvos is banned in *ANG (due to quality reasons), Fiji (due to potential health hazard) , ,Denmark because of being Carcinogenic in category 3 and the formulated products are highly acute toxic therefore harmful to human health . It has high acute inhalation toxicity .Its use is restricted in Korea due to high acuter toxicity , Kuwait and Sweden due to its mutagenic properties.

*ANG- ? Angola

5.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

5.2 (a) PESTICIDE CONSUMPTION IN INDIA

818 MT Technical grade (2003- 04)
(Source States / UT's)

5.2 b FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

Dichlorvos 76% E.C:- Paddy, Wheat, ,Soybean,Sugarcane, Castor,Groundnut,Mustard, Sunflower, cucurbit and Cashew.

5.3 .MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The group noted that Dichlorvos belongs to class IB as per WHO recommended classification of pesticide by hazard. and due to low vapor pressure liable to cause inhalation toxicity. It has high acute inhalation toxicity .

The group considered the information presented by the industry (copy of the presentation made by the industry at Annexure – III- C) regarding carcinogenic and the mutagenic properties that Belgian health council downgraded the classification of Dichlorvos towards non classifiable with regard to cancer in man. and Australian Review Committee has made an observation that the rodent gavage studies were not considered relevant to the assessment of risk to public health . On the weight of evidence it was concluded that Dichlorvos may not be considered to pose a carcinogenic risk to humans under expected exposure conditions in Australia. Regarding the mutagenic properties the industry stated that the recommendations of the International bodies clearly state that “It is a mutagen in a brief microbial system, but there is no evidence of its mutagenicity in mammals for which it is rapidly degraded”. It was also brought to the notice of the group that Occupational safety and health Administration (OSHA) has set a permissible exposure limit of 1 mg dichlorvos per cubic meter of air (1 mg/ m³) for an eight hour work day , 40 Hrs work week Considering the facts the group recommended the following:-

4.4 RECOMENDATIONS

1. Use of Dichlorvos should be continued .
2. The manufacturing unit should be asked to monitor permissible exposure limit of 1 mg dichlorvos per cubic meter of air (1 mg/ m³) for an eight hour work day , 40 Hrs work week
3. Efforts should be made by the industry to develop safer formulations of Dichlorvos.

6. FENITROTHION

Fenitrothion is moderately hazardous organophosphorous Insecticide as per WHO recommended Classification of Pesticides by Hazard 2004.

6.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is restricted in Canada due to adverse effect on aquatic environment, migratory song birds and bees. There are International information about its androgen receptor antagonist effect .

6.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

6.2 (a) PESTICIDE CONSUMPTION IN INDIA

412 MT Technical grade (2003- 04) Source States / UT's

6.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

Fenitrothion 5% D.P.: -Rice, Groundnut,

Fenitrothion 50% E.C.: - Paddy, Cotton, Castor, Groundnut, Brinjal, Chillies,

Onion, Potato, Tomato, Coffee,

Fenitrothion 40% WDP: -Cotton, Tobacco, Paddy, Sugarcane, Groundnut, Apple, Citrus, Public Health.

6.3 .MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

Fenitrothion is moderately hazardous organophosphorous Insecticide as per WHO recommended Classification of Pesticides by Hazard 2004. It is restricted in Canada due to adverse effect on aquatic environment, migratory song birds and bees. In India it is registered for agriculture and Public Health. It is listed as one of the pesticide for locust control measure by FAO. It has come to the notice of the group that there are International information about its androgen receptor antagonist effect . The high level of pest resistance have been observed .No industry have come forward to clarify the concerns . The group also found that its consumption is declining fast .Considering the fact that the alternatives (Alternates available are at Annexure IV) for use in agriculture are available the group recommended the following

6.4 RECOMENDATIONS

1. Use should be banned in Agriculture
2. May be permitted for locust control in scheduled desert area and public health .

7. MANCOZEB

Mancozeb is widely used fungicide and is unlikely to present acute hazard in the normal use (U) as per WHO recommended Classification of Pesticides by Hazard 2004.

7.1. THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is banned in Libya based on the information of FAO and restricted in Korea because of risk of carcinogenic effect on humans & Sweden because of Genotoxic and carcinogenic EBDC compound, containing or creating ETU, a carcinogenic degradation product.

7.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

7.2 (a) PESTICIDE CONSUMPTION IN INDIA

2615 MT Technical grade (2003- 04)

(Source States / UT's)

7.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

(i) Mancozeb 75% W.P :- Potato, Tomato, Chillies, Bittergourd, Onion, Tapioca, Ginger, Cauliflower, Wheat, Maize, Paddy, Jowar,, Beans, Muskmelon, Watermelon, Bottle Gourd Groundnut, Soybean, Sunflower, Urid, Banana, Apple, Grapes, Coconut, Walnut, Guava and Sugarbeet.

(ii) Mancozeb 35% SC:- Potato, Tomato
(ii) Mancozeb 63 % WP + Carbendazim 12% :- paddy

7.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The group noted that it is banned in Libya based on the information of FAO and restricted for use in Korea because of risk of carcinogenic effect on humans and in Sweden because of Genotoxic and carcinogenic effect due to ETU, a carcinogenic degradation product. The group was concerned with the fact that it has shown to cause the effect on thyroid in the experimental animals and that ETU the impurity has antithyroid activity and is a probable human carcinogen to skin. Members also noted that the technical registered product has the ETU content of 0.50 % maximum and the matter regarding skin cancer due to ETU has been examined by Registration Committee in its 134 meeting and accordingly the condition has been incorporated on the label and leaflet of Mancozeb as under:

“Caution:- While handling the fungicide workers and users must wear full protective clothing like long sleeved shirts , long pants , chemical resistant gloves , shoes , goggles , hat and mask”.

The group also noted that effect of mancozeb on iodine metabolism is very well known in animals at a relatively low dosage The group was concerned to know whether such effects do occur in industrial workers.

The group also considered the information available on the storage, packaging and handling and observed that to minimize the decomposition all products containing mancozeb should be stored in cool dry conditions .

Considering all the above facts the group recommended that :

7.4 RECOMMENDATIONS

5. Use of Mancozeb should be continued .
6. The basic manufactures should ensure that the ETU content of the technical and formulation should not be more than 0.5%. The Registration Committee may prescribe the

below mentioned storage condition to maintain the ETU content within the permissible level of 0.5% . “All products containing mancozeb should be stored in cool and dry conditions”

7. To investigate that whether effect of mancozeb on iodine metabolism affect the thyroid profile of the workers , a multilocation study(minimum 3 locations) be carried out as per the protocol approved by the Registration Committee in the workers of the manufacturing unit by the basic manufacturers of mancozeb under the supervision of National Institute of Occupational Health (NIOH,) Indian Council of Medical research Ahmedabad.
8. The caution prescribed by the Registration committee for incorporation on the label & leaflet regarding protective clothing / equipment should be continued.

8.MONOCROTOPHOS

Monocrotophos is highly hazardous pesticide.It belongs to class 1B as per WHO recommended Classification of Pesticides by Hazard 2004

8.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is banned in Hungary, Kuwait, Libya, Union of Soviet Socialist Republic, USA and restricted in Australia , China , Korea, Srilanka, Malaysia because it is highly toxic and there are concerns for human health and environment and increased incidence of suicidal attempts ; high risk of occupational exposure under local socio economic and climatic conditions.

8.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

8.2 (a) PESTICIDE CONSUMPTION IN INDIA

3115 MT Technical grade (2003- 04)
(Source States / UT's)

8.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

(i) Monocrotophos 36% S.L:- Paddy ,Maize,Pulses,Bengal gram,Black gram,Green gram,Pea, Red gram,Sugarcane,Fibre Crop,Cotton, Oilseeds,Castor, Mustard.

8.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

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The group noted that it is an extremely toxic Pesticide included in the PIC and safer alternatives are available and its safe use may be of concern. The group considered the information provided by the industry (Copy of the presentation made by the industry at Annexure – III- D) that Internet search reveals that, Monocrotophos is not in the suspected list of endocrine disruptors, as per : UK EA, DEFRA, GETA, EU, OSPAR, & WWF. (ref: Pesticide Action Network, UK). However the group was not convinced that there are no reports of the endocrine disruption as MRC -Institute for Environment and Health (a UK government Medical Research Institute) 2005 publication has included Monocrotophos in the list of endocrine disruptor. Certain poisoning cases have also been reported due to monocrotophos .The group also noted the Ban on vegetables as imposed by the Registration Committee. Considering the facts the group recommended the following :-

8.4 RECOMMENDATIONS

1. Use of Monocrotophos should be continued .
2. The ban for use on vegetables should be continued .
3. Considering the endocrine disruption effects reported internationally the studies should be undertaken to show that there are no endocrine concerns under Indian conditions by the concerned manufacturers within a period of 5 years.

9. PENDIMETHALIN

Pendimethalin is slightly hazardous(Class III) herbicide as per WHO recommended Classification of Pesticides by Hazard 2004.

9.1 THE BAN/RESTRICTION STATUS INTERNATIONALLY

It is restricted in Sweden due to persistence, high aquatic toxicity and potential for bioaccumulation

9.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

9.2 (a) PESTICIDE CONSUMPTION IN INDIA

140 MT Technical grade (2003- 04)
(Source States / UT's)

9.2 (b) FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

Pendimethalin 30% E.C.:-Wheat, Rice (Transplanted) Cotton, Soybean, Chillies and groundnut.

9.3 .MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The group considered the information that its use is restricted in Sweden due to Persistent, high aquatic toxicity and potential for bioaccumulation. It has come to the notice of the group from the information obtained from the various parts of the country that the persistence is not much in Indian field conditions

Considering the facts the group recommended the following :-

9.4 RECOMEN DATIONS

3. Use of Pendimethalin may be continued.
4. The label and leaflet should bear the safety precaution that it should not be used in the areas where pisciculture /aquaculture is practiced along with rice cultivation.

10. QUINALPHOS

Quinalphos is moderately hazardous (group II) organophosphorous Insecticide as per WHO recommended Classification of Pesticides by Hazard 2004

10.1 THE BAN/ RESTRICTION STATUS INTERNATIONALLY

It is restricted in Korea for transportation, sale and , storage as it is highly hazardous and have high acute toxicity

10.2 THE PRESENT STATUS OF THE PESTICIDE USE IN INDIA

10.2 (a) PESTICIDE CONSUMPTION IN INDIA

1650 MT Technical grade (2003- 04)
(Source States / UT's)

10.2 b FORMULATIONS REGISTERED AND THEIR LABEL CLAIMS:-

(i) Quinalphos 5% GR :- Sugarcane,Sorghum,Paddy

(ii) Quinalphos 25% EC: Paddy, Sorghum, Wheat, Pulses, Bengalgram, Black gram, Frenchbean, Red gram, Soybean, Sugarcane, Fibre Crop, Cotton, Jute, Oilseeds, Groundnut, Mustard, Seasmum, Vegetable, Bhindi, Brinjal, Cabbage, Cauliflower, Chillies Onion, Tomato, Fruit Trees, Apple, Banana, Citrus, Mango, Pomogranate, Cardamom, Coconut, Coffee, Tea

(iii) Quinalphos 1.5% D.P.: Cereals, Paddy, Sorghum, Pulses, Gram, French bean, Red gram, Soybean, Fibre Crops, Cotton, Oilseeds Groundnut, Safflower, Vegetable, Chillies.

10.3 MAJOR CONCERNS OF THE COMMITTEE REGARDING CHEMISTRY, TOXICITY, RESIDUE PERSISTENCE AND RESISTENCE.

The group noted that it is restricted in Korea for transportation, sale and storage as it is highly hazardous and have high acute toxicity. There are International information about testicular and spermatotoxic effects of the pesticide or its metabolites and certain chronic nervous system effect. It is used in the limited part of the world specifically and not used in China and USA. The group also noted that studies conducted under All India Coordinated Research Project on Pesticide Residue, shows that Quinalphos is safe for use and there is no residue risk.

The group was satisfied by the information provided by the industry (Presentation made by the industry at Annexure – III- E) regarding residues and the spermatotoxic effect of Quinalphos that the dose tested in the study is very high and not relevant in the practical situation . Regarding the effect on nervous system the industry stated that Quinalphos have no potential to produce neurotoxicity. However the group was not fully satisfied and desired that to confirm it further studies may be carried out on the nervous system. To the specific query raised about use in limited part of the world the commercial reasons given by industry seems to be logical. Considering the facts the group recommended the following:

10.4 RECOMMENDATIONS

1. Use of Quinalphos may continued
2. The label and leaflet should bear the safety precaution that it should not be used in the areas where pisciculture/aquaculture is practiced along with rice cultivation.
3. The group suggested that the studies be undertaken by the registrants to confirm that it does not have neurotoxic concern.

Annexure I

**Review of various pesticides which are banned/ restricted in other countries
but are being used in India**

S.No.	Name of Pesticides	S.No.	Name of Pesticides
1	Monocrotophos ✓	20	Dinocap ✓
2	Mancozeb ✓	21	Ethofenprox (Etofenprox) ✓
3	Quinalphos ✓	22	Metoxuron ✓
4	Butachlor ✓	23	Trifluralin ✓
5	Diclorvos (DDVP) ✓	24	Chlorofenvinphos ✓
6	Acephate ✓	25	Fenpropathrin ✓
7	Fenitrothion ✓	26	Iprodione ✓
8	Carbendazim ✓	27	Benfuracarb ✓
9	Atrazine ✓	28	Bifenthrin ✓
10	Pendimethalin ✓	29	Dazomet ✓
11	Deltamethrin (Decamethrin) ✓	30	Diflubenzuron ✓
12	Fenthion ✓	31	Kasugamycin ✓
13	Simazine ✓	32	Linuron ✓
14	Metaaldehyde ✓	33	Mepiquate Chloride ✓
15	Diazinon ✓	34	Propergite ✓
16	Carbosulfan ✓	35	Propineb ✓
17	Chlorothalonil ✓	36	Thiodicarb ✓
18	Dalapon ✓	37	Trichlorofon ✓
19	Thiophanate-Methyl ✓		

Phenitrothione

The terms of reference of the Expert Group ;

- I. To review toxicity, persistence, safety in use and substitute available of 37 pesticides (List at APPENDIX I) and make recommendations for their continued use or restricted use or phasing out in the country.
- II. The review may be done in phased manner. In the first phase those pesticides whose consumption is more than 100 MT per annum, may be reviewed. In the next phase pesticide whose consumption is between 99- 11 M.T. and in the third phase whose consumption is less than 10 M.T or data not available may be reviewed. [As per the pesticide consumption information 2003-2004, the pesticide to be reviewed in different phases are indicated in the enclosed list at APPENDIX II.]
- III. The Expert group can co-opt any Member for conducting the business.
- IV. The group may evolve its own procedure and methodology of functioning and call for any relevant data from any department of the Central / State Government / Private Organization/persons etc.
- V. The TA/DA of the Members of the Expert Group will be met by the Organizations from where their pay is being drawn.
- VI. The expert group may give the report within six months for the pesticide to be reviewed in the first phase, in the next 6 months for pesticides to be reviewed in the second phase and further 6 months in the third phase.

S.No.	Name of the Pesticide	Consumption (M.T) Tech. Grade year 2003-04
1	Monocrotophos	3115 *
2	Mancozeb	2615 *
3	Quinalphos	1650 *
4	Butachlor	1520 *
5	Diclorvos (DDVP)	818 *
6	Acephate	440 *
7	Fenitrothion	412 *
8	Carbendazim	400 *
9	Atrazine	315 *
10	Pendimethalin	140 *
11	Deltamethrin (Decamethrin)	83 **
12	Fenthion	62 **
13	Simazine	45 **
14	Metaaldehyde	42 **
5	Diazinon	40 **
16	Carbosulfan	35 **
17	Chlorothalonil	35 **
18	Dalapon	17 **
19	Thiophanate-Methyl	15 **
20	Dinocap	13 **
21	Ethofenprox (Etofenprox)	11 **
22	Metoxuron	10 **
23	Trifluralin	10 **
24	Chlorofenvinphos	8 ***
25	Fenpropathrin	0 ***
26	Iprodione	0 ***
27	Benfuracarb	Data Not Available ***
28	Bifenthrin	Data Not Available ***
29	Dazomet	Data Not Available ***
30	Diflubenzuron	Data Not Available ***
31	Kasugamycin	Data Not Available ***
32	Linuron	Data Not Available ***
33	Mepiquate Chloride	Data Not Available ***
34	Propergite	Data Not Available ***
35	Propineb	Data Not Available ***
36	Thiodicarb	Data Not Available ***
37	Trichlorofon	Data Not Available ***

1999-2000

1999-2000

- * Proposed to be reviewed in the first phase
 ** Proposed to be reviewed in the second phase
 *** Proposed to be reviewed in the third phase

CONSUMPTION OF INDIGENOUS PESTICIDES IN AGRICULTURE FOR THE LAST FIVE YEARS (1999-2000 TO 2003-2004)

S. No.	Pesticides	Group	M.T. (Tech. Grade)				
			1999-2000	2000-01	2001-02	2002-03	2003-04
1.	Acaphate	i					
2.	Cypermethrin	i	697	674	750	782	440
3.	Dichlorvos	i	957	1033	1300	1315	32
4.	Dimethoate	i	971	1021	1070	1250	313
5.	Endosulphan	i	1505	1277	1500	2009	625
6.	Ethion	i	3170	2320	3985	2000	2900
7.	Fenitrothion	i	239	385	415	410	315
8.	Fenthion	i	239	385	415	410	412
9.	Fenvalerate	i	34	38	60	79	62
10.	Lindane	i	695	1085	2100	1192	975
11.	Metal Dehyde	i	607	683	700	615	—
12.	Malathion	i	42	48	32	40	07
13.	Methyl Parathion	i	2635	2486	2600	2384	3015
14.	Monocrotophos	i	2705	2639	3008	3023	3200
15.	Neem based insecticides	i	3496	2680	2815	3205	3115
16.	Oxydemeton methyl	i	739	551	736	632	324
17.	Paradichloro-benzene	i	432	384	512	382	213
18.	Phorate	i	0	0	0	0	1
19.	Phosalone	i	2006	2133	2215	2316	3010
20.	Phosphamidon	i	224	185	218	275	145
21.	Pyrethrum	i	1748	1023	1100	1020	1430
22.	Quinalphos	i	10	10	13	10	11
23.	Sevidol	i	1906	1858	2181	2318	1650
24.	Temephos	i	0	0	0	0	0
25.	Triazophos	i	0	0	0	0	1
26.	Aureofungin	f	107	118	114	108	115
27.	Captafol/Difolaton	f	10	6	8	5	12
28.	Captan	f	144	227	419	344	15
29.	Carbendazim	f	218	156	170	256	200
30.	Copper Oxychloride	f	514	464	625	359	400
31.	Copper Sulphate	f	1081	955	1122	1213	1030
32.	Cuprous Oxide	f	592	692	1042	1128	514
33.	Ethyl Mercury Chloride	f	2	0	5	2	5
34.	Ferbam	f	0	0	0	0	0
35.	Lime Sulphur	f	15	10	25	9	12
36.	Mancozeb	f	16	22	32	45	20
37.	MEMC	f	2200	1939	2577	2800	2615
38.	Organo Mercurials	f	85	87	71	81	22
39.	Nickel Chloride	f	0	0	0	0	0
40.	Paris Green	f	21	40	55	60	0
41.	PMA	f	0	0	0	0	0
42.	Streptocycline	f	0	0	0	0	0
43.	Sulphur	f	0	0	0	0	0
		f	26	31	39	47	20
			1989	2083	2332	3185	3010

44.	Thiram	f	405	403	419	402	302
45.	Zineb	f	215	213	318	418	205
46.	Ziram	f	194	192	277	385	100
47.	Alachlor	h	153	123	142	150	95
48.	Anilophos	h	380	402	535	716	200
49.	Butachlor	h	2332	2161	2019	2480	1520
50.	Dalapon	h	11	51	72	85	17
51.	2,4-D	h	680	678	612	680	612
52.	Diuron	h	11	5	12	11	10
53.	Fluchloralin	h	105	149	155	213	115
54.	Glyphosate	h	178	154	180	178	162
55.	Isoproturon	h	2649	2742	2512	2618	2208
56.	Paraquat Dichloride	h	113	165	110	156	70
57.	Propanil	h	0	0	0	0	30
58.	TCA	h	0	0	0	0	15
59.	Aluminium Phosphide	r	250	265	234	250	142
60.	Barium Carbonate	r	0	0	0	0	0
61.	EDCT Mixture	r	0	0	0	0	0
62.	EDB	r	22	18	18	23	0
63.	Methyl bromide	r	5	2	4	7	7
64.	Warfarin	r	4	4	6	10	1
65.	MB+FDB	r	0	0	0	0	0
66.	Zinc Phosphide	r	207	223	220	359	215
67.	Alpha naphthyl acetic acid	pg	41	27	18	19	25
68.	Chlormequat chloride	pg	4	5	12	4	10
69.	Others		734	604	0	0	0
	TOTAL:	Indegen- ious	41101	38796	43800	45130	37352

Source: States/UTs

Note: i - Insecticide
 f - Fungicide
 h - Weedicide
 r - Rodenticide
 fm - Fumigants
 pg - Plant growth regulator
 mp - Misc. pesticides

CONSUMPTION OF IMPORTED PESTICIDES DURING THE LAST FIVE YEARS
(1999-2000 TO 2003-2004)

Sl. No.	Pesticides	Group	M.T. (Tech. Grade)				
			1999-2000	2000-01	2001-02	2002-03	2003-04
1.	Aldicarb	i	0	0	0	0	0
2.	Allethrin	i	20	11	5	8	9
3.	Alpha cypermethrin	i	30	27	7	10	12
4.	Bacillus thuringiensis	i	135	132	166	143	157
5.	Carbaryl	i	611	543	155	219	273
6.	Carbofuran	i	589	786	419	308	500
7.	Carbosulfan	i	133	29	17	20	35
8.	Cartap hydrochloride	i	56	63	34	26	29
9.	Cyfluthrin	i	0	0	0	0	5
10.	Chlorfenvinphos	i	4	18	7	6	8
11.	Chlorpyrifos	i	912	929	718	825	1161
12.	Cyphenothrin	i	0	0	0	0	8
13.	Deltamethrin	i	166	136	106	96	33
14.	Diazinon	i	62	63	31	35	40
15.	Dicofol	i	357	110	73	56	52
16.	Ethofenprox	i	11	10	2	5	11
17.	Formothion	i	57	35	10	3	8
18.	Febabucarb (EPMC)	i	11	27	8	9	6
19.	Fenpropathrin	i	1	0	0	0	0
20.	Fipronil	i	11	40	10	7	13
21.	Fluvalinate	i	9	10	6	7	7
22.	Lamdocyahalothrin	i	16	83	35	5	28
23.	Methomyl	i	55	66	41	41	10
24.	Permethrin	i	12	4	41	38	3
25.	Phenthoate	i	84	4	2	4	35
26.	Propoxur	i	1	52	38	57	0
27.	Propstempfos	i	0	2	1	1	0
28.	Profenfos	i	0	0	0	0	45
29.	Thiometon	i	35	82	60	39	1
30.	Bencmyl	f	3	2	1	1	13
31.	Bitertanol	f	21	31	10	12	3
32.	Carboxin	f	2	1	1	2	10
33.	Chlorthalonii	f	23	29	14	12	15
34.	Dodin	f	35	27	16	12	6
35.	Dithianon	f	33	35	16	27	0
36.	Dinocap	f	0	12	2	1	0
37.	Ediphenphos	f	14	17	6	8	13
38.	Fosetyl-Al	f	57	37	12	19	20
39.	Hexaconazole	f	35	53	22	25	18
40.	Iprodione	f	26	37	14	17	14
41.	Isoprothiolane	f	1	37	9	7	0
42.	Kitazin	f	4	0	0	0	7
43.	Kasugamycin	f	78	16	11	6	70
			0	69	63	68	10
			17	3	8		

44.	Metolachyl	f	28	32	25	21	6
45.	Penconazole	f	i	1	1	0	0
46.	Propiconazole	f	26	16	7	6	9
47.	Tridemorph	f	269	280	115	125	120
48.	Thiophenate methyl	f	31	40	20	19	15
49.	Triademefon	f	9	18	13	11	1
50.	Tricyclazole	f	13	16	6	15	11
51.	Validamycin	f	2	1	2	1	3
52.	Atrazine	h	340	330	390	325	315
53.	Benthiocarb	h	98	112	147	140	135
54.	Methabenzthiazuron	h	9	0	0	0	8
55.	Mecanuron	h	25	25	42	38	10
56.	Metribuzin	h	2	0	0	0	0
57.	Metolachlor	h	0	0	0	0	2
58.	Oxadiazon	h	2	4	8	8	3
59.	Oxylargyl	h	0	2	3	5	2
60.	Oxyfluorfen	h	6	3	5	2	6
61.	Pendimethalin	h	161	126	130	149	140
62.	Partilachlor	h	31	12	15	12	13
63.	Simazine	h	84	42	55	64	45
64.	Triallats	h	0	0	0	0	1
65.	Trifluralin	h	8	13	7	11	10
66.	Bromodiolone	r	74	47	79	83	50
67.	Ethepon	pg	7	5	3	1	0
68.	Giberallic Acid	pg	10	13	12	10	15
69.	Meleic hydrazide	pg	6	0	0	0	0
70.	DD Mixture	n	0	0	0	0	0
71.	Others	n	101	9	0	0	0
	TOTAL:	Imported	5094	4788	3220	3220	3668
		Indegenious	41101	38796	43800	45130	37352
	Grand Total:		46195	43584	47020	48350	41020

Source: States/UTs

Note: i - Insecticide
 f - Fungicide
 h - Weedicide
 r - Rodenticide
 fm - Fumigants
 pg - Plant growth regulator
 mp - Misc. pesticides

ATRAZINE

Presentation Made to :
**EXPERT GROUP ON PESTICIDE
REVIEW
NEW DELHI, 6TH FEB. 2006**

CONCERNS ON ATRAZINE

- 1. Suspended in some countries due to high mobility in soil and has potential for contamination of ground water**
- 2. Shown to cause serious effects in frog at much lower level of this pesticide in water bodies in United States**

**CONCERN-1
(LIMITED TO FEW EU COUNTRIES)**

EU COUNTRY	REASON FOR BAN/RESTRICTION
SWEDEN	High mobility in soil and potential for contamination of water
GERMANY	High mobility and high persistence in soil. Suspected of having harmful effects on ground water and drinking water
DENMARK	Mobile and persistent and have caused ground water pollution over the limits on drinking water
NORWAY	High persistent and Risk of water pollution

3

**CONCERN-1
(High mobility, potential for GW contamination)
EUROPEAN Vs INDIAN PERSPECTIVE**

MAIN REASON FOR WATER CONTAMINATION

> Soil Erosion

EU

1. 115 Million hectare of European soil are suffering from water erosion.
2. 42 million hectare from wind erosion.
3. Sweden, Norway and Denmark : Water erosion is main problem.
4. Europe has suffered various degree of soil erosion by water and wind.

India

Not an Issue in India with respect to Atrazine (Sugarcane & Maize)

Contd.....

4

CONCERN-1
(High mobility, potential for GW contamination)
EUROPEAN Vs INDIAN PERSPECTIVE

MAIN REASON FOR WATER CONTAMINATION

➤ **Persistence**

EU

Dry and cold climatic conditions ($t_{1/2}$: 160 – 180 days)

India

Low persistence due to high temperature & subtropical conditions
($t_{1/2}$: about 30 days)

Contd... 5

CONCERN-1
(High mobility, potential for GW contamination)
EUROPEAN Vs INDIAN PERSPECTIVE

MAIN REASON FOR WATER CONTAMINATION

➤ **Application**

EU

Frequent and high rates of application 2.5 to 10 lbs/acre (2.8 to 11.5 kg a.i./ha)

India

Single and very low rates of application (Single application @ 0.5 to 2.0 kg a.i. / ha)

6

CONCERN-1
(High mobility, potential for GW contamination)
EUROPEAN Vs INDIAN PERSPECTIVE

MAIN REASON FOR WATER CONTAMINATION

➤ **Use**

EU

Wider use –Maize, plantation, forestry and non-cropped

India

Narrow application window (Sugarcane and Maize)

7

CONCERN-1
(High mobility, potential for GW contamination)
EUROPEAN Vs INDIAN PERSPECTIVE

MAIN REASON FOR WATER CONTAMINATION

➤ **Method of application**

EU

**Aerial, Air blast applicartion, Backpack sprayer, Belly grinder,
Ground boom, Handgun (hydraulic
sprayer)**

India

Only spray application.

8

CONCERN-1
(High mobility, potential for GW contamination)
EUROPEAN Vs INDIAN PERSPECTIVE

MAIN REASON FOR WATER CONTAMINATION

➤ **Use pattern**

EU

In the vicinity of water bodies

India

Away from water bodies

➤ **Water table**

EU : Shallow

India : Deep

9

CONCERN-1

High mobility, potential for GW contamination



Not a issue from Indian Perspective



Insignificant, if any quantity of Atrazine will be available in the soil for subsequent movement through soil to groundwater due to faster degradation, low rates of application, single spray application limited only to Maize and Sugarcane (high retention and adsorption in heavy soils), deep water table and no use in the vicinity of water bodies and hence no possibility of reaching or contaminating the water bodies

10

CONCERN-1

High mobility, potential for GW contamination



Not an issue from Indian Perspective



- Monitoring studies conducted during 1997 in major Atrazine using Sugarcane areas of Karnataka, Tamilnadu & Andhra Pradesh.
- Findings : This herbicide was not detected in soil and groundwater, inspite of the repeated, regular application of Atrazine over 20 years.

(Ref. Pestology, Vol. XXI, No. 4, 7 & 9, 1997)

- In the monitoring studies reported so far, Atrazine has not been reported any where.

11

CONCERN-2

(EFFECTS IN FROG IN WATER BODIES IN US)

USE OF ATRAZINE IN USA - FACTS

- US-EPA conclusion on Amphibians (Frogs) -
Based on a comprehensive evaluation of the available studies (in the open literature along with studies submitted by registrant) regarding the potential effects of Atrazine on amphibian gonadal and laryngial development in frogs, the Agency concluded that the current line-of-evidence did not show that Atrazine produced consistent, reproducible effects across a range of exposure concentrations and amphibians species tested.

12

CONCERN-2

EFFECTS IN FROG IN WATER BODIES IN US

↓
NOT A ISSUE FROM INDIAN PERSPECTIVE

↓
No "contamination" of water bodies due to use of Atrazine in India

No possibility of exposure of frogs to Atrazine due to its use pattern (limited to only sugarcane and maize) in India

No conclusive evidence on effects in frogs in water bodies due to Atrazine

13

USE OF ATRAZINE GLOBAL VS. INDIAN PERSPECTIVE

Crop :

- USA : Corn, Sorghum, Sugarcane
- India: Sugarcane, Maize

Quantum of use :

- USA: 74.8 million lbs a.i. (34000 tonnes) Source: EPA data 1999-2000)
- India: 400-450 tonnes a.i.

Rate of Application:

- USA: 2.8 to 11.5 kg a.i. / ha
- India : 0.5 to 2.0 kg / ha ;

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**USE OF ATRAZINE
GLOBAL VS. INDIAN PERSPECTIVE**

□ Supported Atrazine Uses:

> Applied by:

- | | |
|-------------------------------|---|
| - Air | - High-pressure sprayer |
| - Air blast sprayer | - Low-pressure sprayer (handwand) |
| - Backpack sprayer | - Right-of-Way Sprayer |
| - Belly grinder | - Spreaders (push-type & tractor-drawn) |
| - Ground boom | |
| - Handgun (hydraulic sprayer) | |

□ Generally applied at the rate 2.5 to 10 lbs/acre (2.8 to 11.5 kg a.i./ha) per crop cycle on Corn, Sorghum, Sugarcane.

□ In India used as single spray application on Sugarcane and Maize at the rate of 0.5 to 2 kg a.i./ha using Knapsack sprayer

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**USE OF ATRAZINE
GLOBAL VS. INDIAN PERSPECTIVE
ATRAZINE REGISTRATION STATUS - DEC. 2005**

Argentina	Dominican	Mexico	Turkey
Australia	Ecuador	Morocco	Ukraine
Barbados	Egypt	Nicaragua	USA
Belarus	El Salvador	Nigeria	Uruguay
Belize	Ethiopia	Pakistan	Vietnam
Benin	Guatemala	Panama	Venezuela
Bolivia	Guinea	Paraguay	Zambia
Brazil	Guyana	Peru	Zimbabwe
Bulgaria	Honduras	Philippines	
Cameroon	India	Poland	EU Ess. Uses:
Canada	Iran	Serbia and	Ireland
Chile	Iraq	Slovak Rep.	UK
China	Japan	South Africa	Spain
Colombia	Kenya	Sudan	Portugal
Costa Rica	Korea (S)	Switzerland	Hungary
Cote d'Ivoire	Madagascar	Tanzania	Poland
Croatia	Malawi	Thailand	
Cuba	Malaysia	Trinidad/Tobago	
	Mauritius		

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**USE OF ATRAZINE
GLOBAL VS. INDIAN PERSPECTIVE**

- Registered in over 60 countries including India
- Essential for economic & efficient weed control in maize: use in numerous mixtures (in India major use on long duration Sugarcane crop)
- No country has banned Atrazine for safety reasons
- Review in the EU:
 - Safety to humans confirmed
 - Safety to the aquatic environment confirmed
 - Safe use confirmed by essential uses
- Review in the USA : - Safe use confirmed & Registration maintained
- Review in Canada :- Safe use confirmed & Registration maintained
- Review in Australia:- Safe use confirmed & Registration maintained

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ATRAZINE IN INDIAN CONTEXT

- Major use in Sugarcane/Maize, which are grown on heavy soil, where the movement of Atrazine is minimal and ground water contamination is unlikely. Hence, no potential for ground water contamination and risk to frogs.
- Most effective and cheapest for the management of weeds in Sugarcane and Maize.
- Five decades of Atrazine have shown excellent efficacy, safety and cost effectiveness to farmers.

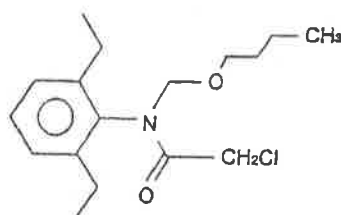
18

THANK YOU

Butachlor:

A

*Global Cost-Effective Rice
Herbicide*



Overview

- Nomenclature & Regulatory Status
- Use pattern in India
- Extensive review in Japan
- Toxicity Profile & MRL
- Review point: Facts from Korea
- Other pesticides with word of precaution
- Summary
- Humble submission

Nomenclature

- Generic name : *Butachlor*
- Chemical name: *2-chloro-2',6'-diethyl-N-butoxymethylacetanilide (IUPAC)*
- Major trade names:
Machete, Butataf, Dhanuchlor,
Rasayanchlor, Trap, Wiper

Regulatory Status

- Registered in 27 rice growing countries including China, Japan, Korea and Latin American countries since early 1970's.
- Pre-emergent cost effective control of annual grasses and sedges plus some broad leaved weeds in transplanted and direct seeded rice.
- Registered in India Since 1975
- >100 Indian companies manufacturing and selling Butachlor formulations.
- Formulation registered in India are 50 EC, 50 EW & 5G

Butachlor use pattern In India:2005
(In Lakh liters)

Punjab	30.0
Uttar Pradesh	9.0
Haryana	7.0
Krnataka	4.0
Tamilnadu	3.0
Andhra Pradesh	3.5
Bihar	1.5
Others	5.0
Total	63.0

> 70 % Use pattern Indicates consumption in three Northern States

**Extensive Review by Japanese
Authorities (1999)**

- Toxicology
- Metabolism and Environmental Fate
- Eco-toxicology
- Crop residue
- ADI established in 1999
- *ADI established in Japan: 0.01 mg/kg/day based on rat chronic NOEL 1 mg/kg/day and safety factor of 100*
- *Use continue in rice fields after review in Japan*

Butachlor Toxicology Profile

- **Low acute toxicity: Rat Oral LD50 = 2000 mg/kg b.w.**
- **No reproductive or teratogenic effects**
- **Not mutagenic**
- **Carcinogenic to Sprague-Dawley strain of rat (nasal, thyroid and stomach) at highly toxic levels (>MTD)**
- **Not carcinogenic to Fischer-344 strain of rat**
- **Not carcinogenic to mouse**
- **Fish toxicity range is LC50 0.5-1.5 mg/L**

Human Safety Conclusions

- **Butachlor not genotoxic**
- **Species differences in metabolism important**
- **Threshold-based, non-genotoxic mechanisms responsible for tumor formation in rats**
- **Mechanisms of rat tumor formation accepted by US EPA and Japan MHW in the process safety review**
- **Potential human exposure is very low**
- **Margins of safety are high and potential risk is low**
-

Butachlor MRLs

Japan :	Rice	0.1 ppm
Korea :	Rice	0.1 ppm
	Barley	0.1 ppm
Taiwan :	Rice	0.5 ppm
India :	Rice	0.5 ppm

Restriction vs word of precaution for Butachlor

A word of precaution was suggested in Korean label for all pesticides with class-II:

Do not EXTENSIVELY use this chemical in such areas of concern where there is a fish farm, irrigation reservoir, sea area etc at close range.

Korean Product Label:

사용방법

1. 논에 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
2. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
3. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
4. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.

주의사항

1. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
2. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
3. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
4. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.

특징

1. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.
2. 살포할 때 물이 차고 논이 젖은 상태에서 살포한다.

부타클로르

400g

부타클로르

Butachlor

00301-01

Korean Fish Toxicity Regulations

- Class I: Not allowed in rice paddy
Carp 48hr LC50 <0.5 mg/L
- Class II: Allowed in rice paddy with
precautionary statement on the label
Carp 48hr LC50 =or>0.5 and <2.0 mg/L
- Class III: Allowed in rice paddy
Carp 48hr LC50 >2.0 mg/L

The butachlor was categorized as fish toxicity class II.

Various other Pesticides categorized as Class-II with word of precaution in Korea

Herbicides:

Fenoxaprop-p-Ethyl
Pretilachlor
Cyhalofop-butyl
Ethoxysulfuron
Clomazone

Insecticides:

Chlorpyrifos
Diazinon
Ethofenprox
Carbofuron
Carbosulfan
Cartap hydrochloride
Pirimiphos-methyl
Fipronil

Fungicides:

Difenconazole
Propiconazole
Benomyl
Thiram
Edifenphos

Same precautionary language used in all the products.

Registered for use in India

Summary

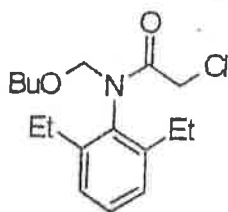
- Butachlor is a global cost effective rice herbicide registered in major rice growing countries since 1970's.
- MRL's established in Japan, Korea, Taiwan and India
- Korean regulation emphasizing to avoid extensive use of butachlor i.e. do not use more than recommended concentration in rice paddy.
- Concentrations in the environment do not reach toxic level for fish in reality

Submission

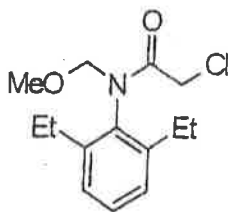
- Considering the Indian crop scenario the use may be continue as per existing label and leaflets
- The opinion from Directorate of Rice Research (DRR) on area under rice & fish cultivation should be considered before reaching any conclusion

Thank You

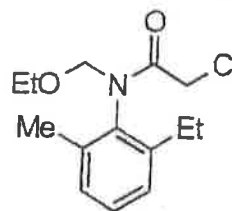
Acetanilide Chemical Structures



Butachlor



Alachlor



Acetochlor

Epidemiology Study

- Butachlor and alachlor produced at same Monsanto facility in Iowa for over 25 years
- Worker exposure is low but higher than that of general population or farmers
- Iowa State maintain cancer registry, providing excellent cancer records for general population
- Epidemiology study findings clearly demonstrate no increase in nasal, thyroid, stomach or any other cancer in worker population
- Study supports human safety of butachlor and alachlor

Swan et al(2003) on Alachlor effect on sperm quality(1)

- Correlation with reduced sperm quality?
- Very small scale preliminary study
- Dr Dana Barr (one of the author)commented in St Louis Dispatch, 27 october,2005
"In epidemiology, one study doesn't allow you enough evidence to conclude anything"
- Positive association with alachlor vs. negative correlation with acetochlor, another analogue
- 92% and 21% of Columbia, MO subjects urine contained mercapturate metabolites of alachlor and acetochlor, respectively.

Swan et al(2003) on Alachlor effect on sperm quality(2)

- Alachlor or acetochlor was absent in 99% drinking water wells(1992) and acetochlor was much more widely used in MO than alachlor at the time of Swan study.
- Monsanto survey on manufacturing workers who work directly with alachlor does not show any findings suggesting this effect.

**DICHLORVOS
(DDVP)
Regulatory Overview of Dichlorvos for India
Regulatory Concerns**

Presented by DDVP Manufacturers -

1. Aarti Industries Ltd.
2. Cheminova India Ltd
3. P I Industries Ltd.
4. Nagarjuna Agrichem Ltd.
5. Sudarshan Chemical Industries Limited
6. Syngenta Crop Protection Ltd.
7. Sabero Organics Gujarat Ltd.
8. United Phosphorus Ltd.

Concerns for DDVP

- It is banned in the sub-tropical countries because it is assessed to be carcinogenic in category 3.
- Its use was restricted in Sweden due to mutagenic properties.
- The formulated products are highly acute toxic.

Concerns for DDVP

- ANGOLA :Vapona 24 EC is banned for use because its content of active ingredient is less than required.- **This formulation is banned, but may be other formulation (s) are in use.**
- Fiji : Potential health hazards, Banned for all uses. No uses are allowed.
- Kuwait : Harmful to health, Severely restricted. Use only till the flowering stage of plants.

Views / Comments :-

- The above countries are not agriculturally dominated country and are insignificant compared to India, therefore these concerns do not have any implication to Indian context

Concerns for DDVP

- Korea: High acute toxicity. Uses are strictly prohibited to rice plant.
 - South Korea restricts use of Dichlorvos in rice, but its use is permitted in citrus, grapes, tobacco, etc, totalling to 600 MT p.a.

Concerns for DDVP

- It is banned in the sub-tropical countries because it is assessed to be carcinogenic in category 3.
 - **IARC Designation Class 3 - Not classifiable for human carcinogenicity.**
 - Cancer bioassays studies has been carried out and only two studies from NTP in rat and mouse show an indication of carcinogenic effects (increase in mononuclear cell leukemia in the rat and an increase in fore-stomach tumour in the mouse). **This effect appear to be related to the corn oil vehicle.**
 - **Increase in mononuclear cell leukemia was confined to the male rat and not dose related**, did not show an earlier onset compared to the controls, had no effect on survival, and was within the range seen in historical controls.

Concerns for DDVP contd...

- It is banned in the sub-tropical countries because it is assessed to be carcinogenic in category 3.
 - Increase in forestomach tumours in mice was confirmed to the highest dose, occurred against a high background of hyperplasic and forestomach tumours in the control and was not confirmed in 10 other studies.
 - Sustained irritation from daily gavaging with the corn oil vehicle in conjunction with this high background, likely explains this response in the forestomach which does not exist in humans.

Concerns for DDVP

- It is banned in the sub-tropical countries because it is assessed to be carcinogenic in category 3.
 - US EPA 2000 conclusions on cancer bio-assay.
 - **Belgian health council** downgraded its classification of Dichlorvos towards non classifiable with regard to cancer in man.
 - **Australian Review Committee** has made an observation that the rodent gavage studies were not considered relevant to the assignment of risk to public health, on the weight of evidence it was concluded that Dichlorvos not considered to pose a carcinogenic risk to humans under expected exposure conditions in Australia.
 - Fore-stomach cancer not induced by DDVP hence not relevant to man
 - Mono-nuclear cell cancer of bone marrow not seen in man.

Concerns for DDVP

- Its use was restricted in Sweden due to mutagenic properties.
 - **In vitro** test systems, DDVP and / or its metabolites were genotoxic.
 - In all **in vivo** studies, DDVP have not been shown to be genotoxic in spite of positive reports from in-vitro studies .
 - Recommendations of the International bodies clearly state that "It is a mutagen in a brief microbial system, but there is no evidence of its mutagenicity in mammals for which it is rapidly degraded".

Concerns for DDVP

- The formulated products are highly acute toxic.
- Existing registration of technical and formulation (76%EC) belong to same toxicity category.
-

**DDVP Formulation
Risk Assessment of DDVP Formulation
(Through sources of Dietary (Food) exposure to Dichlorvos)**

• CIB / RC approved the uses of DDVP in Agricultural crops

Crops	Pests	Dosage(A.I.)
CEREAL		
Paddy	BPH	375
	Cut worm / Army worm,	500
	Leaf roller / folder,	500
Wheat	Caterpillar	500
PULSES		
Soybean	Leaf eating Caterpillar	225-300
Sugarcane	Pyrrilla	300
OILSEED		
Castor	Hairy Caterpillar	625
Groundnut	Red Hairy Caterpillar	375-750
Mustard	Painted Bug	500
Sunflower	Caterpillar,	500
	semi looper, cabbage looper	500
VEGETABLES		
Cucurbit	Red pumpkin beetle	500
FRUIT TREE		
Cashew	Apple borer	0.05%

**Dichlorvos Use in Asia based on data gathered and reported by
Kynetec Ltd, UK**

India 2004 Tonnes of Dichlorvos used as 760 g/l Product

Banana	20.3
Corn	38.1
Cotton	288.9
Grapes	14.2
Oil Seed	20.8
Pome Fruit	10.1
Pulses	280.8
Rice	604.9
Soya	33.0
Sunflower	19.6
Tea	85.1
Tobacco	19.7
Vegetables	319.0
Grand Total	1,754.50

**DDVP Formulation
Risk Assessment of DDVP Formulation
(Through sources of Dietary (Food) exposure to Dichlorvos)**

- DDVP is highly effective to control pests of Brown Plant Hopper in Rice, Pyrilla in Sugarcane, Hairy Caterpillar in Groundnut and Castor, Armyworm in Soybean and many insect pests on vegetables.
- DDVP is the only insecticide which provides both instant and quick knock down effects within a short period to control the extremely virulent pests.
- Government of India has established MRL (Maximum Residue Limit) for 2 mg in Rice.
- Residue data has been generated under Indian conditions for many crops and the residue is within acceptable limits.

Thank You

MONOCROTOPHOS

REVIEW ON CONCERNS & VIEWS FROM THE INDUSTRY

FEB. 06, 2006

Contents :

- Facts on Monocrotophos
- Previous reviews
- Regulatory actions taken
- Present concerns
 - High acute toxicity
 - PIC list
 - Endocrine disruption
 - Implementation on ban on vegetables
 - Poisoning cases
 - Application Technology
 - Alternatives

MONOCROTOPHOS : FACTS

- Introduction : 1969
- Production capacities : > 14,000 MT tech/year
- No. of technical products : 11
- No. of formulators : >150
- Availability of raw materials : Available locally, backward integrated
- Domestic usage : > 8000 MT tech.

MONOCROTOPHOS : FACTS

- Export : > 1500 MT tech.
- Value of exports : Rs. > 100 crores
- Investments : Rs. > 300 Cr.
- Direct employment : 6000 persons
- Indirect employment : 20,000 persons
- Total share of market \approx 12% of insecticides
- Product of responsible, ethical companies with product stewardship

Common Concerns

List of Countries Where Use of Monocrotophos is Approved

Angola	Colombia	Haiti
Argentina	Costa Rica	Honduras
Bangladesh	Dominican Republic	India
Bolivia	Ecuador	Indonesia
Brazil	Egypt	Iran
Bulgaria	El Salvador	Israel
Cameroon	Ethiopia	Italy
Chile	France	Ivory Coast
China	Greece	Japan
Cuba	Guatemala	Jordan

Contd...

Common Concerns

List of Countries Where Use of Monocrotophos is Approved

Korea	Philippines	Tanzania
Malaysia	Poland	Thailand
Mexico	Romania	Tunesia
Morocco	Somalia	Turkey
Mozambique	South Africa	Uruguay
Nicaragua	Spain	Venezuela
Panama	Sudan	Vietnam
Paraguay	Surinam	Yugoslavia
Peru	Taiwan	Zimbabwe

**MONOCROTOPHOS : Previous Reviews
with same objective – restricted in other
countries but used in India**

- ❖ Dr. Bami committee - 1994 - Continued use
- ❖ Dr. Raman Committee - 1996 – Continued use
Restriction on vegetables
- ❖ Registration Committee 2004 – Enforceability of
restriction on Vegetables and consequent ban
- ❖ No further additional adverse effects

MONOCROTOPHOS: Regulatory actions taken

- Label directions : “Not for use on Vegetables”
- Deletion of label claims on vegetables
- Ban on use on vegetables
- DRP Recommendations on MRLs and label claims
- All the members of Industry complied with

MONOCROTOPHOS : Present Concerns

1. High acute toxicity :

- Acute hazard to be mitigated
- Properly labeled
- 35 years of use as a proof of no known risk
- Monocrotophos tech is classified by WHO under class 1b
- In other countries 60% formulation of Mono was widely used against 36% formulation approved in India
- Raman committee observed " due to its lower strength formulation 36% SL it has comparative margin of safety."

MONOCROTOPHOS & inclusion in PIC

Prior Informed consent (PIC) listing is not relevant to this review.

- PIC relates only to export of chemicals and import of the same which should be after permission from Designated National Authority. It does not pertain to local manufacture and sale in a manufacturing country
- The PIC convention states "*listing of chemical in annex III is not a recommendation to ban or severely restrict its use -It is not intended that these chemicals automatically subject to National regulatory actions to ban or severely restrict its use*"

MONOCROTOPHOS: Endocrine Disruption

- Mammalian toxicological studies reveal no treatment related histopathological changes in the endocrine organs viz. adrenals, pituitary, thyroid, parathyroid, pancreas, gonads and accessory sexual organs, in the subacute and long term/carcinogenicity studies;
- Further, observations on no effects on reproduction, fertility and lactation performance, Monocrotophos does not give any indication of endocrine disruption.

MONOCROTOPHOS : Endocrine Disruption

- The source of the concern is not known, requested to provide details to respond.
- Internet search reveals that, Monocrotophos is not in the suspected list of endocrine disruptors, as per : UK EA, DEFRA, GETA, EU, OSPAR, & WWF. (ref: Pesticide Action Network, UK)

MONOCROTOPHOS :

Difficulties in Enforcement of the ban on vegetables

- Industry was issued show cause notice : " Restriction on use of Monocrotophos on vegetable is not practically enforceable, and has resulted in higher residues and why use should not be banned in agriculture"
- Industry presented the case to RC during October'04 and RC observed : "The data submitted by the industry satisfies the concern raised in the show cause notice. Therefore there is no reason to recommend the ban this product on this account"
- Hence the above concern is satisfied.

MONOCROTOPHOS – Poisoning Cases

- There are no specific case attributable to direct poisoning by Monocrotophos
- The Health records of workers in the manufacturing and formulation units do not show any ill effects
- This is considered remarkable in view of its large use in India during the last >3 decades

MONOCROTOPHOS : Application Technology

- Apprehension on misuse by different application technology- details not known to address the concern
- Monocrotophos used only in its 36% SL formulation and is meant only for foliage spray using a high volume sprayers – only which is approved and practiced
- No other/different method is recommended.

MONOCROTOPHOS : Alternatives ?

- The concept of “ better alternatives” needs to be defined.
- Farmers must be given alternatives.
- Alternate products have been present since the beginning.
- No broad spectrum, equally effective, cheap and farmers friendly product available.

Monocrotophos: Status of Ban / Restriction in other Countries

- USA : Voluntariely Withdrawn
 - Sales permit expired in 1979
 - Manufactured & sold until 1989
 - EPA asked Dupont to generate data on exposure to non target species, notably to birds
 - The cost of data generation forced the company to voluntariely withdraw the product in view of cost benefit analysis
- The use of product not being by aerial spray in India.
Such concerns are not applicable in our situation

Monocrotophos: Status of Ban / Restriction in other Countries

- Australia : All usages cancelled
- In absence of commitment by stakeholders to provide data necessary to allay these concerns, Australia's regulatory authorities concluded that there are reasonable grounds to cancel the registration of Monocrotophos

Thank You

- The presentation made by manufacturers of Monocrotophos is without prejudice to the rights and contentions raised in the petitions pending in the Hon'ble Court of Delhi by Crop Care Federation of India and will not be considered as waiver of the issues raised in the petition.

MONOCROTOPHOS : Regulatory Reviews in other Countries

- USA – DuPont – Re-registration – withdrawn due to commercial reasons
- EU & Australia – Stake holders did not support due to commercial reasons
- Other countries – although restricted for domestic use, freely exported. Emergency clearances (coconut/oil palm) always given.

QUINALPHOS

Review by Dr C.D. Mayee Committee

Information compiled by

- Syngenta India Ltd.
- Cheminova India Ltd.
- Gharda Chemicals Ltd.
- Sudarshan Chem. & Ind. Ltd.
- Aarati Industries Ltd.
- Ficom Organics Ltd.

By :
Dr K.N. Singh
Gharda Chemicals Ltd.

Quinalphos : Development and introduction

- 1969 – 70 : Introduction by Bayer A.G
- 1970 – 71 : Technology sold to Sandoz AG
- 1973 – 74 : Introduction against cotton bollworms in India by Sandoz AG
- 1975 onwards : Marketed in Pakistan, Sri Lanka, Malaysia, Indonesia, Bangladesh, S. Africa and Tanzania in field, vegetable and fruit crops.

Quinalphos : Concerns

Restricted use only in single country - Korea

Reasons

- Highly hazardous
High acute toxicity
- Restricted for transportation, sale, storage and use in rice

Remarks

Quinalphos is moderately hazardous
Toxicity class II, WHO

Because of rice-fish farming system not only Quinalphos but seventeen other insecticides are restricted due to their suspected toxicity to fishes.

Rice-fish farming system in India is not common unlike Korea hence, reasons for restrictions in Korea is not relevant under Indian conditions.

Quinalphos :Concerns

Use in the limited part of the world and specifically not used in China and USA

Sandoz (now Syngenta) did not register Quinalphos in China and USA mainly because of the commercial reasons and not any technical reason.

Quinalphos has been used successfully in India since 1974 and has remained a chemical of farmers' choice.

Quinalphos use is not limited to India only. It is being used in many other Asian countries viz. Pakistan, Sri Lanka, Malaysia, Indonesia and Bangladesh and in Africa region viz. South Africa and Tanzania.

Quinalphos :Concerns

Certain (??) Chronic Nervous system effect

Quinalphos has no potential to produce neurotoxicity, hence there is no concern.

> Quinalphos administered orally @ 32 mg/kg ($LD_{50} = 25$ mg/kg) in a group of 10 chickens protected with atropine.

- Initial symptoms : Limpness and slackness
- Recovery : Within 5 days
- Findings : No weight loss
(41 days observations) No paralysis
No histopathological changes in target tissues.

Conclusion: Quinalphos has no potential to cause neurotoxicity

Source : J. Pesticide Sci. (1991). 16 : 337-342

Quinalphos :Concerns

Testicular and spermatotoxic effects of Quinalphos and /or its metabolites

Reproductive toxicity

Data on three generation reproductive toxicity study in rat, no adverse effects were found in adult male and female parents and/or progeny for three generation. NOEL was found to be 0.5 mg/kg per day (maternal toxicity).

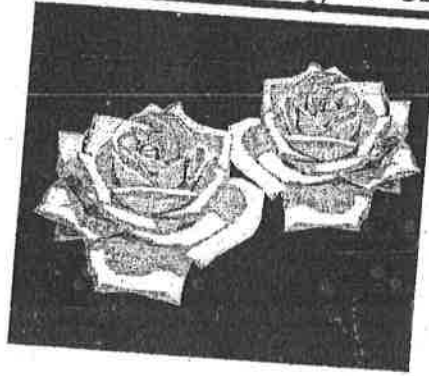
Quinalphos :Concerns

Testicular and spermatotoxic effects of Quinalphos and /or its metabolites

Following articles did not link Quinalphos to male infertility in human population.

- Effects of pesticides on male reproductive functions (2005), *Srinivasa et. al*, IJMS, 30, 153-159
- Effect of occupational exposures on male fertility (2003). *Sheiner et. al*. Industrial Health, 41, 55-62
- Toxic exposures & male infertility. Steven M. Schrader. National Institute for occupational safety & Health, page 1-10

Thank you



APPROVED USAGES OF FENTROTHION VIS-A-VIS ITS SUBSTITUTES

(Approved formulations: 50% EC, 40% WDP, 5% DP, 20% OL, 2% Spray)

Sl No.	Crop	Pest	Substitute(s)
1.	Paddy	Earhead bug	Fenthion 82.5 EC, Methyl parathion 50 EC and 2 DP
		Blue leaf hopper	Fenthion 82.5 EC, Monocrotophos 36 SL, Oxydemeton methyl 25 EC, Triazophos 20 EC
		Gall midge	Chlorpyriphos 20 EC, Diazinon 10 G and 5 G, Endosulfan 35 EC and 4 DP, Ethofenprox 10 EC, Fenthion 82.5 EC and 5 G, Fipronil 5 SC and 0.3 G, Methyl Parathion 50 EC
		Leaf folder	Chlorpyriphos 20 EC, Deltamethrin 25 Tab, Fenthion 82.5 EC, Fipronil 5 SC and 0.3 G, Methyl parathion 2 DP and 50 EC, Monocrotophos 36 SL, Phosalone 35 EC, Phosphamidon 85 SL, Quinalphos 25 EC, Triazophos 20 EC and 40 EC
		Plant hopper	BPMC 50 EC, Ethofenprox 10 EC, Fenthion 82.5 EC and 5 G, Triazophos 20 EC
		Rice hispa	Chlorpyriphos 20 EC, Endosulfan 4 DP and 35 EC, Malathion 5 DP, 50 EC and 95 ULV, Methyl parathion 50 EC, Phorate 10 G, Phosphamidon 85 SL, Triazophos 20 EC and 40 EC
		Stem borer	Chlorpyriphos 20 EC, Diazinon 10 G and 5 G, Endosulfan 35 EC and 4 DP, Ethofenprox 10 EC, Fenthion 82.5 EC, Fipronil 5 SC and 0.3 G, Methyl parathion 50 EC, Monocrotophos 36 SL, Phorate 10 G, Phosalone 35 EC, Quinalphos 25 EC and 5 G, Triazophos 20 EC and 40 EC
		Swarming caterpillar	
		Gall fly	Fenthion 82.5 EC
		Jassid	Diazinon 10 G and 5 G, Endosulfan 35 EC and 4 DP, Fenthion 82.5 EC
		Cutworm	Diazinon 10 G and 5 G
		Caseworm	Malathion 50 EC, Phenthoate 50 EC, Quinalphos 25 EC
		Skipper	Quinalphos 25 EC
		Thrips	
2.	Oilseeds	Grass hopper	Triazophos 40 EC
		Leaf webber	Diflubenzuron 25 WP, Quinalphos 25 EC
		Red hairy caterpillar	

3.	Cotton	Aphid	Acetamiprid 20 SP, Diafenthiuron 50 WP, Dimethoate 30 EC, Endosulfan 4 DP and 35 EC, Fenvalerate 20 EC, Fluvalinate 25 EC, Methyl parathion 2 DP, Thiomethoxam 70 WS, Thiometon 25 EC
		Bollworms	Alphacypermethrin 10 EC, Beta cyfluthrin 2.45 SC, Bifenthrin 10 EC, Deltamethrin 25 Tab, 2.8 EC and 1.8 EC, Endosulfan 4 DP, Ethion 50 EC, Fenpropathrin 10 EC and 30 EC, Fenvalerate 20 EC, Fluvalinate 25 EC, Methyl parathion 2 DP, Monocrotophos 36 SL, Thiodicarb 75 WP, Triazophos 40 EC
		Jassid	Acetamiprid 20 SP, Diafenthiuron 50 WP, Dimethoate 30 EC, Endosulfan 4 DP and 35 EC, Fenthion 82.5 EC, Fenvalerate 20 EC, Fluvalinate 25 EC, Methyl parathion 2 DP, Thiomethoxam 70 WS, Thiometon 25 EC
		Leaf roller	Endosulfan 4 DP and 35 EC
		Thrips	Endosulfan 4 DP and 35 EC, Fenvalerate 20 EC, Thiomethoxam 70 WS, Diafenthiuron 50 WP, Dimethoate 30 EC, Methyl parathion 2 DP
		Whitefly	Acetamiprid 20 SP, Bifenthrin 10 EC, Diafenthiuron 50 WP, Endosulfan 4 DP and 35 EC, Ethion 50 EC, Fenpropathrin 30 EC, Fenthion 82.5 EC, Thiomethoxam 70 WS, Triazophos 40 EC
		Red cotton bug	Fenthion 82.5 EC, Fluvalinate 25 EC
		Grey weevil	Dimethoate 30 EC
		4.	Castor
5.	Groundnut	Semi looper	
		Red hairy caterpillar	
		Leaf webber	
		Leaf miner	Deltamethrin 2.8 EC, Dimethoate 30 EC
6.	Brinjal	Aphid	Endosulfan 4 DP, Thiometon 25 EC
7.	Chillies	Thrips	Dimethoate 30 EC, Ethion 50 EC, Fenthion 82.5 EC, Fipronil 5 SC, Formothion 25 EC, Monocrotophos 36 SL, Oxy-demeton methyl 25 EC, Phorate 10 G, Phosalone 25 EC, Phosphamidon 85 SL,
8.	Onion	Thrips	Fenthion 82.5 EC, Dimethoate 30 EC
9.	Potato	Jassid	Endosulfan 4 DP
10.	Tomato	Fruit borer	
11.	Coffee	Green bug	Fenthion 82.5 EC

		Hairy caterpillar	Fenthion 82.5 EC
		Mealy bug	Fenthion 82.5 EC
12.	Tobacco	Aphid	
13.	Sugarcane	Pyrilla	Chlorpyriphos 20 EC, Endosulfan 4 DP, Malathion 50 EC and 95 ULV, Monocrotophos 36 SL
		Borers	Endosulfan 4 DP, Fipronil 5 SC and 0.3 G
14.	Apple	Beetle scale	
		Mealy bug	
		Aphid	
15.	Citrus	White fly	Oxy-demeton methyl 25 EC
		Leaf miner	
16.	Vegetables	Caterpillar	Malathion 50 EC
		Jassid	Dimethoate 30 EC, Endosulfan 4 DP, Fenvalerate 20 EC, Thiamethoxam 25 WG
		Aphid	Dimethoate 30 EC, Endosulfan 4 DP and 35 EC, Fenvalerate 20 EC, Fenthion 82.5 EC, Fipronil 5 SC, Thiamethoxam 25 WG, Thiometon 25 EC
		Beetle	Dimethoate 30 EC, Formothion 25 EC, Malathion 50 EC, Oxy-demeton methyl 25 EC, Phorate 10 G, Phosphamidon 85 SL, Quinalphos 25 EC, Triazophos 40 EC
		Thrips	Endosulfan 4 DP, Fipronil 5 SC
		White fly	Dimethoate 30 EC, Thiamethoxam 25 WG
		Lace wing bug	
		Diamondback moth	Chlorpyriphos 20 EC, Diafenthiuron 50 WP, Fenthion 82.5 EC, Fipronil 5 SC, Phosalone 35 EC, Quinalphos 25 EC, Spinosad 25 SC, Thiodicarb 75 WP,
17.	Public Health	Adult mosquitoes	Alphacypermethrin 5WP, 10 SC, Deltamethrin 25 Tab and 2.5 WP
		Mosquito larvae	Fenthion 2 G, Temephos 50 EC and 1 SG
		House fly	Alphacypermethrin 10 SC
		Cattle ticks	
		Cattle lice	
		Biting flies on live stock	
18.	House hold	Cockroach	Alphacypermethrin 0.1 Spray, 5 WP and 10 SC, Cyfluthrin 5 EW and 10 WP, Deltamethrin 2.5 Flow, Fenthion 2%, Fipronil 0.03 Gel and 0.05 Gel Malathion 5 Spray,
		Bed bug	Fenthion 2% Spray, Malathion 5% Spray

		Flies	Alphacypermethrin 0.1 Spray, 5 WP and 10 SC, Cypermethrin 0.1% Aq, Diazinon 25 Micro Encapsulation, Malathion 5%
		Mosquitoes	Alphacypermethrin 5 WP, Cyfluthrin 5 EW, Cypermethrin 0.1 Aq, Diazinon 25 Micro Encapsulation, Malathion 5% and 0.1 Spray
		Ants	
		Gnats	
		Moths	