UNITED
NATIONS

SC

UNEP/POPS/POPRC.7/INF/11/Rev.2

Distr.: General
26 September 2011

English only

Stockholm Convention on Persistent Organic Pollutants

Persistent Organic Pollutants Review Committee
Seventh meeting
Geneva, 10–14 October 2011
Item 7 (a) of the provisional agenda*

Technical work in relation to chemicals listed in the annexes to the Convention with exemptions: assessment of alternatives to endosulfan

Compilation of information on alternatives to endosulfan

Note by the Secretariat

1. As referred to in document UNEP/POPS/POPRC.7/9, the Secretariat has gathered information from parties and observers on chemical and non-chemical alternatives to endosulfan. The submissions received by the deadline of 31 July 2011 have been summarized in annex I and compiled in annex II to the present note. Additional information submitted by the European Union and India is set out in annexes III and IV, respectively. The annexes have not been formally edited.

2. All the submissions are available in their original form on the Stockholm Convention website at http://chm.pops.int/tabid/2269/Default.aspx.

---

* UNEP/POPS/POPRC.7/1.

Contents

Annex I

A. Summary of information on chemical alternatives to endosulfan submitted by parties and observers

Name of the Alternative	Country	Crop	Pest	Document reference
Acephate	Canada	Potato, Tomato	Aphids	Canada- form 1
		Potato	Leafhoppers (Jassids)	Canada- form 1
	India	Cotton	Jassids, Boll worms	India- form 1
		Safflower	Aphid	India- form 1
		Rice	Stem borer, Leaf folder, Plant hopper, Green leaf hopper (GLH)	India- form 1
	USA	Cotton, Tobacco, Dry peas and Dry beans	Lygus bug, Whitefly, tobacco aphid, Tobacco budworm, Tobacco hornworm and Pea aphid	USA- form
Acetamiprid	Canada	Tomato	Aphids	Canada- form 2
	India	Cotton	Aphid, Jassids, Whiteflies	India- form 1
		Cabbage & Okra	Aphid	India- form 1
		Chilli	Thrips	India- form 1
		Rice	Brown Plant hopper (BPH)	India- form 1
	Netherlands	Apple	Apple aphid	Netherlands- Endosulfan inquiry
Bifenthrin	USA	Cucumber, Eggplant, Melon, Pumpkin, Squash, Sweet Potato, Tobacco, Tomato, Vegetable seed crops, Alfalfa grown for seed, Dry peas and Dry beans	Cucumber beetle, Whitefly, Aphids, Melon thrips, Silverleaf whitefly, Broad mite, Two-spotted spider mite, Armyworms, Colorado potato beetle, Flea beetle, Green Peach Aphids, Rindworm, Cabbage looper, Melonworm, Pickleworm, Squash beetle, Squash bug, Squash vine borer, Leafroller, Sweet otato weevil, Tobacco aphid, Tobacco budworm, Tobacco hornworm, Stinkbug, Cabbage seedpod weevil, lygus bug and pea aphid	USA- form
	Argentina	Soybean	Anticarsia	Netherlands: Letter report
	Brazil	Cotton	-	Netherlands: Letter report
Bromofos	Netherlands	Apple	Insects (Apple Blossom Beetle and Apple Sawfly)	Netherlands- Endosulfan inquiry
Buprofezin	India	Cotton	Aphid, jassids, Thrips,Whiteflies	India- form 1
		Mango	Hopper	India- form 1
		Chilli	Yellow mites	India- form 1
		Grapes	Mealy bugs	India- form 1
		Rice	BPH, GLH, WBPH	India- form 1

Name of the Alternative	Country	Crop	Pest	Document reference
Carbaryl	Argentina	Soybean	Small green stink bug	Netherlands: Letter report
	Canada	Eggplant, potato, tomato	Leafhoppers (jassids)	Canada -Submitted form 3
	Netherlands	Apple	Insects (Apple Blossom Beetle and Apple Sawfly)	Netherlands - Endosulfan inquiry
	Sri Lanka	Not Specified	Not Specified	Netherlands: Letter report
Carbofuran	Argentina	Soybean	Anticarsia	Netherlands: Letter report
	Sri Lanka	Not specified	Not specified	Netherlands: Letter report
Carbosulfan	India	Cotton	Aphid, Jassids, Thrips.	India- form 1
		Chilli	White aphid	India- form 1
		Rice	BPH, GLH, WBPH, Gall midge, Stem borer, Leaf folder	India- form 1
Chlorantraniliprole	India	Cotton	Bollworm	India- form 1
		Cabbage	Diamond back moth	India- form 1
		Sugar cane	Termite, Early shoot borer, Top borer	India- form 1
		Rice	Stem borer, Leaf folder	India- form 1
		Tomato	Fruit borer	India- form 1
		Chilli	Fruit borer	India- form 1
		Brinjal	Shoot & Fruit borer	India- form 1
		Pigeon pea	Pod borer	India- form 1
		Soybean	Green semilooper, Stem fly, Girdle beetle	India- form 1
Chlorpyriphos	Argentina	Soybean	Anticarsia, Small green stink bug, Outhern green stink bug	Netherlands: Letter report
	Brazil	Coffee	-	Netherlands: Letter report
	Ecuador	Maiz, Palma Africana	Spodoptera frugiperda Sagalassa valida	Ecuador – Informe tecni
	USA	Pineapple, Pear and Alfalfa grown for seed.	Mealybug, Cutworm, and Spotted Alfalfa Aphid.	USA- form
	India	Cotton	Aphid, Whiteflies, Bollworm, Cut worm.	India- form 1
		Rice	BPH, GLH, Stem borer, Leaf folder, Gall midge, Grass hopper	India- form 1
		Ground nut	Aphid, Root grub	India- form 1
		Mustard	Aphid	India- form 1
		Gram	Cut worm, Pod borer	India- form 1
		Beans	Pod borer, Black bug	India- form 1
		Sugarcane	Black bug, Early shoot & stalk borer, Pyrilla	India- form 1
		Brinjal	Shoot & Fruit borer	India- form 1

Name of the Alternative	Country	Crop	Pest	Document reference
		Cabbage	Diamond back moth	India- form 1
		Onion	Root grub	India- form 1
		Apple	Aphid	India- form 1
		Ber	Leaf hopper	India- form 1
		Citrus	Black citrus aphid	India- form 1
		Tobacco	Ground beetle	India- form 1
		Wheat, Barley, Gram, Sugarcane	Termite control	India- form 1
Clothianidin	Canada	Potato	Aphids, leafhoppers(Jassids)	Canada- form 4
	India	Cotton	Jassids, Whiteflies	India- form 1
		Rice	Brown Plant hopper (BPH)	India- form 1
Cyfluthrin	USA	Potato, Sweet potato, Tomato, Dry peas and Dry beans	Colorado Potato Beetle, Potato leafhopper, Potato tuberworm, Sweet potato weevil, Whitefly, Aphids, and Stinkbugs	USA- form
Cypermethrin	Argentina	Soybean	Anticarsia, Small green stink bug, Outhern green stink	Netherlands: Letter report
	Canada	Potato, Tomato	Leafhopper(Jassid)	Canada- form 5
	Ecuador	Maiz, Palma Africana	Spodoptera frugiperda Sagalassa valida	Ecuador – Informe tecni
Deltamethrin	Argentina	Soybean	Anticarsia, Small green stink bug	Netherlands: Letter report
	Canada	Potato	Aphid, Leafhopper(Jassids)	Canada- form 6
	India	Cotton	Boll worm, Sucking pests	India- form 1
		Chick pea	Fruit borer	India- form 1
		Chilli	Fruit borer	India- form 1
		Rice	Stem borer, Leaf folder	India- form 1
		Tea	Thrips, Caterpiller, Leaf roller, Looper	India- form 1
		Okra (Bhindi)	Shoot & Fruit borer, Jassids.	India- form 1
		Ground nut	Leaf miner	India- form 1
		Mango	Hoppers	India- form 1
	Netherlands	Apple	Aphids, Caterpillars	Netherlands-Endosulfan inquiry
Diazinon	Canada	Bean(including cow pea)	Aphids	Canada- form 7
	Canada	Potato, tomato	Aphids and Leafhoppers(Jassids)	Canada- form 7
	Sri Lanka	Not specified	Not specified	Netherlands: Letter report
	USA	Apple, Pineapple, Strawberries and pear	Woolly apple aphid, Pineapple fruit mite, Cyclamen mite and Lygus bug	USA- form

Name of the Alternative	Country	Crop	Pest	Document reference
Diflubenzuron	Netherlands	Apple	Rust acarids, Caterpillars	Netherlands-Endosulfan inquiry
Dimethoate	Argentina	Soybean	Small green stink bug	Netherlands: Letter report
	Canada	Bean(snap)	Aphid	Canada -Submitted form 8
	Canada	Potato, tomato	Aphids, leafhoppers(jassids)	Canada -Submitted form 8
	Sri Lanka	Not specified	Not specified	Netherlands: Letter report
	USA	Potato, Alfalfa grown for seed, Dry peas, Dry beans and Pear	Potato leafhopper, potato tuberworm, Aphids, Lygus bug, and Stink bug	USA- form
d-trans Allethrin/ Piperonyl butoxide/N-octyl bicycle-heptene dicarboximide	Canada	Ornamentals	Aphids, Spruce Gall Aphid	Netherlands: Letter report
Emamectin benzoate	India	Cotton	Boll worm	India- form 1
		Cabbage	Diamond back moth	India- form 1
		Chilli	Thrips, Mites, Fruit borer	India- form 1
		Brinjal	Fruit & Shoot borer	India- form 1
		Red gram	Pod borer	India- form 1
		Chick pea	Pod borer	India- form 1
		Grapes	Thrips	India- form 1
	Netherlands	Apple	Caterpillars	Netherlands-Endosulfan inquiry
Esfenvalerate	USA	Cucumber, Potato, Tomato, Vegetable seed crops, Dry peas and Dry beans	Cucumber beetle, Whitefly, Aphids, Colorado Potato Beetle, potato leafhopper, potato tuberworm, stinkbug, Weevil, and Pea aphid	USA- form
Ethion	Argentina	Soybean	Small green stink bug	Netherlands: Letter report
Fenbutatin oxide	Netherlands	Apple	Rust acarids	Netherlands-Endosulfan inquiry
Fenitrothion	Argentina	Soybean	Small green stink bug	Netherlands: Letter report
Fenoxycarb	Netherlands	Apple	Caterpillars	Netherlands-Endosulfan inquiry
Fenpropathrin	USA	Apple, Melon and Pumpkin	Stink bug, Aphids, Rindworm, Whitefly, Cucumber beetle, Melonworm, Pickleworm, Squash beetle, Squash bug, Squash vine borer, Striped flea beetle, Cabbage looper and Leafroller	USA- form

Name of the Alternative	Country	Crop	Pest	Document reference
Fenvalerate	Argentina	Soybean	Small green stink bug	Netherlands: Letter report
	India	Cotton	Aphid, jassids, Thrips, Bollworms	India- form 1
		Cauliflower	Diamond back moth, American boll worm, Aphids, Jassids	India- form 1
		Brinjal	Shoot & fruit borer, Aphids	India- form 1
		Okra	Shoot & fruit borer, Jassids	India- form 1
Fipronil	Brazil	Sugarcane	-	Netherlands: Letter report
	India	Cotton	Aphid, jassids, Thrips, Whiteflies, Boll worms	India- form 1
		Cabbage	Diamond back moth	India- form 1
		Chilli	Thrips, Aphids,	India- form 1
			Fruit borer	
		Rice	Brown Plant hopper (BPH), WBPH, GLH, Gall midge, Whorl maggot, Stem borer	India- form 1
		Sugar cane	Early shoot borer, Root borer	India- form 1
Flonicamid	Canada	Eggplant, potato, tomato	Aphids	Canada-Submitted form 9
	Netherlands	Apple	Aphids	Netherlands-Endosulfan inquiry
Flubendiamide	India	Not specified	Not specified	Netherlands: Letter report
Fluvalinate	India	Cotton	Aphid, Jassids, Red cotton Bug, Bollworm	India- form 1
Fosalone/phosalone	Netherlands	Apple	Leaf curling midge	Netherlands-Endosulfan inquiry
Gamma Cyhalothrin	Argentina	Soybean	Anticarsia	Netherlands: Letter report
Imidacloprid	Canada	Potato	Aphids, leafhoppers(Jassid)	Canada- form 10
	Ecuador	Maiz, Palma Africana	Spodoptera frugiperda Sagalassa valida	Ecuador – Informe tecni
	India	Not specified	Not specified	Netherlands: Letter report
	Netherlands	Apple	Apple sawfly, Aphids	Netherlands-Endosulfan inquiry
	USA	Apple, Cucumber, Potato, Tobacco, Carrot, Celery, Lettuce, Dry peas and Dry beans	Apple aphid, Cucumber beetle, Whitefly, Aphids, Colorado Ootato beetle, Potato leafhopper, Tobacco aphid, Leafminer, Pea aphid	USA- form
Imidacloprid + beta-Cyfluthrin SC	Brazil	Sugarcane	-	Netherlands: Letter report
Indoxacarb	India	Not specified	Not specified	Netherlands: Letter report
	Netherlands	Apple	Caterpillars	Netherlands-Endosulfan inquiry

Name of the Alternative	Country	Crop	Pest	Document reference
Lambda-Cyhalothrin	Argentina	Soybean	Anticarsia	Netherlands: Letter report
	Canada	Fava bean(Broad beans)	Pea aphid	Canada- form 13
		Bean(dry and succulent), Cow pea, Potato, Tomato	Potato leafhopper(Jassids)	Canada- form 13
	India	Cotton	Jassids, Thrips, Boll worm, Whiteflies	India- form 1
		Brinjal	Shoot & Fruit borer	India- form 1
		Chilli	Thrips, Mite, Fruit borer	India- form 1
		Rice	Leaf folder, Stem borer, GLH, Gall midge, Hispa, Thrips	India- form 1
		Tomato	Fruit borer	India- form 1
		Pigeon pea	Pod borer, Pod fly	India- form 1
		Onion	Thrips	India- form 1
		Bhindi	Jassids, Shoot borer	India- form 1
		Chick pea	Pod borer	India- form 1
		Groundnut	Thrips, Leaf hopper, Leaf miner	India- form 1
		Mango	Hoppers	India- form 1
	USA	Apple, Cucumber, Squash, Tobacco, Vegetable seed crops, Alfalfa grown for seed, Dry peas and dry beans	Stink bug, Cucumber beetle, Whitefly, Aphid, Pickleworm, Silverleaf whitefly, Tobacco budworm, Tobacco hornworm, Cabbage seedpod weevil, Lygus bug and Pea aphid	USA- form
Malathion	Canada	Bean, cow pea, eggplant, potato, tomato	Aphids	Canada- form 14
		Eggplant, potato, tomato	Leafhoppers (Jassids)	Canada- form 14
	USA	Cucumber, Dry peas and Dry beans	Cucumber beetle, Whitefly and Aphids	USA- form
Methamidofos	Argentina	Soybean	Small green stink bug, Outhern green stink bug	Netherlands: Letter report

Name of the Alternative	Country	Crop	Pest	Document reference
Methomyl	Canada	Potato, Tomato	Aphid	Canada- form 15
		Potato	Leafhoppers (Jassids)	Canada- form 15
	USA	Cucumber, Potato, Tobacco and Tomato	Cucumber Beetle, Whiteflies, Aphid, Potato leafhopper, Potato tuberworm, Tobacco budworm, Tobacco hornworm and Stinkbug	USA- form
Methoxyfenozide	Netherlands	Apple	Caterpillars	Netherlands - Endosulfan inquiry
Naled	Canada	Bean (dry) and lima bean	Aphids	Canada- form 16
		Potato	Leafhoppers (Jassids)	Canada- form 16
Novaluron	India	Not specified	Not specified	Netherlands: Letter report
Oxamyl	Canada	Potato	Aphid, leafhoppers (jassids)	Canada- form 17
	USA	cotton and potato	Lygus bug, Whitefly, Colorado potato beetle, Potato leafhopper and Potato tuberworm	USA- form
Permethrin	Canada	Potato, tomato	Leafhopper (Jassid)	Canada- form 18
	USA	cucumber, potato and alfalfa grown for seed	Cucumber beetles, Whiteflies, Aphids, Colorado potato Beetle, Potato leafhopper, Potato tuberworm, Lygus bug and Spotted alfalfa aphid	USA- form
Phenthoate	Argentina	Soybean	Anticarsia	Netherlands: Letter report
Phorate	India	Cotton	Aphid, jassids, Thrips, Whiteflies	India- form 1
		Cauliflower	Aphid	India- form 1
		Chilli	Aphid, Mite, Thrips	India- form 1
		Potato	Aphid	India- form 1
		Tomato	Whiteflies	India- form 1
		Rice	Gall fly, Hispa, Leaf hopper, Plant hopper, Stem borer, Root weevil	India- form 1
		Bajra	Shoot fly, White grub	India- form 1
		Barley	Aphid	India- form 1
		Maize	Shoot fly, Stem borer	India- form 1
		Sorghum	Shoot fly, Aphids,	India- form 1
			White grub	
		Wheat	Shoot fly	India- form 1
		Black gram	Stem fly, White fly	India- form 1
		Green gram	Stem fly, Jassids	India- form 1

Name of the Alternative	Country	Crop	Pest	Document reference
		Pigeon pea	Jassids, Stem fly	India- form 1
		Soybean	Stem fly	India- form 1
		Sugarcane	Top borer, White grub	India- form 1
		Ground nut	Aphid, Leaf miner, White grub	India- form 1
		Mustard	Mustard aphid, Painted bug	India- form 1
		Sesamum	Jassids, White fly	India- form 1
		Apple	Woolly aphid	India- form 1
		Brinjal	Aphid, Jassid, Lace wing bug, Red spider mite, Thrips	India- form 1
		Banana	Aphid	India- form 1
		Citrus	Leaf miner	India- form 1
Phosmet	Canada	Potato	Aphid, Leafhoppers (jassids)	Canada- form 19
Pirimicarb	Netherlands	Apple	Woolly apple aphid	Netherlands- Endosulfan inquiry
	Mexico	Maíz	Pulgones, Ropalosiphum maidis, Schizaphis graminum, Aphis spp, Macrosiphum spp,	Diagnóstico de la situación del Endosulfán en México
Profenophos	Togo	Cotton crops	Not specified	Netherlands: Letter report
Pymetrozine	Canada	Potato	Aphids	Canada- form 20
Quinalphos	India	Cotton	Bollworms,Aphids, Jassids, Thrips.	India- form 1
		Cabbage	Aphid	India- form 1
		Chilli	Aphid, Mites	India- form 1
		Rice	Brown Plant hopper (BPH), Leaf roller, Stem borer, Hispa	India- form 1
			,Gall midge	
		Sugarcane	Early shoot borer & shoot borer, Black bug, leaf hopper	India- form 1
		Sorghum	Stem borer, Mite, Shoot fly, Ear head bug, Ear head midge	India- form 1
		Okra	Shoot & fruit borer, Leaf hopper, Mite	India- form 1
		Brinjal	Shoot & fruit borer, Jassids, Epilechna beetle, Leaf hopper	India- form 1
		Tomato	Fruit borer	India- form 1
		Tea	Hopper Caterpiller, Thrips	India- form 1
		Tur	Pod borer, Pod fly	India- form 1
		Ground nut	Spodoptera, Leaf hopper, Leaf miner, Thrips, jassids, Red hairy Caterpillar	India- form 1
		Wheat	Aphid, Ear head caterpillar, Mite	India- form 1
		Black gram	Bihar hairy caterpillar, Pod borer	India- form 1

Name of the Alternative	Country	Crop	Pest	Document reference
		French bean	Stem fly	India- form 1
		Soybean	Leaf weevil	India- form 1
		Jute	Leaf roller, Semi looper, Yellow mite	India- form 1
		Mustard	Sawfly	India- form 1
		Sesamum	Leaf webber, Jassids	India- form 1
		Safflower	Aphid	India- form 1
		Cauliflower	Stem borer	India- form 1
		Onion	Thrips	India- form 1
		Apple	Wooly aphid	India- form 1
		Banana	Tingid bug	India- form 1
		Citrus	Scale, Citrus butter fly	India- form 1
		Mango	Mango bud mite	India- form 1
		Pomegranate	Scales	India- form 1
		Cardamom	Thrips	India- form 1
		Coffee	Green bug	India- form 1
Spinosad	Canada	Usually applicable to many crops.	Eyespotted bad moth, Imported Gabbageworm, Diamondback moth, Cabbage looper, Colorado potato beetle	Netherlands: Letter report
	India	Not specified	Not specified	Netherlands: Letter report
	Netherlands	Apple		Netherlands- Endosulfan inquiry
Spirodiclofen	Canada	Usually applicable to many crops.	Rust mite, Peach silver mite	Netherlands: Letter report
Spirotetramat	Canada	Beans, cow pea, eggplant, potato, tomato	Aphid	Canada- form 21
	Netherlands	Apple	Aphids	Netherlands - Endosulfan inquiry
Sulphur	Canada	Cherry	Plum rust mite	Netherlands: Letter report
Tebufenozide	Canada	Apple	Codling moth	Netherlands: Letter report
Teflubenzuron	Netherlands	Apple	Caterpillars	Netherlands - Endosulfan inquiry
Thiacloprid	Netherlands	Apple	Apple sawfly, Aphids	Netherlands - Endosulfan inquiry
Thian (=thianon?)	Togo	Cotton crops	Not specified	Netherlands: Letter report
Thiamethoxam	Canada	Potato	Aphids	Canada- form 22
		Bean (dry edible), Potato	Leafhoppers (Jassid)	Canada- form 22
	India	Cotton	Aphid, jassids, Thrips, Whiteflies	India- form 1
		Mango	Hopper	India- form 1
		Okra	Aphid, Jassid, Whitefly	India- form 1

Name of the Alternative	Country	Crop	Pest	Document reference
		Rice	BPH, WBPH, GLH, Stem borer, Gall midge, Leaf-folder	India- form 1
		Sorghum	Shootfly	India- form 1
		Wheat	Termites, Aphid	India- form 1
		Mustard	Aphid	India- form 1
		Tomato & Brinjal	Whiteflies	India- form 1
		Tea	Mosquito bug	India- form 1
		Potato	Aphids	India- form 1
		Citrus	Psylla	India- form 1
Thiamethoxam + cyhalothrin SC	Brazil	Soybean	-	Netherlands: Letter report
Thiodicarb	Cameroon, India, Pakistan	Cotton crops		Netherlands: Letter report
Trichlorfon	Canada	Usually applicable to many crops.	Imported Cabbageworm, Diamondback moth, Gabbage looper, Pepper maggot, Beet webwormx	Netherlands: Letter report

B. Summary of information on non-chemical alternatives to endosulfan submitted by parties and observers

Crop	Pest	Control option	Source
Apple	Apple aphid	Azadirachtin	Netherlands-Endosulfan inquiry
	Caterpillars	Bacillus thuringiensis subsp. kurstaki	Netherlands-Endosulfan inquiry
	Caterpillars	Cydia pomonella granulose virus	Netherlands - Endosulfan inquiry
	Caterpillars	Pheromone	Netherlands-Endosulfan inquiry
	Leafhopper(Jassids)	Kaolin clay	Canada- form 12
Cotton	Cotton Bollworm, Pink Bollworm	*Azadirachtin 0.5% * Pheromone traps: 20-25/ha, lure to be changed at 15-30 day intervals; * Trichogramma Chilonis: 1,500,000/ha; 6-8 times at 10 day intervals; * Bacillus Thuringiensis: 2kg/ha, 2-3 times at 10 day intervals in evening; * Helicoverpa Armigera Nuclear Polyhedrosis Virus (NPV): 500-750 LE/ha, 2-3 times at 10 day intervals in evening.	PAN & IPEN
	Aphids, Jassids, Whiteflies	* Chrysoperla Carnea: 50,000 1st instar larvae/ha, 2-3 times at 15 day intervals	PAN & IPEN
	Oriental leaf worm moth / Cotton leafworm / Cotton cutworm	* Spodoptera Litura NPV: 500-750 LE/ha, 2-3 times at 10 day intervals in evening; * Pheromone traps: 20-25/ha, lure to be changed at 15-30 day intervals.	PAN & IPEN
	Semiloopers	Bacillus Thuringiensis: 2kg/ha, 2-3 times at 10 day intervals in evening	PAN & IPEN
	Bollworm Helicoverpa Armigera	* Plough deeply; clean cultivation to expose the resting pupae, crop rotation and avoidance of rationing reduces pest population; * Use tolerant varieties * Trap crop with crops like tomato, destroying them when the pest population is high; * Use maize, and cowpea on borders and wild Brinjal and Setaria (millet) as intercrops help significantly reduce the pest population.	PAN & IPEN
		* Release egg parasitoids like Trichogramma Chilonis or T. Brasielenis or T. Achaea @ 1,50,000 /ha from 45th day onwards at 10-15 days interval (6 releases) and larval parasitoids such as Chilonus Blackburni, Bracon Brevicornis, Telenomus Heliothidae, Carcelia Illota, Coteria Kazat or Campoletis Chloridae @ 2000 adults/ha at 15 day-intervals;	PAN & IPEN

Crop	Pest	Control option	Source
		* release pupa parasitoids Brachymeria sp.; * release the predators Chrysoperla Carnea, Scymnus sp. or Eulophids suppresses the population of larvae; * spray Helicoverpa Armigera NPV @ 250 LE/ha from 35th to 60th day of crop stage; * Bacillus Thuringiensis Kurstaki @ 1 kg/ha; * application of fungal pathogens like Beauveria Bassiana or Neumorea Riley under humid conditions is effective; * Spray 5% Neem seed Kernel extract.	
	Pink Bollworm (Pectinophora Gossypiella Saunders)	* Clean cultivation and destruction of crop residues (fallen leaves, twigs etc) before the onset of season; * Plough deeply to expose the hibernating larvae / pupae; * Avoid late sowing of the crop; early sowing helps in early maturity facilitating escape; * Use tolerant varieties (Khandwa-2, JKH-1, Abadita, LH 900, Sujay and Desi cotton); * Withhold irrigation water to avoid prolonged late boll production/ formation to reduce the build up of over-wintering population.	PAN & IPEN
		* Release of egg parasitoids Trichogramma chilonis, Bracon Elechidae, Elasmus Johnstoni or pupal parasitoid Microbracon Lefroyi; * Encourage predators Chrysoperla Carnea, Scymnus sp., Triphles Tantilus or Pyremotes Ventricosus (mite), or release them in the fields; * Apply Bacillus Thuringiensis Kurstaki @1 kg/ha.	PAN & IPEN
	Jassids (Amrasca Biguttula Biguttula)	* Sow the crop early; * Use resistant varieties such as Khandwa-2 or the varieties having leaves rich in tannin contents; * Do not use high doses of nitrogen fertilizers; * Grow Cowpea/onion/soybean as an intercrop in cotton to reduce early stage of pest; * Use okra as trap crop * Adopt proper crop rotation; * Summer deep ploughing to expose soil inhabiting insects; * Remove and destroy crop residues/alternate host plants.	PAN & IPEN
		* Use yellow sticky traps; * Hand pick and destroy various insect stages; * Destroy affected plant parts; * Destroy stressed floral bodies; * Destroy resettled flowers; * Install bird perches: "T" shape	PAN & IPEN

Crop	Pest	Control option	Source
		wooden/bamboo sticks @ 50/ha should be erected to encourage predatory birds like king crow, Mynah and blue jay.	
		* Release predator Chrysoperla Carnea, Coccinella Septumpunctata or Syrphus / Scymnus sp.; * Conserve Spiders Distina Albida and Ants like Camponotus sp.	PAN & IPEN
	Cotton Aphid (Aphis Gossypii)	* Avoid late sowing and excessive use of nitrogen fertilizers; * Destroy infested shoots during early stages.	PAN & IPEN
		Handpick and destroy various insect stages and the affected plant parts	PAN & IPEN
		* Release predator Chrysoperla Carnea, Coccinella Septumpunctata, Syrphus / Scymnus sp.; * Conserve Spiders Distina Albida and Ants like Camponotus sp.	PAN & IPEN
	Thrips (Thrips Tabaci)	* Avoid Late sowing; * Grow Cowpea/Onion/Soybean as an intercrop in cotton to reduce early stage pest; * Deep plough in summer and maintain weed free field and surroundings; * Grow certified acid delinted seeds of tolerant varieties; * Remove alternate host plants like Kangni and Ambadi.	PAN & IPEN
		* Encourage the activity of parasitoids Thripoctenus Briu, Triphleps Tantilus and Mite Campsid sp.; * Release Trichogramma Chilonis 1.5 lakh/ha and Chrysoperella Grubs @ 1-2 plants; * release Chrysoperla Cornea @ 2 larvae/plant in early stage of the plant and 4 larvae/plant in later stage; * release Cheilomenes sexmaculata @ 1.5 lakh adults/ha at random on crop canopy.	PAN & IPEN
	White Fly (Bemisia Tabaci)	* Avoid late sowing and adopt crop rotation with crop that is not the host of white fly; * Use resistant varieties K-2; * Cultivate alternate host crops such as Tomato and Castor on the boundaries to trap and destroy pest.	PAN & IPEN
		* Set up yellow pan sticky traps at various places at the Canopy height in field; * Remove and destroy crop residues after last picking; * Remove alternate host plants like Kangni and Ambadi.	PAN & IPEN
		* Encourage activities of parasitiods like Encarsia Shafeei or Eretmocerous mundus; * Release predators such as Chrysoperla Carea, Melachilus Sexaculatus, Coccinella Septampunctata, Brumus sp.	PAN & IPEN

Crop	Pest	Control option	Source
		or Scymnus sp.; * Release Chrysoperla Cornea @ 2 larvae/plant in early stage of the plant and 4 larvae/plant in later stage; * Release Cheilomenes Sexmaculata @ 1.5 lakh adults/ha at random on crop canopy; * Spray Neem products @ 1500 ppm	
	Spotted Bollworm; Ink bollworm; Helicoverpa, Red Cotton bug, Dusky Cotton bug	* Deep summer ploughing to expose larvae and pupa to birds and sun; * Soil inoculation with nitrogen fixing bacteria like Azospirillum and Azotobacter; * Neem seed kernel extract – 5% spray *Application of 200 kg neem cake during ploughing; * Spray 3% neem oil; * Apply Cow dung-urine solution as pest repellant; * Spray 5% Vitex Solution (decoction of leaves of Vitex negundo).	PAN & IPEN
	Leafroller	Neem seed Kernel extract	PAN & IPEN
Coffee	Coffee Berry Borer	* Collect infested Coffee beans before and after Harvest; * Attractant traps; * Spray with Neem (Azadirachtin).	PAN & IPEN
		* A wide range of biological control organisms have been used to replace Endosulfan in Coffee cultivation; these include the parasitic wasps Cephalonomis Stephanotheris, Prorops Nasuta, and Phymastichus Coffea and the Entomopathogenic Fungus Beauvaria Bassiana for Coffee Berry Borer (Hypothenemus Hampei)	PAN & IPEN
	Broca del café Hypothenemus hampei	* Use of biopesticide formulations containing Bauveria Bassiana; * Induced biological control through the release of the parasitoid Cephalonomia stephanoderis.	Diagnóstico de la situación del Endosulfán en México
Rice	Stem Borer	* Triochogramma Japonicum: dose = 50,000/ha, 6 times at 10 day intervals; * Pheromone traps: 20-25 /ha, lure to be changed at 15-30 day intervals	PAN & IPEN
	Yellow stem borer, Hispa	Trichogramma chilonis: dose = 50,000/ha, 6 times at 10 day intervals	PAN & IPEN
	Leaf folder, Hispa, Surti Caterpillar, all pests	* Soil inoculation with nitrogen fixing bacteria like Azospirillum and Azotobacter; * A variety of cultural techniques; * Spray with 5% Neem seed Kernel extract; * Remove Leaf folds using Thorny Twigs; * Spray with 5% Vitex Solution (Decoction of leaves of Vitex Negundo); * Trichogramma Chilonis.	PAN & IPEN
	Gall Midge	* Remove grassy weeds surrounding rice fields – to remove the pests' alternate hosts;	PAN & IPEN

Crop	Pest	Control option	Source
		* Plant resistant varieties - there are several gall midge biotypes; * Delay wet season planting of photoperiod sensitive variety to reduce the length of the vegetative period before a gall midge transfers from its alternate hosts; * Split the nitrogen application 3 times; during the seedling, vegetative, and reproductive growth stages; * Plough-under the rations of the previous crop to expose the pests to sunlight and predators; * Encourage generalist predatory spiders; * Spray with Neem.	
Maize	Stem Borer, Pink Borer	Trichogramma Chilonis: 50,000/ha, 6 times at 10 day interval	PAN & IPEN
	Stem Borer, Corn Earworm,	* Deep summer ploughing; * Application of 200kg Neem cake during ploughing; * Spray with 5% neem seed Kernel extract; * Spray with chilli-garlic solution; * Pheromone traps for corn earworm.	PAN & IPEN
	Gusano Cogollero Spodoptera frugiperda,	* Use of neem extracts (Azadirachta indica) as natural insecticide; * Application of biopesticide formulations containing Bt (Bacillus Thuringiensis); * Use of a biological pesticide with low environmental impact: Spinoteram from the company Dow Agrowsiences; * Natural control by parasitoids (more than 20 species of several families have been identified); * Use of sex pheromones (monitoring and mating confusion).	Diagnóstico de la situación del Endosulfán en México
	Pulgones, Ropalosiphum maidis, Schizaphis graminum, Aphis spp, Macrosiphum spp,	* Natural control with several species of predators. A group of at least 15 species has been identified, among which the orange convergent lady-beetle Hipodamia convergens and chrysopas spp stand out. * Use of yellow traps (sticky traps or trays with water).	Diagnóstico de la situación del Endosulfán en México
Gram, Arhar	Podborers	* Helicoverpa Armigera NPV: 250 LER/ha, 2-3 times at 10-day intervals in evening; * Bacillus Thuringiensis - 2kg/ha, 2-3 times at 10 day intervals in evening.	PAN & IPEN
Gram	All pests	* 5% spray of Neem seed Kernel extract; * Erect bird perches; * Deep summer Ploughing.	PAN & IPEN
Chilli	Leaf and Pod Caterpillar	5% spray with Neem seed Kernel extract	PAN & IPEN
	Sawfly	* 5% spray with Neem seed Kernel extract; * Collect large caterpillars.	PAN & IPEN
	Leaf Webber	*5% spray with Neem seed Kernel extract; * Collect and destroy leaf webs.	PAN & IPEN

Crop	Pest	Control option	Source
Mustard	Aphids	Chrysoperla Carnea – 50,000 1st Instar larvae/ha, 2 times at 15 day intervals	PAN & IPEN
		* Use tolerant varieties like JM-1 and RK-9501; * Sow early; crop sown before 20th October escapes the damage.	PAN & IPEN
		Destroy the affected parts along with Aphid population in the initial stage	PAN & IPEN
		* Ladybird Beetles Cocciniella Septempunctata, Menochilus Sexmaculata, Hippodamia Variegata and Cheilomones Vicina are most efficient predators of the mustard Aphid; adult Beetle may feed an average of 10 to 15 adults/day; * Several species of Syrphid Fly i.e., Sphaerophoria spp., Eristallis spp., Metasyrphis spp., Xanthogramma spp and Syrphus spp. predate on Aphids; * The Braconid Parasitoid, Diaretiella Rapae is a very active bio control agent, causes the mummification of aphids; * The Lacewing, Chrysoperla Carnea, predates on the Mustard Aphid colony; * Predatory Bird Motacilla Cospica active feeds on Aphids during February-March; * A number of Entomogenous Fungi, such as Cephalosporium spp., Entomophthora and Verticillium Lecanii infect Aphids.	PAN & IPEN
Okra	Fruit and Shoot Borer	* Trichogramma Chilonis: 50,000 /ha, 6 times at 10 day intervals; * Pheromone traps: 20-25 ha, lures to be changed at 15-30 day intervals.	PAN & IPEN
	Aphids, Jassids, Whiteflies	* Chrysoperla carnea: 50,000 1st instar larvae/ha, 2 times at 15 day intervals;	PAN & IPEN
	Diamond Back Moth	* Pheromone traps; * Bacillus Thuringiensis Spray; * Parasitoids Diadegma Semiclausum, D. Insulare, D. Mollipla, D. Fenestral, Cotesia sp.; * Spray with decoction of Eupatorium Odoratum leaves.	PAN & IPEN
Okra	Leaf Roller	5% spray of Neem seed Kernel extract	PAN & IPEN
Tomato	Fruit borer	* Deep summer ploughing; * 5% spray of Neem seed Kernel extract; * Erect bird perches; * Spray Chilli-Garlic solution; * Pheromone traps.	PAN & IPEN
	Fruit and Shoot Borer	* Helicoverpa Armigera NPV: 250 LE/ha, 2-3 times at 10day intervals in evening; * Trichogramma Chilonis: 1,00,000/ha, 6 times at 10 day intervals; * Bacillus Thuringiensis: 2kg/ha, 2-3 times at 10 day intervals in evening; * Pheromone traps: lures to be changed at 15-30 days.	PAN & IPEN

Crop	Pest	Control option	Source
Groundnut	All pests	* 5% spray of neem seed kernel extract; * Erect bird Perches; * Pheromone Traps; * Deep summer ploughing;	PAN & IPEN
Mango	Mango Hopper	* 5% spray of Neem seed kernel extract; * 3% Neem oil spray.	PAN & IPEN
	Leafhoppers	* Garlic oil spray; * Neem spray.	PAN & IPEN
	Fruit Fly	* Remove fruits with dimples and oozing clear sap; * Harvest crops early when mature green; * Pick overripe fruits; * Practice crop and field sanitation; collect and destroy fallen and damaged ripe fruits; do not put collected damaged fruits in compost heaps, instead feed to Pigs or Poultry, or bury to eliminate all sources of possible breeding sites.	PAN & IPEN
		* Bag the Fruit; * Use Fruit Fly baits: (Ripe Banana peel cut into small pieces and mixed with sugar, flour, and water; mixture of 1 tsp Vanilla essence, 2 tbsp Ammonia, 1/2 cup Sugar, and 2 liters of Water; mixture of 1 cup Vinegar, 2 cups Water, and 1 tbsp of Honey; or mixture of Sugar, Soya sauce, and Ammonia); * Yellow sticky traps baited with vials containing a ratio of 1 part Ammonia and 1 part of Water; * Spray with basil leaf extract; * Spray with Neem.	PAN & IPEN
Eggplant	Aphids	*Control Ants (Ants cultivate Aphids to gain access to plant Sugars); cultivate and flood the field to destroy ant colonies and expose Eggs and Larvae to predators and sunlight; ants use the Aphids to gain access to nutrients from the plants; * Avoid using heavy doses of highly soluble Nitrogen fertilizers; * Sticky board traps: 1-4 per 300 sq m field area; replace at least once a week; * Yellow basin trap with soapy water; * Spray with ginger rhizome extract; * Spray with custard apple leaf extract.	PAN & IPEN
	Fruit and Shoot Borer	*Plough field to expose Larvae to predators and weather; *Plant resistant varieties - Pusa Purple Long, H-128, H-129, Aushey, Thorn Pendy, Black Pendy, H-165, H-407, Dorley, PPC-17-4, PVR-195, Shyamla Dhepa, and Banaras Long Purple; *Raise seedlings under row covers and/or nets to prevent the Moths from directly laying eggs on them; * Crop rotation; * Proper field sanitation -destroy or burn all plant residues as they may harbor the pupating pest; * Prune immediately any Larvae-infested	PAN & IPEN

Crop	Pest	Control option	Source
		shoots - burn or cut them into small pieces; continue pruning the shoots at least once a week before the final harvest; * Uproot all old plants after harvest and burn them; * Pheromone traps.	
	Diamond back moth	* pheromone traps; * Bacillus thuringiensis spray; * Parasitoids Diadegma Semiclausum, D. Insulare, D. Mollipla, D. Fenestral, Cotesia sp.; * Spray with decoction of Eupatorium Odoratum leaves;	PAN & IPEN
	Jassids	* Chrysoperla Carnea.	PAN & IPEN
Beans	Aphids	* Control Ants (Ants cultivate Aphids to gain access to plant Sugars); cultivate and flood the field to destroy Ant colonies and expose Eggs and larvae to predators and sunlight; ants use the Aphids to gain access to nutrients from the plants; * Avoid using heavy doses of highly soluble Nitrogen fertilizers; * Use sticky board traps: 1-4 per 300 sq m field area; replace at least once a week; * Yellow basin trap with soapy water; * Spray with Ginger Rhizome extract, custard Apple leaf extract, Neem leaf extract, need seed extract, Ammonia spray (1part in 7 parts water), or soap spray.	PAN & IPEN
	Leaf Miner	* Greased yellow traps; * Spray with Neem seed extract; * Spray with Ginger, Garlic and Chilli extract.	PAN & IPEN
	White Fly	* Plant Nicotiana as a trap crop; * Spray with Garlic oil spray, Madre de Caco and Neem leave spray, Neem oil, Soap spray, or Ammonia spray; * Use yellow sticky board traps; *Release parasitoid Encarsia spp; *Release predators Chrysoperla Carnea, Chrysopa rufilabris, Harmonia Conformis, Harmonia Axyridis, Hippodamia Convegens.	PAN & IPEN
Jute	Semilooper	5% spray of Neem seed Kernel extract	PAN & IPEN
	Bihar Hairy Caterpillar, Indigo Caterpillar	* 5% spray of Neem seed Kernel extract; * Deep summer ploughing; * Erecting bird perches; * Chillie-Garlic spray.	PAN & IPEN
	Mites	Spray with 2% wettable Sulphur	PAN & IPEN
Pigeonpea	Podborer	* 5% spray of Neem seed Kernel extract; * Erect bird Perches * Apply shaking method; * Deep summer ploughing.	PAN & IPEN
	Pod Bug, Pod Fly, Defoliators	* 5% spray of Neem seed Kernel extract; * 3% spray of Neem oil.	PAN & IPEN
Tea	Caterpillars	Spray with Bacillus Thuringiensis	PAN & IPEN

Crop	Pest	Control option	Source
	Tea Mosquito Bug	* Encourage or release Weaver Ants; * Spray with Neem seed extract.	PAN & IPEN
	Mealybugs	* Release Cryptolaemus Montrouzieri, Chrysoperla Carnea, Chrysopa Rufilabris, Harmonia Conformis, Harmonia Axyridis, Hippodamia Convegens; * Spray with chilli extract, Soap spray, Citrus peel spray.	PAN & IPEN
	Scale Insects	* Release parasitic wasps Aphytis Melinus or Metaphycus Helvolus or predators Eristalis spp., Volucella spp., Chrysoperla Carnea, Chrysopa Rufilabris, Harmonia Conformis, Harmonia Axyridis, Hippodamia Convegens, Orius Tristicolor, or Orius Insidiosus; * Spray with Neem or Horticultural spraying oil.	PAN & IPEN
	Thrips	* Release predators Chrysoperla Carnea, Chrysopa Rufilabris, Orius Tristicolor, or Orius Insidiosus; * Spray with Neem extract.	PAN & IPEN
	Green Leafhopper	* Release and encourage predators: Chrysoperla carnea, Chrysopa Rufilabris, Harmonia Conformis, Harmonia Axyridis, Hippodamia Convegens, Orius Tristicolor, Orius Insidiosus, Generaliset preadatory Spiders and Birds; * Spray with Neem, or Garlic.	PAN & IPEN
	Flushworm	* Release parasitoid Apanteles sp.	PAN & IPEN
	Aphids	Release predators Leis Dimidiata, Menocillus Sexmaculatusw, Verania Vincta, Syrphid	PAN & IPEN
All crops	whitefly, aphids, mites, thrips, lepidopterous larvae	Caolin Mark “Agro-SIAMIL®” (Aqueous solution in 65% w/w, equivalent to 1,080 g of kaolin per liter).	Diagnóstico de la situación del Endosulfán en México

Annex II

Compilation of information related to alternatives to endosulfan

Submitter	Information on alternatives to endosulfan
Canada	**(1) ACEPHATE-POTATO-TOMATO** **1. Description of the alternatives** **Acephate** Trade name: Orthene 75 CAS #: 30560-19-1 Potato, tomato– aphids Potato - leafhoppers (jassids) **2. Technical feasibility** Registered in Canada **3. Health and environmental effects** Currently under re-evaluation. See PMRA Proposed Acceptability for Continuing Registration (PACR2004-40) - *Re-evaluation of Acephate,* Re-evaluation Note (REV2007-02) – *Acephate interime measures* and Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf (attached) **4. Cost-effectiveness** Cost/ha ($CAD): Potato for the control of aphids and leafhoppers - $39.20 to $57.44 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Cost/ha ($CAD): Potato for the control of aphids and leafhoppers - $39.20 to $57.44 (Source: Savvy Farmer Inc., 2011) **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See PACR2004-40, REV2007-02 and Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(2) ACETAMIPRID-POTATO-TOMATO** **1. Description of the alternatives** **Acetamiprid** Trade Name: Assail 70 WP CAS #: 135410-20-7 Potato, tomato – aphid **2. Technical feasibility**

Submitter	Information on alternatives to endosulfan
Canada	Registered in Canada. **<u>3. Health and environmental effects</u>** See PMRA Registration Decision (RD2010-06) – *Acetamiprid* (attached) **<u>4. Cost-effectiveness</u>** Cost/ha ($CAD): Tomato for control of aphids - $35.90 to $55.14 (Source: Savvy Farmer Inc., 2011) **<u>5. Efficacy</u>** Systemic insecticide with translaminar activity and contact and stomach action. Neonicotinoid insecticide. IRAC Resistance management MoA group 4. Ground application only. For further information on the value of this pesticide please see RD2010-06. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** See RD2010-06 **<u>7. Availability</u>** Available. **<u>8. Accessibility</u>** Accessible across Canada. **(3) CARBARYL-EGGPLANT-POTATO-TOMATO** **<u>1. Description of the alternatives</u>** **Carbaryl** Trade name: Sevin XLR CAS #: 63-25-2 Eggplant, potato, tomato - leafhoppers (jassids) **<u>2. Technical feasibility</u>** Registered in Canada. **<u>3. Health and environmental effects</u>** Currently under re-evaluation. See PMRA Proposed Re-evaluation Decision (PRVD2009-14) - *Carbaryl* and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf (attached) **<u>4. Cost-effectiveness</u>** No data. (Source: Savvy Farmer Inc., 2011) **<u>5. Efficacy</u>** Slightly systemic insecticide. Contact and stomach action. Carbamate insecticide. IRAC Resistance management MoA group 1A. For further information on the value of this pesticide please see PRVD2009-14. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** See PRVD2009-14 and Re-evaluation Summary Table for Stakeholders 31 March 2011 -

Submitter	Information on alternatives to endosulfan
Canada	en.pdf **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(4) CLOTHIANIDIN-POTATO** **1. Description of the alternatives** **Clothianidin** Trade name: Clutch 50 WDG CAS #: 210880-92-5 Potato – aphids Potato - leafhoppers (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Regulatory Note (REG2004-06) – *Clothianidin Poncho 600 Seed Treatment Insecticide* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of leafhoppers - $18.33 to $27.50 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide. Neonicotinoid insecticide. IRAC Resistance management MoA group 4. Applied in furrow at planting or as a foliar application. Foliar applications (up to 3) may not be applied if a group 4 insecticide was used as a seed piece treatment or applied in furrow at planting. Rotational crop restrictions – plant back interval of 30 days for soybean 1 year for leafy, root and tuber vegetables. 0 days for canola, corn and potato. Ground application only – in furrow treatment. Ground and aerial application may be made for foliar sprays. For further information please see REG2004-06. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See REG2004-06 **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(5) CYPERMETHRIN-POTATO-TOMATO**

Submitter	Information on alternatives to endosulfan
Canada	**1. Description of the alternatives** **Cypermethrin** Trade name: Ripcord 400 EC; Up-Cyde 2.5 EC CAS #: 52315-07-8 Potato, tomato – leafhopper (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** Re-evaluation of this pesticide is initiated in Canada (Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of leafhoppers - $10.33 Tomato for control of leafhoppers - $10.33 to12.58 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Contact and stomach action. Also displays anti-feeding action. Synthetic pyrethroid insecticide. IRAC Resistance management MoA group 3. Ground and aerial application for leafhopper control. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Re-evaluation of this pesticide is initiated in Canada. **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(6) DELTAMETHRIN-POTATO** **1. Description of the alternatives** **Deltamethrin** Trade name: Decis 5 EC Hort CAS #: 52918-63-5 Potato - aphid Potato - leafhopper (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** Re-evaluation of this pesticide is initiated in Canada. **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of aphids - $23.00 Cost/ha ($CAD): Potato for control of leafhoppers - $9.20 to $23.00 (Source: Savvy Farmer Inc., 2011)

Submitter	Information on alternatives to endosulfan
Canada	**5. Efficacy** Non-systemic insecticide. Contact and stomach action. Fast acting. Synthetic pyrethroid insecticide. IRAC Resistance management MoA group 3. Ground and aerial application for leafhopper control. Ground application only for control of aphids. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf **7. Availability** Available. **8. Accessibility** Leafhoppers - accessible across Canada. Aphids - accessible in products formulated with a single active ingredient (i.e., deltamethrin only) in Eastern Canada and British Columbia. One product, Concept (Reg. No. 29611) contains deltamethrin co-formulated with imidacloprid and is available for use to control aphids on potato across Canada. **(7) DIAZINON-BEAN-POTATO-TOMATO** **1. Description of the alternatives** **Diazinon** Trade name: Diazinon 50 EC; Diazinon 50 W; Diazinon 500 E CAS #: 333-41-5 Bean (including cow pea) - aphids Potato, tomato– aphids and leafhoppers (jassids) **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Re-evaluation Note (REV2005-06) – *Preliminary Risk and Value Assessments of Diazinon*, Proposed Re-evaluation Decision (PRVD 2007-16) – Diazinon, Re-evaluation Decision (RVD2009-18) – *Diazinon* (attached) and Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf . **4. Cost-effectiveness** Cost/ha ($CAD): Bean for control of aphids - $20.96 Cost/ha ($CAD): Potato for control of leafhopper - $18.92 to 43.00 Cost/ha ($CAD): Tomato for control of aphids - $18.92 to 56.42 Cost/ha ($CAD): Tomato for control of leafhoppers - $43.00 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Contact and stomach action. Organophosphate insecticide. IRAC Resistance management MoA group 1B. Use as a foliar spray is to be discontinued as a result of re-evaluation. For further information on the value of this pesticide please see RVD2009-18. **6. Risk, taking into account the characteristics of potential persistent organic pollutants**

Submitter	Information on alternatives to endosulfan
Canada	**as specified in Annex D to the Convention** Active ingredient is registered. Re-evaluation decision published (RVD2009-18). Human health and environmental risks - foliar use is to be phased out. Soil drench and ear tag uses acceptable for re-registration. See Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf **7. Availability** Available. Foliar applications on beans (including cow pea), potato and tomato are to be phased out. **8. Accessibility** Accessible across Canada. **(8) DIMETHOATE-BEAN-POTATO-TOMATO** **1. Description of the alternatives** **Dimethoate** Trade name: Cygon 480 EC; Cygon 480-Ag, Lagon 480 E CAS #: 60-51-5 Bean (snap) – aphid Potato, tomato– aphids Potato, tomato - leafhoppers (jassids) **2. Technical feasibility** Registered. **3. Health and environmental effects** Re-evaluation of this pesticide is initiated in Canada (Re-evaluation Summary Table for Stakeholders 31 March 2011- en.pdf (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of leafhoppers - $16.91 to $33.83 Tomato for control of aphids - $16.50 to 33.83 Tomato for control of leafhoppers - $16.91 to $33.83 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide. Contact and stomach action. Organophosphate insecticide. IRAC Resistance management MoA group 1B. Ground application only to potato and tomato. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Re-evaluation of this pesticide is initiated in Canada. **7. Availability** Available. **8. Accessibility** Accessible across Canada.

Submitter	Information on alternatives to endosulfan
Canada	**(9) FLONICAMID-EGGPLANT-POTATO-TOMATO** **1. Description of the alternatives** **Flonicamid** Trade name: Beleaf 50SG Insecticide CAS #: 158062-67-0 Eggplant, potato, tomato -aphids **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Registration Decision (RD2011-01) – *Flonicamid* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Eggplant and tomato for control of aphids - $44.70 to $59.60 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide with contact and stomach action with antifedant activity. Unknown mode of action. IRAC Resistance management MoA group 9C. Applied as a foliar spray. Ground application only. For further information on the value of this pesticide please refer to RD2011-01. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See RD2011-01. **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(10) IMIDACLOPRID-POTATO** **1. Description of the alternatives** **Imidacloprid** Trade name: Admire 240F; Alias 240 SC, Grapple CAS #: 138261-41-3 Potato - aphids Potato - leafhoppers (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Regulatory Note (REG2001-11) – *Imidacloprid* (attached). **4. Cost-effectiveness** Potato to control aphids: $CAD/ha: 16.27-25.68 (foliar spray)

Submitter	Information on alternatives to endosulfan
Canada	(Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide with translaminar activity and with contact and stomach action. Readily taken up by the plant and further distributed acropetally, with good root-systemic action. Neonicotinoid insecticide. IRAC Resistance management MoA group 4. Applied as a seed piece treatment or in furrow at planting or as a foliar application. Foliar applications may not be applied if a group 4 insecticide was used as a seed piece treatment or applied in furrow at planting. Rotational crop restrictions – plant back interval of 30 days for cereals and grains; 9 months for peas and beans including soybean; 1 year for all other crops. Ground application only – seed piece treatment in furrow treatment and foliar sprays. Imidacloprid is co-formulated with deltamethrin in one product: *Concept* (Reg. No. 29611). **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See REG2001-11 **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(11) INSECTICIDAL SOAP-BEANS-EGGPLANT-POTATO-TOMATO** **1. Description of the alternatives** **Insecticidal soap** Trade name: Opal CAS #: unavailable; these products are mixtures. Beans (including cow pea), eggplant, potato, tomato - aphid **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Proposed Acceptability for Continuing Registration (PACR2004-04) – *Re-evaluation of Soap Salts* and Re-evaluation and Decision Document (RRD2004-26) – *Soap Salts* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Bean (dry), eggplant, tomato for control of aphids – $158.40 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Contact action. No residual activity once dry. Phytotoxicity from repeated applications. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Re-evaluation is complete.

Submitter	Information on alternatives to endosulfan
Canada	See PACR2004-04, RRD2004-26 and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(12) KAOLIN-APPLE** **1. Description of the alternatives** **Kaolin Clay** Trade name: Surround WP Crop Protectant CAS #: 1332-58-7 Apple – leafhopper (jassids) **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Proposed Regulatory Decision Document (PRDD2003-08) – *Kaolin/Surround WP Crop Protectant* and Regulatory Decision Document (RDD2004-01) – *Kaolin/Surround WP Crop Protectant* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of leafhoppers - $25.75 to $51.50 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Creates a particle film which inhibits movement and feeding by leafhoppers. The exact mode of action of kaolin has not been clearly identified, and probably varies from pest to pest. Applied as a foliar spray. Ground application only. For further information see PRDD2003-08 **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See PRDD2003-08 and RDD2004-01. **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(13) LAMBDA CYHALOTHRIN-BEAN-PEA-POTATO-TOMATO** **1. Description of the alternatives** **Lambda-cyhalothrin** Trade name: Matador 120 EC, Silencer 120 EC CAS #: 91465-08-06

Submitter	Information on alternatives to endosulfan
Canada	Fava bean (broad beans)– pea aphid Bean (dry and succulent), cow pea, potato, tomato – potato leafhopper (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Proposed Regulatory Decision Document (PRDD2003-03 and PRDD2004-02) – *Lambda-cyhalothrin Demand CS Insecticide* and *Lambda-cyhalothrin Saber Insecticide ear Tags* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of leafhoppers - $14.57 to 15.77 Tomato for control of leafhoppers - $14.57 to 21.94 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Contact and stomach action. Also has repellent properties. Synthetic pyrethroid insecticide. IRAC Resistance management MoA group 3. Ground and aerial application. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(14) MALATHION-BEAN-PEA-EGGPLANT-POTATO-TOMATO** **1. Description of the alternatives** **Malathion** Trade name: Malathion 25W; Malathion 500; Malathion 85E CAS #: 121-75-5 Bean, cow pea, eggplant, potato, tomato– aphids Eggplant, potato, tomato - leafhoppers (jassids) **2. Technical feasibility** Registered. **3. Health and environmental effects** Currently under re-evaluation. See PMRA Proposed Re-evaluation Decision (PRVD2010-18) and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Bean for control of aphids - $ 18.89 to 131.51 Eggplant for control of aphids - $13.75 to 131.51 Eggplant to control leafhoppers - $20.16 to $43.20 Potato for control of leafhoppers - $18.89 to $34.57

Submitter	Information on alternatives to endosulfan
Canada	Tomato for control of aphids - $18.89 to 101.62 (Source: Savvy Farmer Inc., 2011) **<u>5. Efficacy</u>** Non-systemic insecticide. Contact, stomach and respiratory action. Organophosphate insecticide. IRAC Resistance management MoA group 1B. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** See PMRA Proposed Re-evaluation Decision (PRVD2010-18) and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf (attached). **<u>7. Availability</u>** Available. **<u>8. Accessibility</u>** Accessible across Canada. **(15) METHOMYL-POTATO-TOMATO** **<u>1. Description of the alternatives</u>** **Methomyl** Trade name: Lannate Toss-N-Go CAS #: 16752-77-5 Potato, tomato – aphid Potato - leafhoppers (jassids) **<u>2. Technical feasibility</u>** Registered. **<u>3. Health and environmental effects</u>** Currently under re-evaluation. See PMRA Re-evaluation Note (REV2009-02) – *Preliminary Risk and Value Assessment of Methomyl*, Re-evaluation Note (REV2010-08) - *Methomyl* and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf (attached). **<u>4. Cost-effectiveness</u>** Cost/ha ($CAD): Tomato for control of aphids - $31.91 to $63.82 (Source: Savvy Farmer Inc., 2011) **<u>5. Efficacy</u>** Systemic insecticide. Contact and stomach action. Carbamate insecticide. IRAC Resistance management MoA group 1A. Ground application only. For further information on the value of this pesticide please see REV2009-02. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** See REV2009-02 and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf **<u>7. Availability</u>** Available.

Submitter	Information on alternatives to endosulfan
Canada	**<u>8. Accessibility</u>** Accessible across Canada. **(16) NALED-BEAN-POTATO** **<u>1. Description of the alternatives</u>** **Naled** Trade name: Dibrom CAS #: 300-76-5 Bean (dry) and lima bean – aphids Potato - leafhoppers (jassids) **<u>2. Technical feasibility</u>** Registered. **<u>3. Health and environmental effects</u>** Re-evaluation is complete. See Proposed Acceptability for Continuing Registration (PACR2004-33) – *Re-evaluation of Naled* (attached). **<u>4. Cost-effectiveness</u>** Cost/ha ($CAD): Bean (dry) for control of aphids - $53.84 to $107.69 (Source: Savvy Farmer Inc., 2011) **<u>5. Efficacy</u>** Non-systemic insecticide. Contact, stomach and respiratory action. Fast acting. Organophosphate insecticide. IRAC Resistance management MoA group 1B. Ground and aerial application. For further information on the value of this pesticide plese see PACR2004-33). **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** See PACR2004-33, RRD2006-24 and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf **<u>7. Availability</u>** Available. **<u>8. Accessibility</u>** Accessible across Canada. **(17) OXAMYL-POTATO** **<u>1. Description of the alternatives</u>** **Oxamyl** Trade name: Vydate L CAS #: 23135-22-0 Potato– aphid Potato - leafhoppers (jassids) **<u>2. Technical feasibility</u>** Registered.

Submitter	Information on alternatives to endosulfan
Canada	**3. Health and environmental effects** Re-evaluation is complete. See PMRA Proposed Re-evaluation Decision (PRVD2007-02) – *Re-evaluation of Oxamyl*, Re-evaluation Decision (RVD2008-05) - *Oxamyl* and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of aphids and leafhoppers - $60.50 to $78.91 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide. Contact and stomach action. Carbamate insecticide. IRAC Resistance management MoA group 1A. Ground application only. For further information on the value of this pesticide please see PRVD2007-02. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See PRVD2007-02, RVD2008-05 and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf **7. Availability** Available. **8. Accessibility** Accessible across Canada. **9. Any other information** **(18) PERMETHRIN-POTATO-TOMATO** **1. Description of the alternatives** **Permethrin** Trade name: Ambush 500 EC; Perm-Up; Pounce 384EC CAS #: 52645-53-1 Potato, tomato – leafhopper (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** Re-evaluation is initiated. See Re-evaluation Summary Table for Stakeholders 31 March 2011.- en.pdf **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of aphids and leafhoppers - $14.00 to 26.34 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Contact and stomach action with slight repellent effect.

Submitter	Information on alternatives to endosulfan
Canada	Synthetic pyrethroid insecticide. IRAC Resistance management MoA group 3. Ground and aerial application for leafhopper control. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(19) PHOSMET-POTATO** **1. Description of the alternatives** **Phosmet** Trade name: Imidan 50-WP CAS #: 732-11-6 Potato – aphids Potato - leafhoppers (jassids) **2. Technical feasibility** Registered. **3. Health and environmental effects** First phase of re-evaluation is complete. See PMRA Proposed Acceptability for Continuing Registration (PACR2004-38) – *Re-evaluation of Phosmet*, and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of aphids and leafhoppers - $78.64 to $78.64 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Non-systemic insecticide. Contact action. Organophosphate insecticide. IRAC Resistance management MoA group 1B. Ground application only. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See PACR2004-38, REV2007-14 and Re-evaluation Summary Table for Stakeholders 31 March 2011 - en.pdf **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(20) PYMETROZINE-POTATO** **1. Description of the alternatives** **Pymetrozine**

Submitter	Information on alternatives to endosulfan
Canada	Trade name: Fulfill 50WG CAS #: 123312-89-0 Potato -aphids **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Proposed Regulatory Decision Document (PRDD2002-03) – *Pymetrozine (TGAI) Endeavor 50WG fulfill50WG* and Regulatory Decision Document (RDD2003-02) – *Pymetozine* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for control of aphids - $55.42 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide with antifedant activity. Unknown mode of action. IRAC Resistance management MoA group 9B. Applied as a foliar spray. Ground and aerial application. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See PRDD2002-03 and RDD2003-02. **7. Availability** Available. **8. Accessibility** Accessible across Canada. **(21) SPIROTETRAMAT-BEANS-PEA-EGGPLANT-POTATO-TOMATO** **1. Description of the alternatives** **Spirotetramat** Trade name: Movento 240 SC CAS #: 203313-25-1 Beans, cow pea, eggplant, potato, tomato – aphid **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Registration Decision (RD2008-07) – *Spirotetramat* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Bean for control of aphids - $47.27 to $70.26 Eggplant and tomato for control of aphids - $56.21 to $93.26 Potato – no data.

Submitter	Information on alternatives to endosulfan
Canada	(Source: Savvy Farmer Inc., 2011) **5. Efficacy** Systemic insecticide with stomach action. Tetronic and Tetramic acid derivatives – inhibit lipid biosynthesis. IRAC Resistance management MoA group 23. Ground application only. For further information on the value of this pesticide please see RD2008-07. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See RD2008-07. **7. Availability** Available. **8. Accessibility** Acessible across Canada. **(22) THIAMETHOXAM-POTATO-BEAN** **1. Description of the alternatives** **Thiamethoxam** Trade Name: Actara 240SC; Actara 25 WG CAS #: 153719-23-4 Potato – aphids Bean (dry edible), Potato - leafhoppers (jassid) **2. Technical feasibility** Registered. **3. Health and environmental effects** See PMRA Regulatory Note (REG2001-03) – *Thiamethoxam, Helix, helix Xtra* (attached). **4. Cost-effectiveness** Cost/ha ($CAD): Potato for the control of aphids and leafhoppers - $17.44 to 35.35 (Source: Savvy Farmer Inc., 2011) **5. Efficacy** Insecticide with contact, stomach and systemic activity. Rapidly taken up into the plant and transported acropetally in the xylem. Neonicotinoid insecticide. IRAC Resistance management MoA group 4. Applied as a seed piece treatment or in furrow at planting or as a foliar application. Rotational crop restrictions – plant back interval of 0 days for potato, sorghum, wheat, barley, canola, pome fruit and cover crops (not to be grazed); All other crops - 120 days. Ground application only – seed piece treatment and in furrow treatment. Ground and aerial application for foliar sprays. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** See REG2001-03.

Submitter	Information on alternatives to endosulfan
Canada	**7. Availability** Available. **8. Accessibility** Accessible across Canada. **ADDITIONAL DOCUMENTS SUBMITTED BY CANADA:** The documents below are posted on the Stockholm Convention's website: http://chm.pops.int/tabid/2269/Default.aspx: 1) Proposed acceptability for continuing registration, Re-evaluation of soal salts 2) Proposed acceptability for continuing registration, Re-evaluation of naled 3) Proposed acceptability for continuing registration, Re-evaluation of phosmet 4) Proposed acceptability for continuing registration, Re-evaluation of acephate 5) Proposed regulatory decision document, Pymetrozine (TGAI), Endeavor 50WG, Fulfill 50WG 6) Proposed regulatory decision document, Lambda-cyhalothrin, Demand CS insecticide 7) Proposed regulatory decision document, Kaolin/Surround WP crop protectant 8) Proposed regulatory decision document, Lambda-cyhalothrin, Saber insecticide ear tags 9) Proposed Re-evaluation decision, Re-evaluation of oxamyl 10) Proposed re-evaluation decision, Diazinon 11) Proposed re-evaluation decision, Carbaryl 12) Proposed re-evaluation decision, Malathion 13) Registration decision, Spirotetramat 14) Re-evaluation summary table for stakeholders, 31 March 2011
Ecuador	Alternative chemicals to endosulfan: <table><tr><th>Name of the chemical product</th><th>CAS number</th></tr><tr><td>**Cipermetrina**</td><td>52315-07-8</td></tr><tr><td>**Clorpirifos**</td><td>2921-88-2</td></tr><tr><td>**Imidacloprid**</td><td>138261-41-3</td></tr></table>Source: Agrocalidad-Chemical Abstracts Service (CAS)

Submitter	Information on alternatives to endosulfan
Egypt	The Egyptian Environment Agency in collaboration with the other related stakeholders in Egypt are currently reviewing the full status of chemicals and non-chemicals alternatives to endosulfan over all the country and we hope very much to provide concrete information within the decided deadline.
European Union	The submission by the European Union “Support related to the international work on Persistent Organic Pollutants” is set out in annex III to the present document.
Georgia	Georgia is agrarian country. The main strategic crops are - wheat, grapes, citrus, fruit, tea, vegetables, grains and legumes. Among these crops there is spread a wide range of diseases against which country uses the integrated pest management. Usage of pesticides and their circulation are regulated in agriculture by legislation of Georgia about “Plant protection from harmful organisms” and “Pesticides and Agrochemicals”, also according normative acts. It is permitted to import and use only those pesticides, which have undergone biological , hygiene- toxicity and ecological examination and demonstrative field exams, are registered and added to “pesticides permitted to use in Georgia , State catalogue “, that is kept by Ministry of Agriculture. The Ministry of Environment Protection, Ministry of Health, Labour, and Social Protection of Georgia are actively involved in the process of evaluating and choosing of pesticides. In Georgia there registered a wide range of pesticides.At the present about 200 active substances and about 400 preparative forms of broad spectrum are registered. These chemicals are added to the list of registered in European Union substances - in first enclosure of 91/414/ECC directive or in USEPA registered list of active substance. Endosulfan is an off-patent organochlorine insecticide and acaricide that is being phased out globally. Endosulfan became a highly controversial agrichemical due to its acute toxicity, potential for bioaccumulation, and role as an endocrine disruptor. .Endosulfan has been used in agriculture around the world to control insect pests including Whiteflys, Aphids, Leafhoppers, Colorado potato beetles and Cabbage worms. Due to its unique mode of action, it is useful in resistance management; however, as it is non-specific, it can negatively impact populations of beneficial insects. It is, however, considered to be moderately toxic to honey bees, and it is less toxic to bees than organophosphate insecticides. Since 1985 Endosulfan did not use in Georgia. Mainly preference is given to pyrethroid preparations, of which consumption per 1 ha are much smaller and have less impact on the environment and human health compared with other classes of pesticides. They also have a low degree of accumulation and risk bio-accumulation in the environment does not exist. In Georgia, the priority is given to insecticide- Decis (Deltametrine), which is the broad spectrum insecticide with double action (oral,contact) and low rates of use . Bio-insecticides - Dipel and Forei are effectively counted in the integrated methods of pest managment (Bacillus thuringiensis subsp.kurstaki Bacillus thuringiensis var. kurstaki) **1. Description of the alternatives** **Crops:** Grapes, Fruits, Citrus, Tea, Vegetables, Grains, Leguminous **Pests:** White flays, Aphids, Leafhoppers, Colorado potato beetles, Cabbage worms, mites and etc. **Main pesticides:** ***Acaricides:*** *Bromopropilat* (Neoron, Faqtor), *Spiromesifen* (Oberon), *Spirodiklofen* (Envidor), *Tebufenpirat* (Masay), *Pyridaben* (Sammite), *Propargite* (Omite), *Sulphur* (Thiovit Jet) ***Insecticides***: *Alfa-cypermethrin* (Fastac , Alpac), *Acetamiprid, Aluminium phosphide-* (Phostoxin , Celphos), *Bentazone* (Basagran), *Chlorphyrifos* (Dursban, Dursban 450 ULU), *Cypermetrin* (Arrivo), *Deltametrin* (Decis , Decis profi Decis ULV), *Dimetoate* (Bi-58 New ,Safagor, Danadim), *Ethoprofos* (Mocap), *Imidacloprid* (Confidor ,Sultan, Confidor Maxy), *Indoxicarb* (Avant), *Lambda-cyhalothrin* (Karate , Karate Zeon) , *Methomil* Llanate), *Thiacloprid* (Calipso), *Thiamethoxam* (Actara) , *Tau-fluvalinate*

Submitter	Information on alternatives to endosulfan
Georgia	(Mavrik)..... etc. ***Bio Pesticides:*** *Spinosin A+Spinosin D* Spintor, *Abamectin* Vertimec, *Bacillus thuringiensis subsp. kurstaki Bacillus thuringiensis var. kurstaki* Foray, Dipel, Delfin, Lepidocide etc. Alternativ pesticide: • Pyrethroid ester insecticide • Delthametrin (Decis 25 EC, Decis ULV, Decis profi, Decis 12,5 EC),CAS # 52918-63-5 In Georgia used approximately 3-4 tone of Delthametrin per year. Main spreaded Pests in Georgia are *Huphantria cunea Drury*, Locusts (*Calliptamus italicus, Dociostamus maroccanus Thab.)*, *Zabrus tenebrioides elongatus, Phtorimaea operculla Zell,* Against them every year is conducted faighting measures: treatment of 15000 ha area and used 4-5 t Decis (Delthametrin). In Recreation territories is used 1 t Dipeli. **<u>2. Technical feasibility</u>** Pyrethroid Decis included in the integrated past management system. Already used in practice during 15 years in Georgia. Chemical treatment usually starts in the beginning of May in early stage of pest development, the rinse is conducted by Dianfog and TIFA types rinsers. From the mid summer territories with pests is treated twice by Decis. Time inteval between treatments 15-20 days. **<u>3. Health and environmental effects</u>** **Identification of hazards** Emergency Overview: • Danger and corrosive. • Causes irreversible eye damage. • May be fatal if swallowed. **Potential health effects** EYES: DANGER; CORROSIVE. Causes irreversible eye damage. SKIN: No skin irritant. INHALATION: Harmful if inhaled. INGESTION: May be fatal if swallowed. **Toxicological information** Oral: LD50 for Rats: 135->5000 mg/kg. LD50 for Dogs: >300 mg/kg. Dermal: LD50 for Rats and Rabbits: > 2000 mg/kg Inhalation: LC50 (4h) for Rats: 2.2 mg/l air. Eye Irritation: mild eye irritant (rabbits). Skin Irritation: Non-irritating to skin (rabbits). ADI (JMPR): 0.01 mg/kg b.w. Other: Non-mutagenic and non-teratogenic (mice, rats, rabbits). Toxicity class: WHO (a.i.) II **Ecological information** This pesticide is toxic to fish and aquatic invertebrates

Submitter	Information on alternatives to endosulfan
Georgia	96 hour LC50, Rainbow trout – 0.91µg/l, bluegill sunfish 1.4µg/l. Toxic to bees exposed to direct treatment LD50 (oral) 79 ng/bee; (contact) 51 ng/bee. **Avian toxicity**: Acute oral LD50 for mallard ducks >4640 mg/kg. Dietary LC50 (8 d) for mallard ducks >8039, quail >5620 mg/kg diet **Risk symbols:** **T:** Toxic., **N**: Dangerous for the environment **Risk phrases:** R23/25 Toxic by inhalation and if swallowed. R50 Very toxic to aquatic organisms. R53 May cause long-term adverse effects in the aquatic environment. **4. Cost effectiveness** The cost of 1 litter pesticide is approximately 15-25 USD. Inclusion of mentioned pesticides in the integrated pest programme is cost –effective as damage from pests much more high than expenses pest fighting activities. Following the recommendation of proper uses of pesticides will guarantee minimum damage of environment and health. **5. Efficacy** Biological effectiveness of Decisi is approximately 95-98 %-s, furthermore consumption is 0, 5 l/ha when consumption of Endosulfan is 3-6 kg/ha. This is in fact proves necessity of use alternative. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Characteristics of Decis: • It not persistent organic pollutant; • Has not bio cumulative character. • Easy degradable in the environment; • Half –life/half-disintegration period one day • Not mutagenic • Not cumulative • Not teratogen • Not gonadotrophic • Not neurotoxic There are no records on negative cases of use of Decis. Necessary to follow the safety rules during all life cycle (use and utilization) of Decis, this will insure to avoid negative impacts on health and environmental. As a widely used broad spectrum insecticide the uses of deltamethrin require careful evaluation of the potential impact on organisms in the environment. Deltamethrin dissipates rapidly mainly by adsorption to organic material. It is degraded moderately fast in soil and sediments. It is not expected to leach into the groundwater or to be transported to remote areas. Deltamethrin is metabolized by animals relatively quickly and therefore does not bioaccumulate. In the laboratory deltamethrin is highly toxic to aquatic invertebrates, fish, honeybees and some non-target arthropods. It is toxic to mammals, but of low toxicity to birds. Due to its environmental profile, exposure of environmental organisms to deltamethrin is relatively low and the toxicity under realistic conditions drastically reduced. Confirmed by a number of field studies, deltamethrin, when used according to the label, can be used

Submitter	Information on alternatives to endosulfan
Georgia	without unacceptable effects to the environment. **7. Availability** Recently in Georgian market available to fined/buy quite amount of pesticides containing Deltametrin and its analogy. Moreover accessible original pesticides such are Decis, Decis ULV, Decis prof as well as generic ones (delta, deltarin). The price of last ones is twice less in comparison with original ones. This gives opportunity to the customer of selection. Above mentioned pesticides are registered in State Catalogue where described the recommendations of use of pesticides, hazardous classes and hygienic norms. **8. Accessibility** Recently in Georgian market available to fined/buy quite amount of pesticides containing Deltametrin and its analogy. Moreover accessible original pesticides such are Decis, Decis ULV, Decis prof as well as generic ones (delta, deltarin). The price of last ones is twice less in comparison with original ones. This gives opportunity to the customer of selection. Above mentioned pesticides are registered in State Catalogue where described the recommendations of use of pesticides, hazardous classes and hygienic norms. **9. Any other information** Decis- ULV included in State Pest management Program against huphantria *cunea Drury, Locusts end etc.*
Guatemala	**INTEGRATED MANAGEMENT OF THE COFFEE (BERRY) BORER:** **(1) SAMPLING** **1. Description of the alternatives** It is the method to determine the population density of the pest and its distribution in order to decide the appropriate control measure. In low altitude regions (up to 600 m) take samples 2.5 - 3.0 months after the first representative flowering. In middle altitude regions (600-1200 m) take samples 3.0 - 3.5 months after a representative flowering, and in high altitude regions (higher than 1200 m) 4.0 - 4.5 months after a representative flowering. In every coffee field measuring up to 5 manzanas (1 manzana (mz) = 6,987 sq m), take a random sampling of 20 sampling sites covering the whole area. Each site is represented by five plants on the furrow: from each site take a random sample of 100 fruits from the top, center and bottom part of the plant, and from all 4 sides of the plant (20 fruits/plant). In order to determine the percentage, count the number of perforated fruits. The amount of borer-affected fruits represents the infestation rate per site. The infestation rate of the 5 manzanas lot is calculated by adding the total of borer-affected fruits divided by 20. **2. Technical feasibility** Fully feasible and assessed; ongoing field staff instruction and training. **3. Health and environmental effects** No effect on the health of workers and the environment. **4. Cost-effectiveness** Highly effective **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** No risk **7. Availability** Immediate **8. Accessibility** No limitations

Submitter	Information on alternatives to endosulfan
Guatemala	**(2) CULTURAL CONTROL** **1. Description of the alternatives** Cultural practices prevent the increase of the coffee berry borer populations by creating an unfavorable environment for their development. These are: a. Shadow management: at the beginning of the rainy season. It will provide more ventilation and lighting within the coffee plantation thereby affecting the development of the pest. b. Management of productive tissue (pruning): It helps to obtain higher production, better ventilation and lighting affecting pest development. c. Weed control: This practice facilitates efficient harvesting and enables efficient collection of fallen fruits. **2. Technical feasibility** Fully feasible and assessed; ongoing field staff instruction and training **3. Health and environmental effects** No effect on the health of workers and the environment. **4. Cost-effectiveness** Effective **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** No risk **7. Availability** Immediate **8. Accessibility** No limitations **(3) BIOLOGICAL CONTROL** **1. Description of the alternatives** Integrated management of the coffee berry borer through biological control using parasitoids is a feasible alternative for Guatemala. Cephalonomia stephanoderis and Prorops nasuta are natural enemies currently in use; its release and establishment in the field regulate the coffee borer populations by keeping them under the economic injury level. They penetrate the grain, deposit their eggs during the immature stages of the borer, destroying them by hatching. In order to implement this control system at farm level, it is necessary to set up a rural laboratory, train staff and breed a stock of parasitoids. The farm production technology of these natural enemies is available to producers. **2. Technical feasibility** Fully feasible and assessed; ongoing field staff instruction and training. **3. Health and environmental effects** No effect on the health of the workers and the environment. **4. Cost-effectiveness** Effective **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention**

Submitter	Information on alternatives to endosulfan
Guatemala	No risk **7. Availability** Immediate **9. Any other information** Relatively few farms have established and maintained a successful rural laboratory, and coffee farmers indicate that it is difficult to keep trained staff permanently. **(4) ETHOLOGICAL CONTROL (USE OF TRAPS)** **1. Description of the alternatives** It is defined as the knowledge of the behavior of the pests in order to control them, because they respond to visual, physical and chemical signals and stimuli. The use of traps with semiochemicals (alcohols) has been applied quite successfully in view of their acceptable catch levels and low cost. **Trap components:** • Trap body: catch container with soapy water (to drown out the borer). • Dispenser: drip containing a mixture of methanol and ethanol in a 1:1 ratio which acts as insect attractant into the trap. **Recommendations on the use of traps:** • Trapping period: install the traps when the harvest is completed (January to March) and remove them when the rainy season starts, the highest borer catches occur during the dry season with the stimulus of accumulated rainfall records not exceeding 150 mm. • Density: 12 traps per manzana, in some farms 16 traps due to its low cost. • Installation height: installed on the coffee trees at 1.20 - 1.50 meters above the ground, the trap opening facing the street of the coffee plantation. • Attractants: use high purity ethanol and methanol alcohols (95%-100%). Mix alcohols in equal parts (1:1 ratio). To avoid risk of poisoning, it is recommended to dye the mixture by adding 3 small envelopes of red aniline per gallon. • Dispenser refill with attractant: When the attractant level falls below half of the drip, refill it to keep the attracting effect of the dispenser. • Design of the trap: Based on experimental assessments, it is recommended to use handmade red Eco-Iapar traps; if these are not available, use same design without color (lower catch rate). **2. Technical feasibility** Fully feasible and assessed; ongoing field staff instruction and training. **3. Health and environmental effects** No effect on the health of the workers and the environment. **4. Cost-effectiveness** Effective **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** No risk **7. Availability** Immediate **8. Accessibility**

Submitter	Information on alternatives to endosulfan

Guatemala

No limitations

9. Any other information

They have been widely accepted by the producers; as the body of the trap is a disposable bottle of carbonated water it offers the additional advantage of reuse.

Integrated management of the coffee berry borer (MIB):

- Sampling - cultural control, manual control, biological control, ethological control - chemical control (when the sampling identifies sites with infestation rates equal to or higher than the economic injury level).

(5) CHEMICAL CONTROL WITH CHLORPYRIFOS (VEXTER)

1. Description of the alternatives

The use of chemical control is only justified when the sampling identifies sites with infestations equal to or higher than the economic injury level, using low toxicity products in the technically recommended dose; only one application, at the right time and by focus avoiding general applications.

The criterion to consider a sampling site as a focus of infestation is based on the level of borer infestation and the production of coffee plantation as shown in a practical manner in the following table:

Chemical control of coffee berry borer depending on the production of coffee plantation and the coffee borer infestation level

Coffee plantation production (qq pergo/mz)	Level of coffee borer infestation (infestation foci)
10	5%
20	4%
30	3%
More than 40	2%

2. Technical feasibility

Fully feasible and assessed; ongoing field staff instruction and training.

It is an organophosphate toxicity category II, posing risks to human health and the environment. General precautions on pesticide management should be followed. As indicated, the recommendation relates to applications in foci once the areas of intervention have been defined on the basis of the sampling.

3. Health and environmental effects

Effective

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Risks inherent in the chemical properties of chlorpyrifos

7. Availability

Immediate

8. Accessibility

No limitations

9. Any other information

In tests on the coffee berry borer control, chlorpyrifos has shown an acceptable level of pest control, although lower than the control obtained with endosulfan.

Submitter	Information on alternatives to endosulfan
Guatemala	
India	Additional information submitted by Inida is set out in annex IV to the present document.

(1) ACETAMIPRID

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Whiteflies.
Cabbage & Okra	Aphid.
Chilli	Thrips
Consumption/year:-NA[1]	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs 175-450/ hectare for **Acetamiprid 20%SP**

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the products.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: - 35, 140 & 210 days in basic, neutral & acidic water, respectively.(As per agenda in India for formulation)

Half life- in soil: - 1-3 days. (As per agenda in India for formulation)

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

9. Any other information

Data regarding toxicity of the pesticide is at Annexe I Sl No 6.

(2) ACEPHATE

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	jassids, Boll worms

---

[1] NA: Not available.

Submitter	Information on alternatives to endosulfan
India	

Safflower	Aphid.
Rice	Stem borer, Leaf folder, plant hopper, Green leaf hopper GLH).
Consumption/year:- 1513.0 MT (Tech. Grade) Source-States/UT,Zonal conference on inputs,2010)	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs. 202-518/ hectare **for Acephate** 75%SP

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: NA

Half life- in soil: - 7-10 days.(As per Pesticide manual-XI Edition)

WHO classification: Moderately Hazardous

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

(3) BUPROFEZIN

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Thrips, Whiteflies.
Mango	Hopper
Chilli	Yellow mites
Grapes	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs 1200/ ha for **Buprofezin 25%**

Submitter	Information on alternatives to endosulfan
India	Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: -51 days at pH 5 and stable at pH 7 & 9 (As per agenda Tech. grade),

Half life- in soil: - 36-104 days. (As per agenda Tech. grade),

WHO classification: Slightly Hazardous

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

9. Any other information

Data regarding toxicity of the pesticide is at Annex I (Sl. No.2)

(4) CARBOSULFAN

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Thrips.
Chilli	White aphid.
Rice	BPH, GLH, WBPH, Gall midge, Stem borer, Leaf folder.
Consumption/year:-131.22 MT(Tech. grade) Source-States/UT,Zonal conference on inputs,2010)	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Cost –Not Available

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: NA

Half life- in soil: - About 2 years (As per agenda for tech.); 2 to 5 days. (As per Pesticide manual-XI Edition)

WHO classification: Moderately Hazardous

<table>
<tr><th>Submitter</th><th>Information on alternatives to endosulfan</th></tr>
<tr><td>India</td><td>
<p>7. Availability</p>
<p>As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.</p>
<p>8. Accessibility</p>
<p>NA</p>
<p>(5) CHLORPYRIPHOS</p>
<p>1. Description of the alternatives</p>
<table>
<tr><th>Crop</th><th>Insect Pest controlled</th></tr>
<tr><td>Cotton</td><td>Aphid, Whiteflies, Bollworm, Cut worm.</td></tr>
<tr><td>Rice</td><td>BPH, GLH, Stem borer, Leaf folder, Gall midge, Grass hopper.</td></tr>
<tr><td>Ground nut</td><td>Aphid, root grub.</td></tr>
<tr><td>Mustard</td><td>Aphid</td></tr>
<tr><td>Gram</td><td>Cut worm, Pod borer.</td></tr>
<tr><td>Beans</td><td>Pod borer, Black bug.</td></tr>
<tr><td>Sugarcane</td><td>Black bug, Early shoot & stalk borer, Pyrilla</td></tr>
<tr><td>Brinjal</td><td>Shoot & fruit borer,</td></tr>
<tr><td>Cabbage</td><td>Diamond back moth.</td></tr>
<tr><td>Onion</td><td>Root grub</td></tr>
<tr><td>Apple</td><td>Aphid</td></tr>
<tr><td>Ber</td><td>Leaf hopper</td></tr>
<tr><td>Citrus</td><td>Black citrus aphid</td></tr>
<tr><td>Tobacco</td><td>Ground beetle</td></tr>
<tr><td>Wheat, Barley, Gram, Sugarcane</td><td>Termite control.</td></tr>
<tr><td colspan="2">Consumption/year:- 1540.90 MT(Tech. grade).
Source-States/UT,Zonal conference on inputs, 2010)</td></tr>
</table>
<p>2. Technical feasibility</p>
<p>The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.</p>
<p>3. Health and environmental effects</p>
<p>The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products. Hence, the insecticides used as per the recommended dose have no health hazards and ill environmental effects.</p>
<p>4. Cost-effectiveness</p>
<p>Rs 241-362/ hectare for Chlorpyriphos 20%EC Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.</p>
<p>5. Efficacy</p>
<p>The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.</p>
<p>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</p>
<p>Half life- in water: - 1.5 to 100 days. (As per Pesticide manual-XI Edition)</p>
<p>Half life- in soil: - 60 to 120 days. (As per Pesticide manual-XI Edition)</p>
<p>WHO classification: Moderately Hazardous</p>
<p>7. Availability</p>
<p>As reported by State Department of Agriculture, sufficient quantities of the pesticides are</p>
</td></tr>
</table>

Submitter	Information on alternatives to endosulfan
India	available for use in the country.

8. Accessibility

NA

(6) CHLORANTRANILIPROLE

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Bollworm
Cabbage	Diamond back moth.
Sugar cane	Termite, early shoot borer, Top borer
Rice	Stem borer, Leaf folder
Tomato	Fruit borer
Chilli	Fruit borer
Brinjal	Shoot & Fruit borer
Pigeon pea	Pod borer
Soybean	Green semilooper, Stem fly, Girdle beetle.
Consumption/year:- NA	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs.1563-2055/ hectare for **Chlorantraniliprole 18.5%SC**

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: 14 to 38 days (As per agenda Tech. grade).

1.32 to 1.39 days in India for formulation.

Half life- in soil: - 95.03 to 120 days. (As per agenda Tech. grade).

3.64 to 4.59 days in India for formulation.

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

9. Any other information

Data regarding toxicity of the pesticide is at Annexe I Sl No 1

Submitter	Information on alternatives to endosulfan
India	**(7) EMAMECTIN BENZOATE**

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Boll worm
Cabbage	Diamond back moth
Chilli	Thrips, Mites, fruit borer
Brinjal	Fruit & shoot borer
Red gram	Pod borer
Chick pea	Pod borer
Grapes	Thrips
Consumption/year:- NA	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Cost Not Available.

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: - 19.5 weeks in pH 9.0 and stable up to 6 weeks at pH-5.2 to 8.0 (As per agenda Tech. grade).

1.03 to 1.26 days in India for formulation.

Half life- in soil: - 174.2 days. (As per agenda Tech. grade).

2.04 to 2.89 days, in India for formulation.

7. Availability

As reported by State Departments of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

(8) DELTAMETHRIN

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Boll worm, Sucking pests.
Chick pea	Fruit borer
Chilli	Fruit borer
Rice	Stem borer, Leaf folder
Tea	Thrips, Caterpiller, Leaf roller, Looper.
Bhindi	Shoot & fruit borer, jassids.
Ground nut	Leaf miner.

Submitter	Information on alternatives to endosulfan
India	

Mango	Hoppers.
Consumption/year:- 94.0 MT (Tech.grade). Source-States/UT,Zonal conference on inputs,2010)	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs172-215/ hectare for **Deltamethrin2.8%EC**

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: -2.5 days at pH-9. (As per Pesticide Manual XI Edition).

Half life- in soil: - 21 to 36 days. (As per Pesticide Manual XI Edition).

WHO classification: Moderately Hazardous.

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

(9) FIPRONIL

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Thrips, Whiteflies, Boll worms.
Cabbage	Diamond back moth.
Chilli	Thrips, Aphids, fruit borer.
Rice	Brown Plant hopper (BPH), WBPH, GLH, Gall midge, Whorl maggot, Stem borer.
Sugar cane	Early shoot borer, Root borer.
Consumption/year:- 46.34 MT (Tech grade). Source-States/UT,Zonal conference on inputs,2010)	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil,

Submitter	Information on alternatives to endosulfan
India	water and plant while registering the above products.

4. Cost-effectiveness

Rs 1120-2800/ hectare for **Fipronil 5%EC**

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: - 28 days at pH-9 and stable in water at pH-5 & 7 (As per Pesticide Manual XIth Edition).

Half life- in soil: - NA

WHO Classification: Moderately Hazardous

7. Availability

As reported by State Departments of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

(10) LAMBDA- CYHALOTHRIN

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Jassids, Thrips, Boll worm. Whiteflies.
Brinjal	Shoot & fruit borer
Chilli	Thrips, Mite, Fruit borer.
Rice	Leaf folder, Stem borer, GLH, Gall midge, Hispa, thrips.
Tomato	Fruit borer.
Pigeon pea	Pod borer, pod fly.
Onion	Thrips.
Bhindi	Jassids, Shoot borer.
Chick pea	Pod borer.
Groundnut	Thrips, Leaf hopper, Leaf miner.
Mango	Hoppers
Consumption/year: - 90.2 MT (Tech. grade). Source-States/UT,Zonal conference on inputs,2010)	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Cost Not Available.

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

Submitter	Information on alternatives to endosulfan
India	

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of these products.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: 7 days at pH-9 (As per agenda tech. grade)

Half life- in soil: - 22 to 82 days (As per agenda in tech. grade)

4 to 12 weeks (As per Pesticide Manual XI th Edition).

WHO classification: Moderately Hazardous.

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

9. Any other information

Data regarding toxicity of the pesticide is at Annexe I Sl No 8

(11) THIAMETHOXAM

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Thrips, Whiteflies.
Mango	Hopper
Okra	Aphid, Jassid, Whitefly.
Rice	BPH, WBPH, GLH, Stem borer, Gall midge, Leaf-folder.
Sorghum	Shootfly.
Wheat	Termites, Aphid.
Mustard	Aphid
Tomato & Brinjal	Whiteflies
Tea	Mosquito bug
Potato	Aphids
Citrus	Psylla
Consumption/year:- NA	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs. 400/= per kg/lit.

Cost per hectare is Rs 180

Cost of Endosulfan 35% EC varies from Rs. 110 to Rs.329 per hectare depending on variation in crop wise dosage.

5. Efficacy

Submitter	Information on alternatives to endosulfan
India	The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: - 0.12 days in pH-9 while it was stable at pH-5 (As per agenda, tech.)

7.22 to 11.55 days in India for formulation.

Half life- in soil: - 9.66 to 15.71 days (As per agenda, in India for formulation).

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

NA

9. Any other information

Data regarding toxicity of the pesticide is at Annex I Sl No 3

(12) CLOTHIANIDIN

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Jassids, Whiteflies.
Rice	Brown Plant hopper (BPH)
Consumption/year:- NA	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Cost Not Available.

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: - 31 to 65 days (As per agenda tech. grade) & 3.8 years at 200C.

4.13 to 7.83 days in India for formulation.

Half life- in soil: - 143 to 1328 days. (As per agenda tech. grade) in different types of soil)

5.19 to 6.03 days in India for formulation.

7. Availability

As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.

8. Accessibility

Submitter	Information on alternatives to endosulfan
India	NA

(13) QUINALPHOS

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Bollworms, Aphids, Jassids, Thrips.
Cabbage	Aphid.
Chilli	Aphid, Mites.
Rice	Brown Plant hopper (BPH), Leaf roller, Stem borer, Hispa,Gall midge,
Sugarcane	Early shoot borer & shoot borer, Black bug, leaf hopper.
Sorghum	Stem borer, Mite, shoot fly, Ear head bug, Ear head midge.
Okra	Shoot & fruit borer, Leaf hopper, Mite.
Brinjal	Shoot & fruit borer, Jassids, Epilechna beetle, Leaf hopper.
Tomato	Fruit borer
Tea	Hopper Caterpiller, Thrips.
Tur	Pod borer, Pod fly.
Ground nut	Spodoptera, Leaf hopper, Leaf miner, Thrips, jassids, Red hairy Caterpillar.
Wheat	Aphid, Ear head caterpillar, Mite.
Black gram	Bihar hairy caterpillar, Pod borer
French bean	Stem fly
Soybean	Leaf weevil
Jute	Leaf roller, Semi looper, yellow mite.
Mustard	Sawfly
Sesamum	Leaf webber, jassids.
Safflower	Aphid
Cauliflower	Stem borer
Onion	Thrips
Apple	Wooly aphid.
Banana	Tingid bug.
Citrus	Scale, Citrus butterfly.
Mango	Mango bud mite
Pomegranate	Scales
Cardamom	Thrips
Coffee	Green bug.
Consumption/year:-NA	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs 265-1396/ hectare for **Quinalphos 25%EC**

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by

Submitter	Information on alternatives to endosulfan
India	the registrants at the time of registration of the product. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** **Half life- in water:** - 23 to 39 days (As per Pesticide Manual XI Edition). **Half life- in soil:** - 3 weeks (As per Pesticide Manual XI Edition). WHO classification: Moderately Hazardous **7. Availability** As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country. **8. Accessibility** NA **(14) FENVALERATE** **1. Description of the alternatives**

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Thrips, Bollworms.
Cauliflower	Diamond back moth, American boll worm, Aphids, Jassids.
Brinjal	Shoot & fruit borer, Aphids.
Okra	Shoot & fruit borer, Jassids.
Consumption/year:- NA	

Submitter	Information on alternatives to endosulfan
India	**2. Technical feasibility** The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968. **3. Health and environmental effects** The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products. **4. Cost-effectiveness** Rs 99-132/ hectare for **Fenvalerate20%EC** Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage. **5. Efficacy** The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** **Half life- in water:** - NA **Half life- in soil:** - 75 to 80 days (As per Pesticide Manual XI Edition). WHO classification: Moderately Hazardous **7. Availability** As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country. **8. Accessibility** NA

Submitter	Information on alternatives to endosulfan
India	

(15) PHORATE

1. Description of the alternatives

Crop	Insect Pest controlled
Cotton	Aphid, jassids, Thrips, Whiteflies.
Cauliflower	Aphid
Chilli	Aphid, Mite, Thrips
Potato	Aphid.
Tomato	Whiteflies.
Rice	Gall fly, Hispa, Leaf hopper, Plant hopper, Stem borer, Root weevil.
Bajra	Shoot fly, White grub.
Barley	Aphid
Maize	Shoot fly, Stem borer.
Sorghum	Shoot fly, Aphids, White grub.
Wheat	Shoot fly.
Black gram	Stem fly, White fly.
Green gram	Stem fly, Jassids.
Pigeon pea	Jassids, Stem fly.
Soybean	Stem fly.
Sugarcane	Top borer, White grub.
Ground nut	Aphid, Leaf miner, White grub.
Mustard	Mustard aphid, Painted bug.
Sesamum	Jassids, White fly.
Apple	Woolly aphid.
Brinjal	Aphid, Jassid, Lace wing bug, Red spider mite, Thrips.
Banana	Aphid
Citrus	Leaf miner.
Consumption/year:- 3284.0 MT (Tech. Gr.) Source-States/UT, Zonal conference on inputs,2010)	

2. Technical feasibility

The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.

3. Health and environmental effects

The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.

4. Cost-effectiveness

Rs 580-870/ hectare for **Phorate 10%CG**

Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.

5. Efficacy

The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.

6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention

Half life- in water: - 3.2 to 3.9 days (As per Pesticide Manual XI Edition).

Half life- in soil: - 2 to 14 days (As per Pesticide Manual XI Edition).

WHO classification: Extremely Hazardous.

<table>
<tr><th>Submitter</th><th>Information on alternatives to endosulfan</th></tr>
<tr><td>India</td><td>
<p><u>7. Availability</u></p>
<p>As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.</p>
<p><u>8. Accessibility</u></p>
<p>NA</p>
<p>(16) FLUVALINATE</p>
<p><u>1. Description of the alternatives</u></p>
<table>
<tr><th>Crop</th><th>Insect Pest controlled</th></tr>
<tr><td>Cotton</td><td>Aphid, jassids, Red cotton Bug, Bollworm.</td></tr>
<tr><td colspan="2">Consumption/year:- 11.04 MT (Tech. Gr.)
Source-States/UT, Zonal Conference on inputs,2010)</td></tr>
</table>
<p><u>2. Technical feasibility</u></p>
<p>The pesticide is approved for control of various insect pests of different crops under the Insecticides Act, 1968.</p>
<p><u>3. Health and environmental effects</u></p>
<p>The Registration Committee constituted under section 5 of the Insecticides Act, 1968 has evaluated the data on various parameters of toxicity and persistence and residue data in soil, water and plant while registering the above products.</p>
<p><u>4. Cost-effectiveness</u></p>
<p>Cost Not Available.</p>
<p>Rs.110-329/ hectare for Endosulfan 35% EC depending on variation in crop wise dosage.</p>
<p><u>5. Efficacy</u></p>
<p>The product is efficacious which has been proved through multi-location data submitted by the registrants at the time of registration of the product.</p>
<p><u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u></p>
<p>WHO classification: Slightly Hazardous.</p>
<p><u>7. Availability</u></p>
<p>As reported by State Department of Agriculture, sufficient quantities of the pesticides are available for use in the country.</p>
<p><u>8. Accessibility</u></p>
<p>NA</p>
<p><u>9. Any other information</u></p>
<p>Data regarding toxicity of the pesticide is at Annexe I Sl No 9</p>
</td></tr>
<tr><td>Iraq</td><td>
<p>Alternative to Endosulfan:</p>
<p>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.</p>
<p>A number of alternatives to endosulfan 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,</p>
</td></tr>
</table>

Submitter	Information on alternatives to endosulfan
Iraq	first consideration should be given to non-chemical management methods, and chemical pesticides viewed only as a last resort. **Chemical alternatives:** The chemical provided includes those registered in the EU for use on vegetable crops, to allow exporters to conform to EU import criteria. 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. **Biological control:** Biological control is increasing, with the introduction of beneficial insects, 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.
Japan	**1. Description of the alternatives** There are many alternative insecticides available for the following target crops / pests： ・ Target crops: Vegetables, Fruits, etc.; and ・ Target pests: Lepidopteran pests (i.e. Spodoptera litura, cabbageworm, diamondback moth), Hemipteran pests (i.e.cabbage aphids), etc. **2. Technical feasibility** These chemicals have been registeted and widely used in the country. **3. Health and environmental effects** Please refer to the column 6 below. **4. Cost-effectiveness** No informtion provided. **5. Efficacy** The effectiveness against target organisms of these chemicals was confirmed. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The environmental and human health risks were evaluated and were satisfied that the use of chemicals in compliance with Good Agricultural Practice (GAP) would not have adverse effects.

Submitter	Information on alternatives to endosulfan
Japan	**7. Availability** These chemicals have been on the market. **8. Accessibility** These chemicals can be purchased and used across the country. **9. Any other information** If necessary, information on alternatives for the specific crop / pest can be provided.
Mexico	The study by the National Ecology Institute (INE) of the Ministry of Environment and Natural Resources (SEMARNAT) identified some non-chemical alternatives for this pesticide have been approved in Mexico, such as biological control, manual control and cultural control and the use of traps, botanical insecticides and biochemicals. No embago, there is no detailed information on these alternatives regarding the different items that request on the form, as beyond the scope of the study. **(1) BIODIE** **1. Description of the alternatives** Commercial Name: BIODIE® (RSCO-MEZC-1101E-301-406-012) Description: Botanical contact insecticide/acaricide Percent content: Argemonine, 3.5% by weight, equivalent to 35.70 g/L. (CAS: N/A). Berberine, 2.2% by weight, equivalent to 22.20 g/L. (CAS: N/A). Ricinine, 2.8% by weight, equivalent to 28.00 g/L. (CAS: N/A). α-Terthienyl, 3.5% by weight, equivalent to 35.35 g/L. (CAS: N/A). Formulation: Aqueous extract Crops: Vegetables, fruits, ornamentals, grains and fodder. Control: whitefly *(Bemisia tabaci, Trialeurodes vaporariorum),* jumping plant lice *(Paratrioza cockerelli),* ashmead or citrus rust mite *(Phyllocoptruta oleivora),* broad mite *(Poliphagotarsonemus latus),* red spider mite *(Tetranychus spp., Panonychus sp., Oligonychus spp.),* Asian citrus psyllid *(Diaphorina citri),* diamondback moth (Plutella *xylostella),* cabbage looper *(Trichoplusia ni),* thrips *(Thrips spp., Frankliniella spp., Caliothrips phaseoli, Heliothrips sp.),* aphids *(Aphis spp., Myzus persicae, Brevicoryne brassicae, Toxoptera spp.).* Mode and mechanism of action: It exerts its insecticide action by contact and ingestion through a group of active ingredients with different modes of action, its detoxification is very difficult for the insects and there is a low probability of generating resistance. It easily penetrates through the cuticle of the insects affecting the central and peripheral nervous system. Its components have an intense excitatory action, causing hypersensitivity to external stimuli, convulsions, tetanization of the muscles and the death of the insect. It has a high knock down effect so that the insects stop eating and are paralyzed as soon as they touch the product or the treated surfaces. When consumed, it alters the physiological rhythm of the digestive system, prevents the contraction of the intestinal muscles and causes the paralysis of the insects and their destruction (hemolysis). Use per year: 200,000 liters. Effective dose: The application dose is 1.0 – 2.0 L/ha in horticultural crops, 1.5 – 2.0 L/ha in fruit crops, 1.0 – 1.5 L/ha in ornamentals, grains and fodder. **2. Technical feasibility** (1). Technology exists and can be used immediately. (2). The proposed alternative has already been implemented and marketed in Mexico. Trials or tests with the product have been conducted to expand its use in Mexico and to register it in Central America in accordance with guidelines on biological effectiveness studies currently

Submitter	Information on alternatives to endosulfan
Mexico	in force. **3. Health and environmental effects** (1). This product is a botanical insecticide/acaricide, with toxicity category 5 in the range of DL$_{50}$ oral (mg/kg) higher than 5000 according to the Mexican Official Standard NOM-232-SSA1-2009. (2). Oral (DL$_{50}$): no overt toxicity detected in a limit test with a dose of 2,000 mg/kg. Dermal (DL$_{50}$): no overt toxicity detected in a limit test with a dose of 2,000 mg/kg. No antidote or specific treatment required. Take symptomatic measures in case of allergy in susceptible individuals. The most common signs and symptoms of poisoning by oral or dermal contact and inhalation include headache, nausea, abdominal pain and diarrhea. Immediate measures that should be taken in case of overexposure to the product are: if spillage on the skin, wash the affected areas with soap and water and remove contaminated clothing. In case of contact with the eyes, wash the affected area thoroughly with clean water for 15 minutes. If the product has been swallowed and the person is conscious, induce vomiting by putting a finger in the throat or administering warm salt water. In case of unconsciousness, make sure that the person can breathe easily, do not induce vomiting and do not introduce anything in the mouth. It is toxic to fishes or other aquatic organisms. It is biodegradable. **4. Cost-effectiveness** BIODIE® has low environmental impact and is suitable for use in conventional production systems, integrated pest management, sustainable agricultural production systems and organic agriculture. BIODI®e is a very effective botanical insecticide for the control of whitefly (*B. tabaci*) and paratrioza (*B. cockerelli*) adults and nymphs using doses of 1.5 to 2 L/ha^{-1}, with a comparable effectiveness to *Imidacloprid + Cyflutrin* in its commercial doses of 0.3 L/ha^{-1}. BIODIE® (1.0, 1.5 y 2.0 L /ha-1) can be used as effective botanical insecticide for the control of diaphorina, aphids, white mites and mealybugs, in addition to being an alternative in the integrated management of the Persian lime pests. In general, it provides more strength and performance to the Persian lime trees, less damaged sprouts by diaphorina, aphids and broad mite, lower amount of fruits damaged by the broad mite as a result of diminished presence of insects on the treated fruits; its effectiveness is comparable to that of the *Dimetoato*. Cost per application is $360.00 pesos/ha. **5. Efficacy** Technical reports on biological effectiveness 044/2006 and 098/2009, issued by the Secretariat (SAGARPA) according to NOM-032-FITO-1995, are available. The biological efficacy of BIODIE® to control whitefly adults (*B. tabaci*) ranges from 33.3% to 80.4%; with an application of 2 L/ha^{-1} higher control rates but statistically equal to *Imidacloprid + Cyflutrin*, and even higher (75%) were obtained. The control of nymphs ranges between 44.8 and 83.3%; with the application of 2 L/ha^{-1} equal control rates as with *Imidacloprid + Cyflutrin* were obtained. BIODI®e used in doses from 1 to 1.5 L/ha^{-1} obtained biological effectiveness rates from 65.9% up to 68.2% in adult insects, while in nymphs the obtained rates were from 46.6% and 79.1% respectively. BIODIE® controlled between 47.1% and 89.4% of paratrioza adults (*B. cockerelli*). Using 1, 1.5 and 2 L/ha^{-1} the obtained effectiveness rates were statistically equal to that of Imidacloprid + Cyflutrin. The best results for BIODIE® were obtained with a dose of 2 L/ha^{-1} which exceeded that of Imidacloprid + Cyflutrin after 7, 28 and 42 days, equivalent to effectiveness rates of 83.3%, 81.8% and 66.6% respectively. With the application of 1.5 and 2 L/ha^{-1} the control of nymphs reached up to 78.49% and 94.73%, respectively, the latter exceeded that obtained with Imidacloprid + Cyflutrin in any assessment. With a dose of 1 L/ha^{-1} the maximum effectiveness obtained was 51.4%. In a study on Persian lime, the highest number of sprouts per tree was obtained using botanical insecticides BIODIE®, PROGRANIC® CinnAcar, PROGRANIC® Nimicide 80 and *Dimetoato*, reaching values from 164.25 to 256.5 sprouts per tree; these results exceeded that of the absolute control plot which produced only 112.5 sprouts per tree. A comparison of the number of sprouts when botanical and chemical insecticides were used showed that the

Submitter	Information on alternatives to endosulfan
Mexico	values were similar, ranging up to 240.75 and 256.5 sprouts per tree respectively. When using botanical insecticides the size of the sprouts was bigger reaching values from 28.75 to 38.75 cm, which exceeds the sprout size of the absolute control plot (18.75 cm). The damage caused by diaphorina in the control plot reached almost 100% of the sprouts, showing severe damage and small sizes (18.75 cm), while the damage on sprouts treated with botanical and chemical insecticides was slight, ranging between 18% and 37%, and the sprouts showed large sizes (28.75 to 40 cm); the efficacy ranged between 32% and 66% when botanical insecticides were applied and reached 54% when using Dimethoate. The damage caused by aphids was of 5.1% in the control plot, while in the sprouts treated with botanical or chemical insecticides the damage was only 0.38 to 0.60%, indicating an efficacy of 83% compared to the control plot. Likewise, the control plot showed damages by white mites on 10% of the sprouts, while the damage with botanical insecticides ranged between 0.0% and 4.1% and reached 7.89% when Dimethoate was applied; therefore, the efficacy with respect to the control plot was 40% to 100 % where botanical insecticides were applied and negative (-80%) where Dimethoate was applied. Where botanical insecticides and Dimethoate were applied, the amount of fruits obtained was three to six times bigger (2.63 to 4.27 tons/ha) than that of the control plot (0.708 tons/ha). The amount of fruits per tree ranged between 35.75 and 82.75 weighing between 4.01 and 8.73 kg per tree; these values exceed those obtained in the control plot, where about 13 fruits weighing 1.41 kg per tree were obtained. The comparison between the statistical data of chemical and botanical insecticides does not indicate a different behavior regarding the production in tons; there is a trend indicating increased production where BIODIE® (2.0 l L/ha-1), dimethoate (0.5 L/ha-1) and Nimicide PROGRANIC ® 80 (3.0 l L/ ha-1) were applied. The damage caused by broad mite in the control plot affected 20.23% of the fruits produced, 1.76% to 7.36% where botanical insecticides were applied and 33. 29% damage where Dimethoate was applied. The control efficacy obtained with botanical insecticides ranged between 22% and 62% and reached negative values in the number of damaged fruits (-887%) and a loss of tons per hectare (-890) caused by broad mites in trees where Dimethoate was applied indicating lack of control of this pest. The mealybug causes up to 77.22% of the total damage to the fruits harvested from the trees of the control plot, while 2.71% to 4.79% of the fruits treated with botanical insecticide were damaged, similarly to the chemical control, in view of the fact that of all fruits harvested per tree that were treated with this product, 6.16% were damaged. The control efficacy where botanical insecticides were applied was 76% to 82% thereby exceeding that of Dimethoate (52%). **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** (1). BIODIE® contains active ingredients that are approved for use in organic agriculture according to the "Guideline Inputs" of BIOAGRICERT-IFOAM, registered under Code IT BAC 008880. The inert ingredients are EPA-approved in its list Nr. 4. They do not pose risks during its use cycle, including manufacturing, distribution, use, maintenance and disposal. (2). BIODIE® does not contain any persistent organic pollutants or chemicals that could increase involuntarily health and environmental risks. It is biodegradable, does not accumulate in the food chain, does not require special measures for their transport over long distances and does not fall into the CRETIB classification. Because of its botanical conditions it is not considered as toxic or environmental contaminant by the 49CFR, ICAO, IMDG and the UN. Because of its botanical conditions it is considered to be neither nontoxic nor environmental contaminant according to 49CFR, ICAO, IMDG and the UN. There are no transport restrictions according to the Regulations for the Transport of Hazardous Materials and Waste. NFPA Class 7 (HMIS): health risk category 1. **7. Availability** The product is currently available on the market and can be used immediately. **8. Accessibility** (1). This product is registered in Mexico, is certified for free sale and has the export permit under the ""REGLAMENTO en Materia de Registros, Autorizaciones de Importación y Exportación y Certificados de Exportación de Pesticidas, Nutrientes Vegetales y Sustancias y Materiales Tóxicos o Peligrosos (Regulations on Registration, Import and Export

Submitter	Information on alternatives to endosulfan
Mexico	Authorizations, and Export Certificates for Pesticides, Plant Nutrients and Toxic or Hazardous Substances or Materials), published in the Official Gazette of the Federation on December 2004. It also has the SEMANAT export authorization under the terms of the registry and the export permit issued by the Federal Commission for Protection against Sanitary Risks. (2). The information provided is in line with the specific needs and circumstances of developing countries. **<u>9. Any other information</u>** The product can be mixed with other consumables without any restrictions. It is compatible with insecticides, fungicides (including those containing copper and sulfur), foliar fertilizers that do not alter the pH of the mixture beyond the specified range, pheromones, oils, soaps and microbial products. Its biological effectiveness remains unchanged even when mixed with hard water up to 1200 ppm, and its pH ranges between 6 and 8. **(2) CAOLIN** **<u>1. Description of the alternatives</u>** Kaolin (CAS 1332-58-7). Mark “Agro-SIAMIL®” (Aqueous solution in 65% w/w, equivalent to 1,080 g of kaolin per liter). Control of whitefly, aphids, mites, thrips, lepidopterous larvae in all crops. **<u>2. Technical feasibility</u>** It is available and can be applied. **<u>3. Health and environmental effects</u>** It does not pose risks; only the use of a dust mask is recommended. Inhalation: It may irritate the respiratory tract. Symptoms are sneezing and slight reddening of the nose. Skin Contact: It may cause dryness in case of excessive contact. Eye Contact: It may cause slight irritation. Ingestion: The product is of low toxicity but may obstruct and paralyze the intestine if large amounts are ingested. LIQUID MATERIAL HARMLESS FOR THE ENVIRONMENT, N.E.P. Contains KAOLIN directly from mines. Proper shipping name for domestic transport (D.O.T.): Chemicals, N.O.S. (Not Regulated) Proper shipping name for international air transport (I.M.O.): Chemicals, N.O.S. (Not Regulated) It is not a marine pollutant. Proper shipping name for international air shipping (I.C.A.O.): Chemicals, N.O.S. (Not Regulated) U.S. Customs Harmonization Number: 25070000004. **<u>4. Cost-effectiveness</u>** Low cost. High effectiveness against pests (even when compared against neonicotinoids). No adverse effect on health or environment. **<u>5. Efficacy</u>** Agro-SIAMIL® is a 100% natural product based on kaolin, a nonmetallic mineral (known in some parts of Mexico as "Blanco de España" or white lead) with laminar structure that alters

<table>
<tr><th>Submitter</th><th>Information on alternatives to endosulfan</th></tr>
<tr><td>Mexico</td><td>
<p>the behavior of pests creating undesirable environments for them; hence its insecticidal properties. It does not have phytotoxic effects. Because of its liquid form it is very easy to dispense.</p>
<p>Dose: 20 – 50 ml per liter of water (2% - 5 %). Start applications on the first appearances of the pest. Repeat the treatment every week.</p>
<p>It is recommended to dissolve the product previously in a half tank of water and then to add the remaining amount of water. It is recommended to use enough water to cover the whole crop.</p>
<p><u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u></p>
<p>It does not contain organic solvents. Agro-SIAMIL® is formulated with ingredients suitable and approved for organic agriculture. It does not pose any risks as environmental pollutant.</p>
<p><u>7. Availability</u></p>
<p>Fully available.</p>
<p><u>8. Accessibility</u></p>
<p>Fully accesible.</p>
<p><u>9. Any other information</u></p>
<p>Agro-SIAMIL® also creates a uniform porous film on the surface of plants, fruits and other surfaces that reflects the sunlight and protects the crop against sunspots in fruits and reduces the stress caused by excessive cold or heat.</p>
<p>(3) EBIOLUZION AND AKABROWN</p>
<p><u>1. Description of the alternatives</u></p>
<p>Commercial products: 1) ebioluzion vo, 2) akabrown. Crops: cucurbitaceae, solanaceae, cruciferae and fruit trees; pests: aphids, whiteflies, mites, leafhoppers, leafminers; doses: 1.0-2.0 L/ha, 4-6 applications/year.</p>
<p><u>2. Technical feasibility</u></p>
<p>The use of the two above-mentioned products showed successful results against the aforementioned pests in the Pacific, West, South East and Bajío regions in our country, and in specific crops like tomato, cucumber, pepper, melon, watermelon, potatoes, broccoli and cauliflower.</p>
<p><u>3. Health and environmental effects</u></p>
<p>Because of its organic base, these products are harmless to health and the environment; hence, they are officially certified for the use in organic agriculture.</p>
<p><u>4. Cost-effectiveness</u></p>
<p>The investment per hectare according to the cost of the above mentioned products (<i>akabrown</i> $ 515.00 and <i>ebioluzion vo</i> $ 596.00 in national currency) is highly effective taking into account the high economic damages that these pests cause to national agriculture.</p>
<p><u>5. Efficacy</u></p>
<p>Having assessed and compared the results obtained using these products to that of chemical-based products for the crops and pests mentioned above, it can be concluded that their use is highly effective in pest control and in reducing the resistance of the insects to chemicals.</p>
<p><u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u></p>
<p>Because of its organic base this does not apply to the products previously mentioned.</p>
<p><u>7. Availability</u></p>
<p>Greencorp biorganiks from Mexico is in a position to supply immediately these two</p>
</td></tr>
</table>

Submitter	Information on alternatives to endosulfan
Mexico	products, both for the domestic and international market where they are already been commercialized. **<u>8. Accessibility</u>** Considering the commercial distribution network of the company, these products are available in the agricultural market without accessibility limitations, as we cover the domestic regions of the Pacific, South East, Bajío and the West, and in Ecuador, Peru and Spain markets. **<u>9. Any other information</u>** The company has the capacity to develop and commercialize any product required in organic agriculture, either for use as a pesticide, fungicide, bactericide or organic fertilizer. **(4) JIRO** **<u>1. Description of the alternatives</u>** About 6 applications per ha in short cycle crops. **<u>2. Technical feasibility</u>** Full technical feasibility. Expected to be developed in the foreseeable future. It has been used already. **<u>3. Health and environmental effects</u>** No effects. **<u>4. Cost-effectiveness</u>** Cheap in relation to its effectiveness **<u>5. Efficacy</u>** Very effective. It attacks the nervous system of insects, without affecting the rest of the animals and plants: it acts as insect growth regulator since the active ingredient penetrates in larvae, nymphs and pupae blocking the biosynthesis of the hormone ecdysone that regulates the metamorphosis of the insects, so that they do not reach the adult stage. It controls whitefly, thrips, aphids, leafhoppers, spider mites, bollworm, and armyworm. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** There are no risks **<u>7. Availability</u>** It is on the market and can be used immediately. **<u>8. Accessibility</u>** Fully accessible. **(5) PEST: COFFEE BORER Broca del café Hypothenemus hampei, CROP: COFFEE** **<u>1. Description of the alternatives</u>** 1. Use of biopesticide formulations containing *Bauveria bassiana* 2. Induced biological control through the release of the parasitoid *Cephalonomia stephanoderis*. **<u>2. Technical feasibility</u>** The simultaneous use of some of these alternatives can ensure a completely satisfactory pest control in most of the coffee growing regions of México where the coffee berry borer represents an issue of economic importance. **<u>3. Health and environmental effects</u>** These alternatives are considered to have a low environmental impact and no health risks for

Submitter	Information on alternatives to endosulfan
Mexico	farm workers or consumers. **4. Cost-effectiveness** The cost of these alternatives is similar to or less than the cost of other conventional chemical treatment using products like endosulfan. The use of the parasitoid requires the implementation of conservation alternatives that allow its increased introduction and improved effectiveness, as well as the establishment of a rural infrastructure for rearing the parasitoid. **5. Efficacy** The efficacy of the application of alternative treatments such as *B. bassiana* is similar to that of conventional chemical treatments such as the use of endosulfan. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** There are no known risks. **7. Availability** Alternatives are available. **8. Accessibility** There is enough access to the alternatives; only training and a very economical infrastructure are needed to rear the parasitoid. Generally, cooperation between producers of the different regions is required. **9. Any other information** The comments provided here are based on the findings of research conducted in INIFAP, the Colegio de la Frontera Sur (ECOSUR) and other institutions. See: J.F. Barrera, J. Gómez, A. Castillo, E. López, J. Herrera y G. González. Broca del café, *Hypothenemus hampei* (Coleoptera: curcilionidae) in Hugo C. Arredondo Bernal y Luis A. Rodríguez del Bosque Editores. México 208 México 2008 p.101-120 MundiPrensa, Senasica, Soc. Mexicana de Control Biológico, INIFAP, Colegio Postgraduados. **(6) PEST: APHIDS *Ropalosiphum maidis, Schizaphis graminum, Aphis* spp, *Macrosiphum* spp, CROP: MAIZ** **1. Description of the alternatives** 1. Use of a pesticide with less environmental impact and specific effect against aphids: Pirimicarb (Pirimor). 2. Natural control with several species of predators. A group of at least 15 species has been identified, among which the orange convergent lady-beetle *Hipodamia convergens* and *chrysopas* spp stand out. 3. Use of yellow traps (sticky traps or trays with water). **2. Technical feasibility** The simultaneous use of several of these alternatives can ensure a completely satisfactory pest control in most maize growing regions of Mexico. **3. Health and environmental effects** These alternatives are considered to have low environmental impact and minimal health risks. **4. Cost-effectiveness** The cost of these alternatives is similar to the cost of conventional chemical treatment using products like endosulfan. The use of predators only requires the implementation of conservation alternatives that

Submitter	Information on alternatives to endosulfan
Mexico	enable its increased introduction and improved effectiveness. **5. Efficacy** The efficacy of alternative treatments such as Pirimor is at least similar to that of chemical treatment with endosulfan. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** There are no known risks. **7. Availability** There is full availability of these alternatives. The chemical insecticide Pirmicarb is available in the market. Predator species are native in the maize fields of Mexico. The producer can prepare the traps for himself; they are low cost. **8. Accessibility** Access to the alternatives is not a problem; they are available in most of the maize growing regions of our country. **9. Any other information** The comments provided here are based on the findings of research conducted in INIFAP. **(7) PEST: STEM BORER *Spodoptera frugiperda,* CROP: MAIZ** **1. Description of the alternatives** 1. Use of neem extracts (*Azadirachta indica)* as natural insecticide. 2. Application of biopesticide formulations containing Bt (*Bacillus Thuringiensis).* 3. Use of a biological pesticide with low environmental impact: Spinoteram from the company Dow Agrowsiences. 4. Natural control by parasitoids (more than 20 species of several families have been identified). 5. Use of sex pheromones (monitoring and mating confusion). **2. Technical feasibility** The simultaneous use of several of these alternatives can ensure a completely satisfactory pest control in most maize growing regions of Mexico. **3. Health and environmental effects** These alternatives are considered to have low environmental impact and minimal health risks. **4. Cost-effectiveness** These alternatives are similar in cost to the conventional chemical treatment with products like endosulfan. The use of parasitoids only requires the implementation of conservation alternatives that allow its increased introduction and the improved effectiveness. **5. Efficacy** The use of alternative treatments like Bt, neem or spinoteram, is at least as effective as the chemical treatment with endosulfan. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** There are no known risks.

Submitter	Information on alternatives to endosulfan
Mexico	**7. Availability** Alternatives are available. **8. Accessibility** The biological insecticide from Dow is on the market. Biopesticide formulations containing Bt are accessible. Access to neem extract and sex pheromones is limited in some States of the country and the products must be purchased in other regions. The above mentioned parasitoids are accessible, as they are locally native; conservation practices enhance their efficacy. **9. Any other information** The information provided here is based on the findings of research conducted in the INIFAP; see: Bahena J., F.; E. Cortes-Mondaca y R. Sánchez. 2010. Parasitoids of Fall Armyworm *Spodoptera frugiperda* Smith in Michoacán, México. Proceedings of the 58th Annual Meeting of the Southwestern Branch of the Entomol. Soc. Ame. p. 36 Molina O., J.; J. E. Carpenter; E. A. Heinrichs & J. E. Foster. 2003. Parasitoids and parasites of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas and Caribbbean basin: an inventory. Florida Entomol., 86 (3): 254 – 289 **ADDITIONAL DOCUMENTS SUBMITTED BY MEXICO:** The documents below is posted on the Stockholm Convention's website: http://chm.pops.int/tabid/2269/Default.aspx 1) Diagnóstico de la situación del Endosulfán en México
Monaco	Endosulfan is not used and/or produced in Monaco. In addition, no alternative is produced in Monaco. Finally, only alternatives used in France or the European Union are used in Monaco, where applicable.
Netherlands	**1. Description of the alternatives** Two literature sources have been used: **a)** the document submitted for the CRC1 of Rotterdam Convention in 2005: http://archive.pic.int/INCs/CRC1/o15add2)/English/ CRC%201-15-Add2%20endosulfan%20netherlands.pdf **b)** RIVM report 601356002/2011: http://www.rivm.nl/bibliotheek/rapporten/601356002.pdf

Submitter	Information on alternatives to endosulfan
Netherlands	Both documents have been added as pdf. Endosulfan has been in a phase out process in the Netherlands since 1984. Registration was terminated in 1991. Since 1988 only the application as insecticide and mite pesticide on apples were allowed until 1991. The CRC document mentions eight different alternative products for the application on apples: carbaryl, bromofos, diflubenzuron, teflubenzuron, fenoxycarb, pirimicarb, fenbutatin oxide and fosalone. Data on these alternatives have been summarized in the accompanying excelsheet. As a second entry the apple-pest combinations as mentioned in the CRC document were used to find out which pesticides are used at present for these combinations. Besides the three pesticides already mentioned in the CRC document (diflubenzuron, fenoxycarb and pirimicarb) 15 other products were thus retrieved. Three of these contained the pheromone codlemon, and two were other biological insecticides (bacillus and cydia (CpGV)). One pesticide often mentioned in the literature as alternative for endosulfan (spinosad) is not applied for pests on apples in the Netherlands. To support the Dutch delegation for the Stockholm Convention COP5 alternatives for endosulfan have been summarized and the results have been laid down in chapter 8 of the RIVM report 601356002/2011. Main attention was dedicated to alternatives for the use in cotton, which was the most important crop considering endosulfan use. Information about the Dutch autorisation for the most important alternatives have been added to the excelsheet. Status and production of alternatives for the use of endosulfan have been compiled in annex 18 of the report. Most of the alternatives were taken from the annex F information. For details on the alternatives on the Dutch market see accompanying excel sheet. **<u>2. Technical feasibility</u>** Please refer to the Excel sheet available on the website: www.pops.int/poprc/ **<u>3. Health and environmental effects</u>** Please refer to the Excel sheet available on the website: www.pops.int/poprc/ **<u>4. Cost-effectiveness</u>** Not available. **<u>5. Efficacy</u>** Please refer to the Excel sheet available on the website: www.pops.int/poprc/ **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** Please refer to the Excel sheet available on the website: www.pops.int/poprc/ **<u>7. Availability</u>** Please refer to the Excel sheet available on the website: www.pops.int/poprc/ **<u>8. Accessibility</u>** Please refer to the Excel sheet available on the website: www.pops.int/poprc/ **<u>9. Any other information</u>** Please refer to the Excel sheet and other submissions by the Netherlands available on the website: www.pops.int/poprc/ **ADDITIONAL DOCUMENTS SUBMITTED BY THE NETHERLANDS:** The documents below are posted on the Stockholm Convention's website: http://chm.pops.int/tabid/2269/Default.aspx: 1) Endosulfan. A closer look at the arguments against a worldwide phase out 2) Endosulfan: supporting documentation from Netherlands (UNEP/FAO/RC/CRC.1/15/Add.2)

Submitter	Information on alternatives to endosulfan
Netherlands	3) Excel sheet: Pesticides mentiond in CRC document CRC 1-15-Add2 endosulfan netherlands.pdf as alternative for endosulfan
United States	**(1) ACEPHATE** **1. Description of the alternatives** • Acephate is an organophosphate pesticide alternative currently used on cotton, tobacco, dry peas and dry beans. • Relevant pests include the lygus bug, whitefly, tobacco aphid, tobacco budworm, tobacco hornworm and pea aphid. • Annual domestic use is approximately 4 to 5 million pounds of active ingredient per year. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Acephate can cause cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills), respiratory paralysis and death. Acephate and its degradate methamidophos are highly toxic to honey bees and beneficial predatory insects on an acute contact basis. Acute and chronic risks to birds and chronic risk to mammals are also high. **4. Cost-effectiveness** Acephate is similar in cost-effectiveness to endosulfan in U.S. cotton, dry pea and dry bean production. **5. Efficacy** Acephate is the most commonly used pesticide for all three of the target pests on tobacco, and is similarly efficacious as endosulfan. Efficacy of acephate is similar to endosulfan in U.S. cotton, dry pea and dry bean production. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency completed a comprehensive review of the human health and ecological risks for registered uses of acephate under its reregistration program in 2006. Because acephate shares a common mechanism of toxicity with other organophosphates, the Agency conducted a cumulative risk assessment of the entire chemical class (http://www.epa.gov/oppsrrd1/cumulative/2006-op/op_cra_main.pdf). The 2006 assessment indicated that dietary exposures to acephate from eating food crops treated with acephate were below the level of concern for the entire U.S. population, including infants and children. Ecological risks are of concern to the Agency. Acephate is highly toxic to honey bees and beneficial predatory insects on an acute contact basis. Acute and chronic risks to birds and chronic risk to mammals are also of concern. The Agency will re-evaluate human health and ecological risk assessments, including a cumulative risk assessment of the organophosphates and an endangered species assessment for all uses of acephate in the next few years. The estimated completion of this re-evaluation under its registration review program is 2015. This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2008-0915-0006) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility**

Submitter	Information on alternatives to endosulfan
United States	Acephate is accessible in the U.S. and there are no geographic restrictions on its use. **9. Any other information** Fact sheet: http://www.epa.gov/oppsrrd1/REDs/factsheets/acephate_fs.pdf Reregistration Eligibility Decision for Acephate: http://www.epa.gov/pesticides/reregistration/REDs/acephate_red.pdf More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/acephate/index.htm **(2) BIFENTHRIN** **1. Description of the alternatives** • Bifenthrin is a broad-spectrum non-systemic pyrethoid insecticide/miticide alternative currently used on cucumber, eggplant, melon, pumpkin, squash, sweet potato, tobacco, tomato, vegetable seed crops, alfalfa grown for seed, dry peas and dry beans. • Relevant pests include cucumber beetle, whitefly, aphids, melon thrips, silverleaf whitefly, broad mite, two-spotted spider mite, armyworms, Colorado potato beetle, flea beetle, green peach aphids, rindworm, cabbage looper, melonworm, pickleworm, squash beetle, squash bug, squash vine borer, leafroller, sweet potato weevil, tobacco aphid, tobacco budworm, tobacco hornworm, stinkbug, cabbage seedpod weevil, lygus bug and pea aphid. • Annual domestic use is approximately 200,000 pounds of active ingredient per year. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Bifenthrin is a synthetic pyrethroid. As with the other pyrethroids, bifenthrin causes neurotoxicity in insects and mammals by the modulation of nerve axon sodium channels. Pyrethroids interfere with the ability of the nervous system to relay nerve transmissions, potentially resulting in tremors, convulsions, salivation, and other clinical effects. Bifenthrin is relatively persistent in the environment under most circumstances. Available data suggests that it has the potential to bioaccumulate in terrestrial food chains via consumption of contaminated aquatic organisms. Because of its high tendency to bind to soil, bifenthrin is expected to reach water bodies primarily bound to sediment. With its persistence, bifenthrin may accumulate in sediment, where it may be a reservoir for exposure for benthic organisms. Bifenthrin is very highly toxic to aquatic organisms, very highly toxic to terrestrial invertebrates (i.e., honey bees), and slightly to moderately toxic to birds and mammals. Product labels include restrictions on use practices that may result in bifenthrin run-off to water bodies. **4. Cost-effectiveness** Similar in cost-effectiveness to endosulfan in U.S. cucumber, eggplant, tobacco, alfalfa grown for seed, dry peas and dry beans production. Slightly lower cost-effectiveness due to higher cost in melon, pumpkin, squash, sweet potato, tomato production. Slightly higher cost-effectiveness due to lower cost in vegetable seed crop production. **5. Efficacy** Bifenthrin has a lower efficacy rating for whitefly than endosulfan, but it is the best alternative for controlling the entire key target pest spectrum for melon. Efficacy ratings indicate that bifenthrin effectively controls the same key target pest spectrum for cucumber, eggplant, melon, pumpkin, squash, sweet potato, tobacco, tomato,

Submitter	**Information on alternatives to endosulfan**
United States	vegetable seed crops, alfalfa grown for seed, dry peas and dry beans. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency completed a comprehensive review of the human health and ecological risks for registered uses of bifenthrin under its reregistration program in 2006. It will re-evaluate human health and ecological risk assessments, including an endangered species assessment, for all uses of bifenthrin in the next few years. The estimated completion of this registration review is 2016. Bifenthrin shares a common mechanism of toxicity with other pyrethroids, and is subject to cumulative risk assessment under U.S. law. Information regarding EPA's efforts to evaluate the cumulative risks of pyrethroid pesticide uses in the U.S. is available at the following website: http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-0384-0033) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Bifenthrin is accessible in the U.S. and there are no geographic restrictions on its use. Some, but not all, bifenthrin products are classified as "Restricted Use." **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/bifenthrin/index.html **(3) CHLORPYRIFOS** **1. Description of the alternatives** • Chlorpyrifos is an organophosphate insecticide, acaricide and miticide alternative used on pineapple, pear and alfalfa grown for seed. • Relevant pests include mealybug, cutworm, and spotted alfalfa aphid. • Approximately 8 million pounds are applied annually on all registered agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Chlorpyrifos can cause cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills), respiratory paralysis and death. Chlorpyrifos is highly toxic to fish and aquatic invertebrates on an acute basis. It is also highly toxic to birds and terrestrial invertebrates. **4. Cost-effectiveness** Similar in cost-effectiveness to endosulfan in U.S. pineapple, pear and alfalfa grown for seed production. **5. Efficacy** Comparative efficacy data are not available for endosulfan and its alternatives for control of key target pests in pineapple. Endosulfan is considered a "good" control of the suite of aphid pests in alfalfa grown for seed, which indicates 80-90% control, and is considered the most effective chemical control

Submitter	Information on alternatives to endosulfan
United States	for spotted alfalfa aphid. However, a more recent Integrated Pest Management (IPM) guide for controlling spotted alfalfa aphid in seed alfalfa crops considered chlorpyrifos the most effective chemical control, followed by dimethoate. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency's most recent draft human health risk assessment (2011) indicates that dietary exposures from eating food crops treated with chlorpyrifos are below the level of concern for the entire U.S. population, including infants and children. Drinking water risk estimates based on screening models and monitoring data from both ground and surface water for acute and chronic exposures exceed level of concern. The Agency's most recent ecological risk assessment (2000) identified acute and chronic risk of concerns to birds, mammals, terrestrial invertebrates, fish, and aquatic invertebrates. Mitigations to these concerns include the use of buffer zones, reductions in application rate and the number of application per season. EPA plans to conduct a complete ecological risk assessment including endangered species assessment by 2013. This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2008-0850-0007) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Chlorpyrifos is accessible in the U.S. and there are no geographic restrictions on its use. **9. Any other information** Link to fact sheet: http://www.epa.gov/oppsrrd1/REDs/factsheets/chlorpyrifos_fs.htm Reregistration Eligibility Decision for Chlorpyrifos: http://www.epa.gov/pesticides/reregistration/REDs/chlorpyrifos_red.pdf More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/chlorpyrifos/index.htm **(4) CYFLUTHRIN** **1. Description of the alternatives** • Cyfluthrin is a pyrethroid insecticide alternative used on potato, sweet potato, tomato, dry peas and dry beans. • Relevant pests include the Colorado Potato Beetle, potato leafhopper, potato tuberworm, sweet potato weevil, whitefly, aphids, and stinkbugs. • Approximately 150,000 pounds are applied annually on registered agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Cyfluthrin and beta-cyfluthrin target the neuromuscular system, along with causing non-specific effects such as decreased body weight gain and food consumption. The neuromuscular effects (i.e., tremors, gait abnormalities, abnormal postural reactions, splaying of limbs, and decreases in activity) occurred mainly in oral studies in the dog and the rat. The Agency is regulating cyfluthrins on neurotoxic endpoints to protect human health. For terrestrial species, cyfluthrin is practically nontoxic to birds, moderately toxic to mammals, and highly toxic to terrestrial invertebrates on an acute basis. Cyfluthrin is

Submitter	Information on alternatives to endosulfan
United States	classified as very highly toxic to aquatic organisms, based on data for aquatic vertebrates and invertebrates. An acceptable toxicity study with green algae suggests that cyfluthrin has low toxicity to nonvascular aquatic plants. **4. Cost-effectiveness** Similar in cost-effectiveness to endosulfan in U.S. dry peas and dry beans production. Slightly lower cost-effectiveness due to higher cost in potato, sweet potato, production. **5. Efficacy** Efficacy ratings indicate that cyfluthrin effectively controls the same key target pest spectrum for potato, tomato, dry peas and dry beans. Cyfluthrin controls a more narrow pest spectrum than endosulfan for sweet potato (namely only the sweet potato weevil). **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** In the Agency's 2007 human health risk assessment performed for cyfluthrin and *beta*-cyfluthrin, EPA determined that acute, short-term, intermediate-term, and chronic aggregate risk assessments were appropriate and risks were not of concern. The most recent ecological risk assessments on cyfluthrin were conducted in 2007. These assessments indicated risk concerns for freshwater and estuarine/marine organisms. In addition, there were risk concerns for organisms living in the sediment. The Agency intends to require data needed to conduct a comprehensive ecological risk assessment, including an endangered species risk assessment, and to update and revise the human health risk assessment for all uses of cyfluthrin and *beta*-cyfluthrin. The estimated completion of this registration review is 2016. Cyfluthrin and *beta*-cyfluthrin share a common mechanism of toxicity with other pyrethroids, and is subject to cumulative risk assessment under U.S. law. Information regarding EPA's efforts to evaluate the cumulative risks of pyrethroid pesticide uses in the U.S. is available at the following website: http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0081-0128) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Cyfluthrin and beta-cyfluthrin are accessible in the U.S. There are no restrictions on the use of cyfluthrins. **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/cyfluthrins/index.html **(5) DIAZINON** **1. Description of the alternatives** • Diazinon is an organophosphate pesticide alternative used on apple, pineapple, strawberries and pear. • Relevant pests include woolly apple aphid, pineapple fruit mite, cyclamen mite and Lygus bug.

Submitter	Information on alternatives to endosulfan
United States	- Approximately 4 million pounds are applied annually on all registered agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Although not carcinogenic, diazinon can cause cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills) respiratory paralysis and death. Furthermore, diazinon is a suspected endocrine disruptor. Diazinon is very highly toxic to birds, insects, fish, plants, invertebrates, and mammals. Chronic exposure to diazinon results in decreased reproduction in birds and inhibits growth and survival in mammals. Toxicity studies conducted in mice, rats and dogs showed decreases in body weight and reduced body weight gains. An endangered species assessment in 2007 by the Agency determined that diazinon would likely affect the California red-legged frog and 22 other evolutionarily significant species. **4. Cost-effectiveness** Costs are similar to endosulfan in U.S. apple and pear production. For pineapple and strawberry, diazinon has higher cost and yields lower production than endosulfan. In the U.S., with yield losses as high as 33% or the loss of an entire year of production for perennial strawberries, growers could be forced to discontinue growing strawberries or switch to another crop. **5. Efficacy** Similar efficacy for U.S. apple and pear production. For pineapple and strawberries, diazinon is less efficacious than endosulfan. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency completed a comprehensive review of the human health and ecological risks for registered uses of diazinon under its reregistration program in 2006. Because diazinon shares a common mechanism of toxicity with other organophosphates, the Agency conducted a cumulative risk assessment of the entire chemical class (http://www.epa.gov/oppsrrd1/cumulative/2006-op/op_cra_main.pdf). The assessments indicate that diazinon residues in food and drinking water resulting from agricultural uses do not pose human dietary risks of concern. However, residues from both residential and agricultural uses in surface were of concern, but mitigation measures, including the cancellation of all residential uses are expected to alleviate this concern. During the 2006 review, occupational exposure to diazinon was of concern for handlers and workers entering fields after applications. The Agency has also identified ecological risks of concern, particularly to birds, mammals, bees, fish, and aquatic invertebrates. In 2006, the Agency determined a number of mitigation measures were necessary to address occupational and ecological risks. The Agency believes that the adoption of these mitigation measures will reduce, but not eliminate, risks to wildlife and agricultural workers. The Agency will re-evaluate human health and ecological risk assessments, including a cumulative risk assessment of the organophosphates and an endangered species assessment for all uses of diazinon in the next few years. The estimated completion of this re-evaluation under its registration review program is 2015. This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2008-0351-0003). **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels.

Submitter	Information on alternatives to endosulfan
United States	**8. Accessibility** Diazinon is accessible in the U.S. All diazinon products are restricted use products and can only be used for agricultural purposes. There are no geographical restrictions on diazinon use. **9. Any other information** Link to fact sheet: http://www.epa.gov/oppsrrd1/REDs/factsheets/diazinon_ired_fs.htm Reregistration Eligibility Decision for Diazinon: http://www.epa.gov/pesticides/reregistration/REDs/diazinon_red.pdf More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/diazinon/index.htm **(6) DIMETHOATE** **1. Description of the alternatives** • Dimethoate is an organophosphate pesticide alternative used on potato, alfalfa grown for seed, dry peas, dry beans and pear. • Relevant pests include potato leafhopper, potato tuberworm, aphids, Lygus bug, and stink bug. • Approximately 1.8 million pounds are applied annually on agricultural sites. All non-agricultural uses, including residential uses, were cancelled in 2000. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** As with other organophosphates, the principal toxic effects induced by dimethoate are related to its cholinesterase-inhibiting activity; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g. accidents or major spills) respiratory paralysis and death. Dimethoate has a Group C classification as a “possible human carcinogen.” Dimethoate is moderately to very highly toxic to birds and moderately toxic to mammals, resulting in acute and chronic risks to terrestrial animals. Dimethoate is highly toxic to honeybees. Dimethoate plant toxicity has been observed, but data are lacking. **4. Cost-effectiveness** Similar to endosulfan in U.S. alfalfa grown for seed, dry pea and dry bean production. Lower cost-effectiveness due to higher cost in potato and pear production. **5. Efficacy** Effectively controls the key target pest spectrum for potato, alfalfa grown for seed, dry peas, dry beans and pear. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency completed a comprehensive review of the human health and ecological risks for registered uses of dimethoate under its reregistration program in 2006. Because dimethoate shares a common mechanism of toxicity with other organophosphates, the Agency conducted a cumulative risk assessment of the entire chemical class (http://www.epa.gov/oppsrrd1/cumulative/2006-op/op_cra_main.pdf). The Agency will re-evaluate human health and ecological risk assessments, including a cumulative risk assessment of the organophosphates and an endangered species assessment for all uses of dimethoate and its metabolites of concern in the next few years. The estimated completion of this re-evaluation under its registration review program is 2015.

Submitter	Information on alternatives to endosulfan
United States	This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0059-0002). **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Dimethoate is accessible in the U.S. and there are no geographic restrictions on its use. **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/dimethoate/index.htm **(7) ESFENVALERATE** **1. Description of the alternatives** • Esfenvalerate is a pyrethroid pesticide alternative used on cucumber, potato, tomato, vegetable seed crops, dry peas and dry beans. • Relevant pests include cucumber beetle, whitefly, aphids, Colorado Potato Beetle, potato leafhopper, potato tuberworm, stinkbug, weevil, and pea aphid. • Approximately 172,000 pounds are applied annually on agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Esfenvalerate is considered moderately acutely toxic via the oral route, but is less toxic via the dermal route. Esfenvalerate is a mild skin irritant but is not a skin sensitizer. The primary effects seen in subchronic and chronic toxicity studies are signs of neurotoxicity (e.g., decreased motor activity and hindlimb grip strength) and decrease in body weight. Esfenvalerate is classified as a Group E carcinogen (no evidence of carcinogenicity). Surface water runoff and spray drift are expected to be the major routes of exposure for esfenvalerate. Because of its high tendency to bind to soil, esfenvalerate is expected to reach water bodies primarily bound to sediment. With its persistence, esfenvalerate may accumulate in sediment, where it may be a reservoir for exposure for benthic organisms. The results of a submitted leaching study indicate esfenvalerate is unlikely to leach into ground water. However, esfenvalerate is not persistent in the atmosphere and is not expected to migrate through long-range transport. Previous ecological risk assessments for esfenvalerate indicated the following risks of concern: acute and chronic risk to small mammals, chronic risk to birds, acute and chronic risk to freshwater fish and invertebrates, and acute risk to estuarine/marine fish and invertebrates. Esfenvalerate was also found to be toxic to bees and other non-target insects. Risk to plants and chronic risk to estuarine/marine aquatic organisms could not be assessed due to lack of data. **4. Cost-effectiveness** Similar to endosulfan in U.S. cucumber, potato, vegetable seed crops, dry peas and dry beans production. Slightly lower cost-effectiveness due to higher cost in tomato production. **5. Efficacy** Effectively controls the key target pest spectrum for potato, tomato, vegetable seed crops, dry peas and dry beans. Esfenvalerate controls three of the four pests in the target spectrum for cucumber.

Submitter	Information on alternatives to endosulfan
United States	**6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency completed a comprehensive review of the human health and ecological risks for registered uses of esfenvalerate under its reregistration program in 2006. It will re-evaluate human health and ecological risk assessments, including an endangered species assessment, for all uses of esfenvalerate in the next few years. The estimated completion of this registration review is 2016. Esfenvalerate has a common mechanism of toxicity with other pyrethroids, and is subject to cumulative risk assessment under U.S. law. Information regarding EPA's efforts to evaluate the cumulative risks of pyrethroid pesticide uses in the U.S. is available at the following website: http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0301-0018) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Esfenvalerate is accessible in the U.S. and there are no geographic restrictions on its use. Some, but not all, esfenvalerate products are classified as "Restricted Use." **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/esfenvalerate/index.html **(8) FENPROPATHRIN** **1. Description of the alternatives** • Fenpropathrin is a pyrethroid insecticide and acaracide alternative used on apple, melon and pumpkin. • Relevant pests include stink bug, aphids, rindworm, whitefly, cucumber beetle, melonworm, pickleworm, squash beetle, squash bug, squash vine borer, striped flea beetle, cabbage looper and leafroller. • Approximately 87,000 pounds are applied annually on agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Fenpropathrin exhibits high acute toxicity through the oral and dermal routes of exposure. Fenpropathrin is a mild eye irritant, non-irritating to the skin and is not a skin sensitizer. Fenpropathrin is classified as "not likely to be carcinogenic to humans" based on carcinogenicity studies in rats and mice. Fenpropathrin is also toxic to honeybees; therefore, risk to beneficial insects is assumed. **4. Cost-effectiveness** Similar to endosulfan in U.S. apple and pumpkin production. Lower cost-effectiveness due to higher cost in melon production. **5. Efficacy** Similarly effective control of stink bug in apple production. Fenpropathrin controls the same range of pests as endosulfan in watermelon and pumpkin production.

Submitter	**Information on alternatives to endosulfan**
United States	**6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The most recent ecological and human health risk assessments for fenpropathrin were completed in 2008. In the 2008 human health risk assessment, dietary risk estimates (food and water) were below the Agency's level of concern. The results of previous occupational handler exposure assessments showed no risk estimates of concern. The primary environmental concerns identified in previous risk assessments were chronic risk to birds and mammals, and acute and chronic risk to fish, aquatic invertebrates including benthic organisms, reptiles, and terrestrial and aquatic phase amphibians. EPA anticipates completing its registration review of fenpropathrin in 2016. During this review, thehe Agency anticipates conducting a comprehensive ecological risk assessment, including an endangered species risk assessment, for all uses of fenpropathrin. The Agency also anticipates conducting an occupational human exposure risk assessment. Based on the 2008 human health risk assessment results, the Agency does not anticipate conducting a new dietary risk assessment unless endpoints and/or safety factors for fenpropathrin are revised. Fenpropathrin has a common mechanism of toxicity with other pyrethroids and is therefore subject to a cumulative risk assessment under U.S. law. Information regarding EPA's efforts to evaluate the cumulative risks of pyrethroid pesticide uses in the U.S. is available at the following website: http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-0422-0008) **7. Availability** (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-0422-0008) **8. Accessibility** Fenpropathrin is accessible in the U.S. It is not geographically restricted for apple, melon, or pumpkin uses. **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/fenpropathrin/index.html **(9) IMIDACLOPRID** **1. Description of the alternatives** • Imidacloprid is a neonicotinoid nitroguanidine insecticide alternative used on apple, cucumber, potato, tobacco, carrot, celery, lettuce, dry peas and dry beans. • Relevant pests include apple aphid, cucumber beetle, whitefly, aphids, Colorado potato beetle, potato leafhopper, tobacco aphid, leafminer, pea aphid. • Approximately 347,000 pounds are applied annually on agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Imidacloprid has low acute toxicity via the dermal and inhalation routes and moderate acute toxicity via the oral route. It is not an eye or dermal irritant and is not a dermal sensitizer. The nervous system is the primary target organ of imidacloprid. Nervous system effects evidenced as changes in clinical signs and Functional Observation Battery (FOB) assessments were seen in rat acute and subchronic neurotoxicity studies. These effects included: decreased motor and locomotor activities, tremors, gait abnormalities, increased righting reflex impairments and body temperature, and decreased number of rears and response to stimuli and decreases in forelimb and hindlimb grip strength. Imidacloprid as a "Group E" chemical, no evidence of carcinogenicity for humans, by all routes of exposure

Submitter	Information on alternatives to endosulfan
United States	based upon lack of evidence of carcinogenicity in rats and mice. Imidacloprid is environmentally persistent, thereby increasing the probability of exposure by non-target organisms. Imidacloprid has the potential to cause chronic risk to avian species and small mammals. A screening level ecological assessment indicates that imidacloprid may also pose an acute and chronic risk to both freshwater and estuarine/marine invertebrates. Secondary toxicity to fish is also possible through alteration in food chains based on invertebrates. Data reviewed by EPA indicates that imidacloprid is highly toxic to honeybees on an acute exposure basis; however, there is uncertainty regarding the potential chronic effects of imidacloprid on the honeybee colony. **4. Cost-effectiveness** Similar to endosulfan in U.S. cucumber, potato, dry peas and dry beans production. Lower cost-effectiveness due to higher cost in apple, tobacco, carrot, celery, lettuce production. **5. Efficacy** Similarly effective control of pests in apple, potato, tobacco, carrot, celery, lettuce, dry peas and dry beans production. Imidacloprid controls three of the four pests in the target spectrum for cucumber. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Human health risk assessments for imidacloprid conducted in 2007, including dietary, occupational, non-occupational and aggregate, did not indicate any risks of concern. A human health risk assessment for all registered uses is being conducted as part of registration review. The most recent ecological risk assessment for all registered uses was conducted in October 2007. An ecological risk assessment for all registered uses is being conducted as part of registration review including a risk assessment that supports a complete endangered species determination. Estimated completion of this registration review is 2016. This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2008-0844-0003) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Imidacloprid is accessible in the U.S. and there are no geographic restrictions on its use. **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/imidacloprid/index.htm **(10) LAMBDA-CYHALOTHRIN** **1. Description of the alternatives** • Lambda-Cyhalothrin is a non-systemic pyrethroid insecticide alternative used on apple, cucumber, squash, tobacco, vegetable seed crops, alfalfa grown for seed, dry peas and dry beans. • Relevant pests include stink bug, cucumber beetle, whitefly, aphid, pickleworm, silverleaf whitefly, tobacco budworm, tobacco hornworm, cabbage seedpod weevil,

Submitter	Information on alternatives to endosulfan
United States	Lygus bug and pea aphid. • Approximately 241,000 pounds are applied annually on agricultural sites. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** Lambda-cyhalothrin is moderately toxic following oral, dermal or inhalation exposures, and mildly toxic for eye and skin irritation. Lambda-cyhalothrin is not a dermal sensitizer. Lambda-cyhalothrin is classified as “not likely to be carcinogenic to humans” based on the lack of evidence of carcinogenicity in mice and rats. Lambda-cyhalothrin is very highly toxic to fish and aquatic invertebrates. It is also highly toxic to bees and other beneficial insects. Products that are co-formulated with the synergist piperonyl butoxide are likely to cause increased toxicity to non-target aquatic species. **4. Cost-effectiveness** Similar to endosulfan in U.S. apple, cucumber, tobacco, alfalfa grown for seed, dry peas and dry beans production. Lower cost-effectiveness due to higher cost in squash, production. Higher cost-effectiveness due to lower cost in vegetable seed crop production. **5. Efficacy** Similarly effective control of pests in apple, cucumber, squash, tobacco, vegetable seed crop, alfalfa grown for seed, dry peas and dry beans production. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency conducted its most recent ecological risk assessment of lambda-cyhalothrin for all registered uses in December 2006. That assessment indicated that there are risk concerns for freshwater, estuarine/marine organisms, and organisms living in the benthos. The most recent human health assessments were conducted in 2007 and 2008. The assessments identified no risk concerns from dietary, residential and occupational exposures. The Agency will re-evaluate human health and ecological risk assessments, including an endangered species assessment, for all uses of lambda-cyhalothrin in the next few years. The estimated completion of this registration review is 2016. Lambda-cyhalothrin shares a common mechanism of toxicity with other pyrethroids, and is subject to cumulative risk assessment under U.S. law. Information regarding EPA’s efforts to evaluate the cumulative risks of pyrethroid pesticide uses in the U.S. is available at the following website: http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html This chemical does not meet the Stockholm Convention’s bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-0479-0005) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Lambda-Cyhalothrin is accessible in the U.S. Lambda-Cyhalothrin is a Restricted Use Pesticide, due to toxicity to fish and aquatic organisms. **9. Any other information** More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/lambda_cyhalothrin/index.html **(11) MALATHION** **1. Description of the alternatives**

Submitter	Information on alternatives to endosulfan
United States	• Malathion is a organophoshate insecticide alternative used on cucumber, dry peas and dry beans. • Relevant pests include cucumber beetle, whitefly and aphids . • Approximate annual domestic usage of malathion is 15 million pounds of malathion as active ingredient. **2. Technical feasibility** This alternative is registered for use and is currently in use in the U.S. **3. Health and environmental effects** The toxic mode of action of malathion in insects and humans is by inhibition of acetylcholinesterase in the brain and peripheral nervous systems, which causes accumulation of the neurotransmitter, acetylcholine, and resulting signs of neurotoxicity. Malathion is metabolically activated to its cholinesterase inhibiting oxon metabolite, malaoxon, in insects and mammals. Brain, plasma and red blood cell cholinesterase inhibition all occurred at the same dose level in many, but not all, studies. Females are slightly more sensitive than males. Malathion is toxic to aquatic organisms, including fish and invertebrates. Product labels include restrictions on use practices that may result in malathion run-off to water bodies. **4. Cost-effectiveness** Similar to endosulfan in U.S. cucumber, dry pea and dry bean production. **5. Efficacy** Malathion controls three of the four pests in the target spectrum for cucumber and controls the same range of pests as endosulfan in dry pea and dry bean production. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** In order to mitigate occupational handler risk, the malathion RED revised in May 2009, specified additional personal protective equipment and engineering controls for some use patterns. The Agency anticipates updating and revising the ecological risk assessment for malathion (including an endangered species risk assessment) and updating and revising the human health risk assessment. The estimated completion of this registration review is 2015. Malathion shares a common mechanism of toxicity with other organophosphates, and is subject to cumulative risk assessment under U.S. law. Information regarding EPA's efforts to evaluate the cumulative risks of organophosphate uses in the U.S. is available at the following website: http://www.epa.gov/pesticides/cumulative/common_mech_groups.htm#op This chemical does not meet the Stockholm Convention's bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0317-0002) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Malathion is accessible in the U.S. There are no geographic restrictions nor are there any products designated "Restricted Use." **9. Any other information** Reregistration Eligibility Decision for Malathion: http://www.epa.gov/oppsrrd1/REDs/malathion-red-revised.pdf More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/malathion/index.html

Submitter	Information on alternatives to endosulfan
United States	**(12) METHOMYL** **<u>1. Description of the alternatives</u>** • Methomyl is an *N*-methyl carbamate insecticide and molluscicide alternative used on cucumber, potato, tobacco and tomato. • Relevant pests include cucumber beetle, whiteflies, aphid, potato leafhopper, potato tuberworm, tobacco budworm, tobacco hornworm and stinkbug. • An estimated 2.5 to 3.5 million pounds active ingredient of methomyl are applied annually in the U.S. **<u>2. Technical feasibility</u>** This alternative is registered for use and is currently in use in the U.S. All methomyl products, except the 1% bait formulations, are classified as restricted use pesticides. **<u>3. Health and environmental effects</u>** Methomyl is considered highly toxic via the oral route and in eye irritation studies, moderately toxic via the inhalation route, and to have low toxicity from dermal and skin irritation studies. It is not a dermal sensitizer. Methomyl is classified as a Group E carcinogen (no evidence of carcinogenicity). For handlers, there is no risk of concern when varying levels of personal protection equipment (respirators) and engineering controls (water soluble bags) are used. Methomyl shares a common mechanism of toxicity, cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills) respiratory paralysis and death. The major concerns for non-target organisms is chronic risks to non-target mammalian and freshwater invertebrate organisms. Methomyl is moderately to highly toxic to freshwater fish and moderately toxic to estuarine fish. Methomyl is very highly toxic to mammals on an acute oral basis and highly toxic to birds on an acute oral basis. **<u>4. Cost-effectiveness</u>** Costs are similar to endosulfan in U.S. cucumber, potato, tobacco and tomato production. **<u>5. Efficacy</u>** The Agency's analysis, based on available data, indicates that methomyl is an equally efficacious and affordable alternatives for use on cucumber, potato, tobacco and tomato. Methomyl is used more frequently than endosulfan in potato production for control of the potato leafhopper and potato tuberworm. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** The Agency completed it last review of ecological risks in 1998. The assessment indicated general concern about the ecological effects to terrestrial wildlife and aquatic organisms posed by exposure to methomyl. The 1998 risk assessment for methomyl shows various levels of concern regarding avian risk and mammalian risk from multiple applications of methomyl at short intervals. In addition, most agricultural uses present acute and chronic risks of varying levels to endangered and nonendangered aquatic organisms. The major concerns for non-target organisms are the chronic risks posed by the use of methomyl to non-target mammalian and freshwater invertebrate organisms. With risk mitigation measures in place, the Agency considers these risks acceptable. The Agency completed a comprehensive review of the human health risks for registered uses of methomyl under its reregistration program in 2007. Because methomyl shares a common mechanism of toxicity with other *N*-methyl carbamate, the Agency conducted a cumulative risk assessment of the entire chemical class (http://www.epa.gov/pesticides/cumulative/common_mech_groups.htm#carbamate) The Agency will re-evaluate human health and ecological risk assessments, including a cumulative risk assessment of *N*-methyl carbamate and an endangered species assessment for

<table>
<tr><th>Submitter</th><th>Information on alternatives to endosulfan</th></tr>
<tr><td>United States</td><td>
<p>all uses of methomyl in the next few years. The estimated completion of this re-evaluation under its registration review program is 2016.</p>
<p>This chemical does not meet the Stockholm Convention’s bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-0751-0004)</p>
<p><u>7. Availability</u></p>
<p>This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels.</p>
<p><u>8. Accessibility</u></p>
<p>Methomyl is accessible in the U.S. and is generally a restricted use pesticide (based on percent active ingredient. However, certain low percentage active ingredient. formulations are not designated as restricted use and can be used around livestock quarters, commercial premises, and refuse containers. There are currently no residential uses of methomyl registered in the U.S.</p>
<p><u>9. Any other information</u></p>
<p>Link to fact sheet: http://www.epa.gov/oppsrrd1/REDs/factsheets/0028fact.pdf</p>
<p>Reregistration Eligibility Decision for Methomyl:</p>
<p>http://www.epa.gov/oppsrrd1/REDs/0028red.pdf</p>
<p>More information can be accessed at:</p>
<p>http://www.epa.gov/oppsrrd1/registration_review/methomyl/index.html</p>
<p>(13) OXAMYL</p>
<p><u>1. Description of the alternatives</u></p>

Oxamyl is an <i>N</i>-methyl carbamate systemic and contact insecticide/acaricide and nematicide alternative used on cotton and potato.
Relevant pests include Lygus bug, whitefly, Colorado potato beetle, potato leafhopper and potato tuberworm.
Approximately 800,000 pounds of oxamyl active ingredient are applied annually.

<p><u>2. Technical feasibility</u></p>
<p>This alternative is registered for use and is currently in use in the U.S. Oxamyl is a restricted use pesticide.</p>
<p><u>3. Health and environmental effects</u></p>
<p>Oxamyl can cause cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills), respiratory paralysis and death.</p>
<p>Oxamyl, which is of toxicological concern, has a low affinity for adsorption and is mobile in a variety of soils. Data are also available to assess the hazard oxamyl poses to nontarget terrestrial and aquatic organisms. Oxamyl is highly to very highly toxic to birds and mammals, highly toxic to bees, and moderately toxic to fish and aquatic invertebrates.</p>
<p><u>4. Cost-effectiveness</u></p>
<p>Slightly lower cost-effectiveness due to higher cost in potato production. Similar to endosulfan in U.S. cotton production.</p>
<p><u>5. Efficacy</u></p>
<p>Similarly as effective against target pests on cotton and potato.</p>
<p><u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u></p>
</td></tr>
</table>

Submitter	Information on alternatives to endosulfan
United States	The Agency completed a comprehensive review of the human health and ecological risks for registered uses of oxamyl under its reregistration program in 2007. Because oxamyl shares a common mechanism of toxicity with other *N*-methyl carbamate, the Agency conducted a cumulative risk assessment of the entire chemical class (http://www.epa.gov/pesticides/cumulative/common_mech_groups.htm#carbamate). Used on several vegetables, fruits, and nonfood items, oxamyl residues in food and drinking water do not pose risk concerns for the general population. Oxamyl has no residential uses. During it review under its reregistration program, the Agency concluded that with required mitigation measures, oxamyl worker and ecological risks are believed to be significantly reduced. The Agency will re-evaluate human health and ecological risk assessments, including a cumulative risk assessment of the *N*-methyl carbamate, including a cumulative risk assessment of the *N*-methyl carbamates and an endangered species assessment for all uses of oxamyl in the next few years. The estimated completion of this re-evaluation under its registration review program is 2016. This chemical does not meet the Stockholm Convention’s bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-0028-0005) **<u>7. Availability</u>** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **<u>8. Accessibility</u>** Oxamyl is accessible in the U.S. All oxamyl end-use products are classified as “Restricted Use.” For some use sites, oxamyl is geographically restricted to certain states, as specified on product labels. **<u>9. Any other information</u>** Link to fact sheet: http://www.epa.gov/oppsrrd1/REDs/factsheets/0253iredfact.pdf Reregistration Eligibility Decision for Oxamyl: http://www.epa.gov/pesticides/reregistration/REDs/oxamyl_red.pdf More information can be accessed at: http://www.epa.gov/oppsrrd1/registration_review/oxamyl/index.html **(14) PERMETHRIN** **<u>1. Description of the alternatives</u>** • Permethrin is a pyrethroid pesticide alternative used on cucumber, potato and alfalfa grown for seed. • Relevant pests include cucumber beetles, whiteflies, aphids, Colorado potato beetle, potato leafhopper, potato tuberworm, Lygus bug and spotted alfalfa aphid. • Approximately 2 million pounds are applied annually on agricultural, residential and public health uses sites. **<u>2. Technical feasibility</u>** This alternative is registered for use and is currently in use in the U.S. **<u>3. Health and environmental effects</u>** The Agency classified permethrin as “Likely to be Carcinogenic to Humans” by the oral route. This classification was based on two reproducible benign tumor types (lung and liver) in the mouse, equivocal evidence of carcinogenicity in Long-Evans rats, and supporting structural activity relationship information. Permethrin is a synthetic pyrethroid. As with the other pyrethroids, permethrin causes

Submitter	Information on alternatives to endosulfan
United States	neurotoxicity in insects and mammals by the modulation of nerve axon sodium channels. Pyrethroids interfere with the ability of the nervous system to relay nerve transmissions, potentially resulting in tremors, convulsions, salivation, and other clinical effects. Permethrin is toxic to aquatic organisms, including fish and invertebrates. Product labels include restrictions on use practices that may result in permethrin run-off to water bodies. **4. Cost-effectiveness** The Agency's analysis, based on available data, indicates that permethrin is an equally efficacious and affordable alternative for use on cucumber and potato (similar to endosulfan). **5. Efficacy** Permethrin is considered equally efficacious as endosulfan for aphid pest control. It is considered an effective control of the key target pest spectrum for cucumber and somewhat more effective against target pests for potato. While endosulfan is considered a “fair” control of Lygus bugs, indicating 70-80% control, in alfalfa grown for seed, at least ten chemical alternatives to endosulfan are considered equally, or more, efficacious, including permethrin. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** The Agency completed a comprehensive review of the human health and ecological risks for registered uses of permethrin under its reregistration program in 2006. The Agency concluded that occupational handler risks were not of concern to the Agency with varying levels of personal protective equipment (e.g., double-layer, respirator) or engineering controls (e.g., enclosed cab, closed mixing/loading systems). Acute, chronic non-cancer, and cancer dietary (food and drinking water) risks from permethrin were below the Agency’s level of concern. The Agency anticipates completing a comprehensive registration review (ecological and human health risk assessment) for all uses of permethrin by 2017. Permethrin shares a common mechanism of toxicity with other pyrethroids, and is subject to cumulative risk assessment under U.S. law. Information regarding EPA’s efforts to evaluate the cumulative risks of pyrethroid pesticide uses in the U.S. is available at the following website: http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html This chemical does not meet the Stockholm Convention’s bioaccumulation criteria in Annex D, paragraph 1(c). (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2011-0039-0004) **7. Availability** This alternative is currently registered for use in the U.S. and can be legally used according to EPA-approved labels. **8. Accessibility** Permethrin is accessible in the U.S. Permethrin is a restricted use pesticide for crop and wide area applications (i.e., nurseries, sod farms) due to high toxicity to aquatic organisms, except for wide area mosquito adulticide use. It is a general use pesticide for residential and industrial applications. **9. Any other information** Link to fact sheet: http://www.epa.gov/oppsrrd1/REDs/factsheets/permethrin-facts-2009.pdf Reregistration Eligibility Decision for Permethrin: http://www.epa.gov/oppsrrd1/REDs/permethrin-red-revised-may2009.pdf From 2002 to 2010, approximately 10,000 human health incident cases were reported for permethrin, including 5 deaths and 15 major incidents; most of the major incidents were the result of using products without the required protective clothing. Based on the number and severity of incidents reported, the Agency will further analyze the incident data during registration review to determine whether additional use restrictions are warranted. More information can be found at:

Submitter	Information on alternatives to endosulfan
United States	http://www.epa.gov/oppsrrd1/registration_review/permethrin/index.htm
Pesticide Action Network (PAN) and International POPs Elimination Network (IPEN) PAN & IPEN	**SECTION 1: CROP-SPECIFIC** **(1) CROP: COTTON[1]** **1. Description of the alternatives** **Pests: cotton bollworm, pink bollworm** *Azadirachtin 0.5% * pheromone traps: 20-25/ha, lure to be changed at 15-30 day intervals * *Trichogramma chilonis:* 1,500,000/ha; 6-8 times at 10 day intervals * *Bacillus thuringiensis:* 2kg/ha, 2-3 times at 10 day intervals in evening * *Helicoverpa armigera* Nuclear Polyhedrosis Virus (NPV): 500-750 LE/ha, 2-3 times at 10 day intervals in evening **Pests: aphids, jassids, whiteflies** * *Chrysoperla carnea*: 50,000 1st instar larvae/ha, 2-3 times at 15 day intervals **Pest: Oriental leaf worm moth / cotton leafworm / cotton cutworm** * *Spodoptera litura* NPV: 500-750 LE/ha, 2-3 times at 10 day intervals in evening * pheromone traps: 20-25/ha, lure to be changed at 15-30 day intervals **Pest: semiloopers** **Bacillus thuringiensis:* 2kg/ha, 2-3 times at 10 day intervals in evening **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **5. Efficacy** Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so likely to be available **8. Accessibility** Recommended by the Government of India, so likely to be accessible **9. Any other information** Recommended by the Government of India **(2) CROP: COTTON[2]**

---

[1] Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf

[2] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-cotton.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	**<u>1. Description of the alternatives</u>** **Pest: Bollworm *Helicoverpa armigera*** <u>Cultural control</u>: * plough deeply; clean cultivation to expose the resting pupae, crop rotation and avoidance of ratooning reduces pest population * use tolerant varieties * trap crop with crops like tomato, destroying them when the pest population is high * use maize, and cowpea on borders and wild brinjal and *Setaria* (millet) as intercrops help significantly reduce the pest population <u>Biological control</u>: * release egg parasitoids like *Trichogramma chilonis* or *T. brasielenis* or *T. achaea* @ 1,50,000 /ha from 45th day onwards at 10-15 days interval (6 releases) and larval parasitoids such as *Chilonus blackburni, Bracon brevicornis, Telenomus heliothidae*, *Carcelia illota, Coteria kazat* or *Campoletis chloridae* @ 2000 adults/ha at 15 day-intervals * release pupa parasitoids *Brachymeria sp*. * release the predators *Chrysoperla carnea*, *Scymnus sp*. or *Eulophids* suppresses the population of larvae * spray *Helicoverpa armigera* NPV @ 250 LE/ha from 35th to 60th day of crop stage * *Bacillus thuringiensis* kurstaki @ 1 kg/ha * application of fungal pathogens like *Beauveria bassiana* or *Neumorea riley* under humid conditions is effective * spray 5% neem seed kernel extract **<u>2. Technical feasibility</u>** Recommended by an Indian university IPM programme so assumed to be technically feasible **<u>3. Health and environmental effects</u>** Health and environmental effects are less than those of endosulfan and likely to be negligible **<u>5. Efficacy</u>** Recommended by an Indian university IPM programme so assumed to be efficacious **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **<u>7. Availability</u>** Cultural controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **<u>8. Accessibility</u>** Cultural controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(3) CROP: COTTON**[1] **<u>1. Description of the alternatives</u>** **Pest: Pink bollworm (*Pectinophora gossypiella* Saunders)**

---

[1] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-cotton.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Cultural control: * clean cultivation and destruction of crop residues (fallen leaves, twigs etc) before the onset of season * plough deeply to expose the hibernating larvae / pupae * avoid late sowing of the crop; early sowing helps in early maturity facilitating escape * use tolerant varieties (Khandwa-2, JKH-1, Abadita, LH 900, Sujay and Desi cotton). * withhold irrigation water to avoid prolonged late boll production/ formation to reduce the build up of over-wintering population Biological control: * release of egg parasitoids *Trichogramma chilonis*, *Bracon elechidae*, *Elasmus johnstoni* or pupal parasitoid *Microbracon lefroyi* * encourage predators *Chrysoperla carnea*, *Scymnus* sp., *Triphles tantilus* or *Pyremotes ventricosus* (mite), or release them in the fields * apply *Bacillus thuringiensis* kurstaki @1 kg/ha **2. Technical feasibility** Recommended by an Indian university IPM programme so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **5. Efficacy** Recommended by an Indian university IPM programme so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Cultural controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **8. Accessibility** Cultural controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(4) CROP: COTTON**[1] **1. Description of the alternatives** **Pests: Jassids (*Amrasca biguttula biguttula*)** Cultural control: * sow the crop early * use resistant varieties such as Khandwa-2 or the varieties having leaves rich in tannin contents * do not use high doses of nitrogen fertilizers * grow cowpea/onion/soybean as an intercrop in cotton to reduce early stage of pest * use okra as trap crop * adopt proper crop rotation

---

[1] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-cotton.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* summer deep ploughing to expose soil inhabiting insects * remove and destroy crop residues/alternate host plants Mechanical control: * use yellow sticky traps * hand pick and destroy various insect stages * destroy affected plant parts * destroy stressed floral bodies * destroy resettled flowers * install bird perches: "T" shape wooden/bamboo sticks @ 50/ha should be erected to encourage predatory birds like king crow, mynah and blue jay Biological control: * release predator *Chrysoperla carnea*, *Coccinella septumpunctata* or *Syrphus / Scymnus* sp. * conserve spiders *Distina albida* and ants like *Camponotus* sp. **2. Technical feasibility** Recommended by an Indian university IPM programme so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **5. Efficacy** Recommended by an Indian university IPM programme so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **8. Accessibility** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(5) CROP: COTTON**[1] **1. Description of the alternatives** **Pest: Cotton aphid (*Aphis gossypii*)** Cultural control: * avoid late sowing and excessive use of nitrogen fertilizers * destroy infested shoots during early stages Mechanical control: * handpick and destroy various insect stages and the affected plant parts Biological control: * release predator *Chrysoperla carnea, Coccinella septumpunctata, Syrphus /Scymnus* sp.

---

[1] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-cotton.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* conserve spiders *Distina albida* and ants like *Camponotus* sp. **2. Technical feasibility** Recommended by an Indian university IPM programme so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **5. Efficacy** Recommended by an Indian university IPM programme so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **8. Accessibility** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(6) CROP: COTTON**[1] **1. Description of the alternatives** **Pest: Thrips (*Thrips Tabaci*)** Cultural control: * avoid Late sowing * grow cowpea/onion/soybean as an intercrop in cotton to reduce early stage pest * deep plough in summer and maintain weed free field and surroundings * grow certified acid delinted seeds of tolerant varieties * remove alternate host plants like kangni and ambadi Biological control: * encourage the activity of parasitoids *Thripoctenus briu*, *Triphleps tantilus* and mite *Campsid* sp. * release *Trichogramma Chilonis* 1.5 lakh/ha and *Chrysoperella* grubs @ 1-2 plants * release *Chrysoperla cornea* @ 2 larvae/plant in early stage of the plant and 4 larvae/plant in later stage * release *Cheilomenes sexmaculata* @ 1.5 lakh adults/ha at random on crop canopy **2. Technical feasibility** Recommended by an Indian university IPM programme so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **5. Efficacy** Recommended by an Indian university IPM programme so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants**

---

[1] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-cotton.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	**as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Cultural controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **8. Accessibility** Cultural controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(7) CROP: COTTON**[1] **1. Description of the alternatives** **Pest: White Fly (*Bemisia Tabaci*)** Cultural control: * avoid late sowing and adopt crop rotation with crop that is not the host of white fly * use resistant varieties K-2 * cultivate alternate host crops such as tomato and castor on the boundaries to trap and destroy pest Mechanical control: * set up yellow pan sticky traps at various places at the canopy height in field * remove and destroy crop residues after last picking * remove alternate host plants like kangni and ambadi Biological control: * encourage activities of parasitiods like *Encarsia shafeei* or *Eretmocerous mundus* * release predators such as *Chrysoperla carea, Melachilus sexaculatus, Coccinella septampunctata, Brumus* sp. or *Scymnus* sp. * release *Chrysoperla cornea* @ 2 larvae/plant in early stage of the plant and 4 larvae/plant in later stage * release *Cheilomenes sexmaculata* @ 1.5 lakh adults/ha at random on crop canopy * spray neem products @ 1500 ppm **2. Technical feasibility** Recommended by an Indian university IPM programme so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **5. Efficacy** Recommended by an Indian university IPM programme so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability**

---

[1] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-cotton.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **8. Accessibility** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(8) CROP: COTTON**[1 2 3] **1. Description of the alternatives** **Pests: spotted bollworm; ink bollworm; Helicoverpa, red cotton bug, dusky cotton bug** * deep summer ploughing to expose larvae and pupa to birds and sun * soil inoculation with nitrogen fixing bacteria like *Azospirillum* and *Azotobacter* * neem seed kernel extract – 5% spray *application of 200 kg neem cake during ploughing * spray 3% neem oil * apply cow dung-urine solution as pest repellant * spray 5% Vitex Solution (decoction of leaves of *Vitex negundo*) **Pest: leafroller** * neem seed kernel extract – 5% spray These methods are technically feasible: they are practised, initially by more than 300,000 farmers implementing Community Managed Sustainable Agriculture in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represented 5.1% of the cropped area of the state and was achieved in just four years. By 2011 this had risen to 10 million farmers on over 10 million acres **2. Technical feasibility** These methods are technically feasible: they are practised, initially by more than 300,000 farmers implementing Community Managed Sustainable Agriculture in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represented 5.1% of the cropped area of the state and was achieved in just four years. By 2011 this had risen to 10 million farmers on over 10 million acres **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and are likely to be negligible **4. Cost-effectiveness** The average saving on costs of cotton cultivation using these practices = US $100 per acre. The initial state-wide savings = US $ 6.4 million. A farmer raising cotton on 1.0ha of land using these practices can potentially save US$ 250 a year on the cost of pesticides alone. This is 56% of the farmer's annual income and is a significant amount. **5. Efficacy**

---

[1] Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

[2] Nair SK. 2009. Does Endosulfan have an Alternative? Non-pesticidal Management – A large-scale success story from Andrah Pradesh, India. Thanal, Thiruvananthapuram.

[3] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	The Community Managed Sustainable Agriculture practiced inititally in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **9. Any other information** India is the world’s largest organic cotton producer. Organic cotton output increased 292% during 2007-08 to 73,702 tonnes compared with the previous year. This resulted in a global organic cotton increase by 152%, to146,000 tonnes. India contributes half of the world’s organic cotton output. The state of Madhya Pradesh grows the largest quantity in India, followed by Maharashtra and Orissa. Gujarat and Andra Pradesh are also important organic cotton producers.[1] Indian organic cotton growers, in place of endosulfan and other synthetic chemical pesticides, manage pests by varietal selection, crop rotation, intercropping with maize and pigeon peas as trap crops, use of flowering plants like marigold and sunflower to attract beneficial insects, use of the parasitic wasp Trichogramma, and use of botanical pesticides.[2] [3] Detailed research in 2003 and 2004 in India demonstrated that organic cotton farming can be far more profitable than conventional cotton farming using endosulfan, with gross margins about 30-52% higher than the conventional production. Revenues from organic cotton sales were about 30% higher than conventional cotton.[4] **(9) CROP: COFFEE**[5] **1. Description of the alternatives** **Pest: Coffee berry borer** Cultural: * collect infested coffee beans before and after harvest * attractant traps * spray with neem (azadirachtin) Biological: * a wide range of biological control organisms have been used to replace endosulfan in coffee cultivation; these include the parasitic wasps *Cephalonomis stephanotheris, Prorops nasuta,* and *Phymastichus coffea* and the entomopathogenic fungus *Beauvaria bassiana* for

---

[1] Subramani MR. 2008. India tops in world organic cotton output. The Hindu Business Line. Nov 1. http://www.blonnet.com/2008/11/01/stories/2008110150302100.htm.

[2] Eyhorn F. 2007. Organic farming for sustainable livelihoods in developing countries? The case of cotton in India. vdf Hochschulverlag AG. ISBN:978-3-7281-3111-9.

[3] Eyhorn F, Ratter SG, Ramakrishnan M. 2005. Organic Cotton Crop Guide. A manual for practitioners in the tropics. FiBL, 1st edition, 2005, ISBN 978-3-906081-67-0.

[4] Eyhorn F. 2007. Organic farming for sustainable livelihoods in developing countries? The case of cotton in India. vdf Hochschulverlag AG p.106-107. ISBN:978-3-7281-3111-9.

[5] Bejarano et al. 2009. Alternatives to Endosulfan in Latin America. International POPs Elimination Network (IPEN) and Pesticide Action Network in Latin America (Red de Accion sobre Plaguicidas y sus Alternativas en America Latina, RAP-AL). http://www.ipen.org/ipenweb/documents/ipen%20documents/summary%20endosulfan%20alternativesenglish.pdf

Submitter	Information on alternatives to endosulfan
PAN & IPEN	coffee berry borer (*Hypothenemus hampei*) **2. Technical feasibility** Field studies have shown that *B. bassiana* alone can eliminate up to 80% of adult coffee berry borers **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Cost- effectiveness is demonstrated by the widespread use of these techniques: in 2008, 25% of the coffee produced in Mexico was organic, using these techniques. In 2007 Costa Rica grew 1,713 hectares of organic coffee **5. Efficacy** Efficacy is demonstrated by the widespread use of these techniques: In 2008, 25% of the coffee produced in Mexico was organic, using these techniques. In 2007 Costa Rica grew 1,713 hectares of organic coffee. In both countries organic production systems have proven efficacious replacements for endosulfan **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Their widespread use in developing countries demonstrates their availability **8. Accessibility** Their widespread use in developing countries demonstrates their accessibility **(10) CROP: PADDY/RICE**[1] **1. Description of the alternatives** **Pest: stem borer** Treatment: * *Triochogramma japonicum*: dose = 50,000/ha, 6 times at 10 day intervals * Pheromone traps: 20-25 /ha, lure to be changed at 15-30 day intervals **Pest: yellow stem borer, Hispa** * *Trichogramma chilonis*: dose = 50,000/ha, 6 times at 10 day intervals **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by the Government of India, so assumed to be cost-effective **5. Efficacy**

---

[1] Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so assumed to be available **8. Accessibility** Recommended by the Government of India, so assumed to be accessible **(11) CROP: PADDY/RICE**[1 2 3] **1. Description of the alternatives** **Pests: Leaf folder, Hispa, surti caterpillar, all pests** * soil inoculation with nitrogen fixing bacteria like *Azospirillum* and *Azotobacter* * a variety of cultural techniques * spray with 5% neem seed kernel extract * remove leaf folds using thorny twigs * spray with 5% Vitex Solution (decoction of leaves of *Vitex negundo*) * *Trichogramma chilonis* **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represented, initially, 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** The cost of cultivating rice is much lower under CMSA as evidenced by data from the field. In a survey of 141 farmers, the cost of cultivation per acre under CMSA was found to be lower by 33 percent of the costs under conventional rice growing. The state-wide savings = US $ 11 million, initially. **5. Efficacy** The Community Managed Sustainable Agriculture practiced in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention**

---

[1] Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

[2] Nair SK. 2009. Does Endosulfan have an Alternative? Non-pesticidal Mangament – A large-scale success story from Andrah Pradesh, India. Thanal, Thiruvananthapuram.

[3] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(12) CROP: RICE**[1] **1. Description of the alternatives** **Pest: gall midge** * remove grassy weeds surrounding rice fields – to remove the pests' alternate hosts * plant resistant varieties - there are several gall midge biotypes * delay wet season planting of photoperiod sensitive variety to reduce the length of the vegetative period before a gall midge transfers from its alternate hosts * split the nitrogen application 3 times; during the seedling, vegetative, and reproductive growth stages * plough-under the ratoons of the previous crop to expose the pests to sunlight and predators * encourage generalist predatory spiders * spray with neem **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(13) CROP: MAIZE**[2] **1. Description of the alternatives** **Pests: stem borer, pink borer** Treatment: * *Trichogramma chilonis*: 50,000/ha, 6 times at 10 day interval **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by the Government of India, so assumed to be cost-effective

---

[1] Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany. http://www.oisat.org/pests/insect_pests/very_small/rice_gall_midge/preventive_control.html

[2] Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	**5. Efficacy** Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so assumed to be available **8. Accessibility** Recommended by the Government of India, so assumed to be accessible **(14) CROP: MAIZE**[1] **1. Description of the alternatives** **Pests: Stem borer, corn earworm,** * deep summer ploughing * application of 200kg neem cake during ploughing * spray with 5% neem seed kernel extract * spray with chilli-garlic solution * pheromone traps for corn earworm **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represented initially 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** The farmers involved in CMSA have found these methods to be cost-effective. **5. Efficacy** The Community Managed Sustainable Agriculture practiced in the initial 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised now by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility**

---

[1] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	These methods are accessible: they are practised now by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(15) CROPS: GRAM, ARHAR**[1] **1. Description of the alternatives** **Pest: podborers** Treatment: * *Helicoverpa armigera* NPV: 250 LER/ha, 2-3 times at 10-day intervals in evening * *Bacillus thuringiensis* - 2kg/ha, 2-3 times at 10 day intervals in evening **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by the Government of India, so assumed to be cost-effective **5. Efficacy** Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so assumed to be available **8. Accessibility** Recommended by the Government of India, so assumed to be accessible **(16) CROP: GRAM**[2] [3] **1. Description of the alternatives** **Pests: all** * 5% spray of neem seed kernel extract * erect bird perches * deep summer ploughing **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represented, initially 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects**

---

1 Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf.

2 Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

3 Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** The average saving of costs of gram cultivation using these practices is US $24/acre. The estimated state-wide savings = US $2.5 million (initially). **5. Efficacy** The Community Managed Sustainable Agriculture practiced in, initially, 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(17) CROP: CHILLI[1] [2]** **1. Description of the alternatives** **Pest: leaf and pod caterpillar** * 5% spray with neem seed kernel extract **Pest: sawfly** * 5% spray with neem seed kernel extract * collect large caterpillars **Pest: leaf webber** *5% spray with neem seed kernel extract * collect and destroy leaf webs **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** The average saving of costs of chilli cultivation using these practices is US $300/acre. The estimated state-wide savings = US $7.2 million (initially). **5. Efficacy**

---

[1] Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

[2] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	The Community Managed Sustainable Agriculture practiced, initially, in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(18) CROP: MUSTARD**[1] **1. Description of the alternatives** **Pests: aphids** Treatment: * *Chrysoperla carnea* – 50,000 1st instar larvae/ha, 2 times at 15 day intervals **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by the Government of India, so assumed to be cost-effective **5. Efficacy** Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so assumed to be available **8. Accessibility** Recommended by the Government of India, so assumed to be accessible **(19) CROP: MUSTARD**[2] **1. Description of the alternatives** **Pests: aphids**

---

[1] Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf.

[2] IPM Programme, Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University, Jabalpu, Madya Pradesh, India. http://www.jnkvv.nic.in/IPM%20project/insect-mustard.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Cultural control: * use tolerant varieties like JM-1 and RK-9501 * sow early; crop sown before 20th October escapes the damage Mechanical control: * destroy the affected parts along with aphid population in the initial stage Biological control: * ladybird beetles *Cocciniella septempunctata*, *Menochilus sexmaculata*, *Hippodamia variegata* and *Cheilomones vicina* are most efficient predators of the mustard aphid; adult beetle may feed an average of 10 to 15 adults/day * several species of syrphid fly i.e., *Sphaerophoria* spp., *Eristallis* spp., *Metasyrphis* spp., *Xanthogramma* spp and *Syrphus* spp. predate on aphids * the braconid parasitoid, *Diaretiella rapae* is a very active bio control agent, causes the mummification of aphids * the lacewing, *Chrysoperla carnea,* predates on the mustard aphid colony * predatory bird *Motacilla cospica* active feeds on aphids during February-March * a number of entomogenous fungi, such as *Cephalosporium* spp., *Entomophthora* and *Verticillium lecanii* infect aphids **2. Technical feasibility** Recommended by an Indian university IPM programme so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by an Indian university IPM programme, so assumed to be cost-effective **5. Efficacy** Recommended by an Indian university IPM programme so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be available **8. Accessibility** Cultural and mechanical controls can be used by anyone; biological controls recommended by an Indian university IPM programme so assumed to be accessible **(20) CROP: OKRA**[1] **1. Description of the alternatives** **Pest: Fruit and shoot borer** * *Trichogramma chilonis*: 50,000 /ha, 6 times at 10 day intervals * pheromone traps: 20-25 ha, lures to be changed at 15-30 day intervals **Pests: aphids, jassids, whiteflies**

---

[1] Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* *Chrysoperla carnea*: 50,000 1st instar larvae/ha, 2 times at 15 day intervals **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by the Government of India, so assumed to be cost-effective **5. Efficacy** Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so assumed to be available **8. Accessibility** Recommended by the Government of India, so assumed to be accessible **(21) CROP: OKRA**[1] **1. Description of the alternatives** **Pest: Diamond back moth** * pheromone traps * *Bacillus thuringiensis* spray * parasitoids *Diadegma semiclausum*, *D. insulare, D. mollipla, D. fenestral, Cotesia* sp. * spray with decoction of *Eupatorium odoratum* leaves **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(22) CROP: OKRA / BHINDI**[2] **1. Description of the alternatives** **Pests: leaf roller** * 5% spray of neem seed kernel extract **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000

---

[1] Bissdorf J. 2008. How to Grow Crops Without Endosulfan. PAN Germany. http://www.oisat.org/downloads/field_guide_without_endosulfan.pdf

[2] Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** These methods have been found to be cost-effective by the farmers practicing CMSA. **5. Efficacy** The Community Managed Sustainable Agriculture practiced, initially, in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(23) CROP: TOMATO[1]** **1. Description of the alternatives** **Pest: fruit borer** * deep summer ploughing * 5% spray of neem seed kernel extract * erect bird perches * spray chilli-garlic solution * pheromone traps **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** These methods have been found to be cost effective by the farmers practicing CMSA. **5. Efficacy** The Community Managed Sustainable Agriculture practiced in, initially, 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the

---

[1] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(24) CROP: TOMATO**[1] **1. Description of the alternatives** **Pests: fruit and shoot borer** * *Helicoverpa armigera* NPV: 250 LE/ha, 2-3 times at 10 day intervals in evening * *Trichogramma chilonis*: 1,00,000/ha, 6 times at 10 day intervals * *Bacillus thuringiensis*: 2kg/ha, 2-3 times at 10 day intervals in evening * pheromone traps: lures to be changed at 15-30 days **2. Technical feasibility** Recommended by the Government of India, so assumed to be technically feasible **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** Recommended by the Government of India, so assumed to be cost-effective **5. Efficacy** Recommended by the Government of India, so assumed to be efficacious **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** Recommended by the Government of India, so assumed to be available **8. Accessibility** Recommended by the Government of India, so assumed to be accessible **(25) CROP: GROUNDNUT**[2] **1. Description of the alternatives** **Pests: all** * 5% spray of neem seed kernel extract

---

[1] Recommended by the Expert Committee, Government of India, 2008-09 for use in the State of Orissa. http://india.gov.in/allimpfrms/alldocs/10051.pdf.

[2] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* erect bird perches * pheromone Traps * deep summer ploughing **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** These methods have been found to be cost-effective by the farmers practicing CMSA. **5. Efficacy** The Community Managed Sustainable Agriculture practiced, initially, in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(26) CROP: MANGO**[1] **1. Description of the alternatives** **Pests: Mango hopper** * 5% spray of neem seed kernel extract * 3% neem oil spray **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** These methods have been found to be cost-effective by the farmers practicing CMSA. **5. Efficacy**

---

[1] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	The Community Managed Sustainable Agriculture practiced, initially, in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **<u>7. Availability</u>** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **<u>8. Accessibility</u>** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(27) CROP: MANGO[1]** **<u>1. Description of the alternatives</u>** **Pests: leafhoppers** * garlic oil spray * neem spray **Pest: fruit fly** <u>Cultural practices:</u> * remove fruits with dimples and oozing clear sap * harvest crops early when mature green * pick overripe fruits * practice crop and field sanitation; collect and destroy fallen and damaged ripe fruits; do not put collected damaged fruits in compost heaps, instead feed to pigs or poultry, or bury to eliminate all sources of possible breeding sites <u>Mechanical practices:</u> * bag the fruit * use fruit fly baits: (ripe banana peel cut into small pieces and mixed with sugar, flour, and water; mixture of 1 tsp vanilla essence, 2 tbsp ammonia, 1/2 cup sugar, and 2 liters of water; mixture of 1 cup vinegar, 2 cups water, and 1 tbsp of honey; or mixture of sugar, soya sauce, and ammonia). * yellow sticky traps baited with vials containing a ratio of 1 part ammonia and 1 part of water * spray with basil leaf extract * spray with neem **<u>3. Health and environmental effects</u>** Health and environmental effects are less than those of endosulfan and likely to be negligible **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>**

---

[1] Bissdorf J. 2005. Field Guide to Non-chemical Pest Management in Mango Production. PAN Germany. http://www.oisat.org/downloads/field_guide_mango.pdf

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are likely to be readily available to all users. **8. Accessibility** These methods are likely to be readily available to all users. **(28) CROP: EGGPLANT[1] [2]** **1. Description of the alternatives** **Pests: aphids** *control ants (ants cultivate aphids to gain access to plant sugars); cultivate and flood the field to destroy ant colonies and expose eggs and larvae to predators and sunlight; ants use the aphids to gain access to nutrients from the plants * avoid using heavy doses of highly soluble nitrogen fertilizers * sticky board traps: 1-4 per 300 sq m field area; replace at least once a week. * yellow basin trap with soapy water * spray with ginger rhizome extract * spray with custard apple leaf extract **Pests: fruit and shoot borer** *plough field to expose larvae to predators and weather *plant resistant varieties - Pusa Purple Long, H-128, H-129, Aushey, Thorn Pendy, Black Pendy, H-165, H-407, Dorley, PPC-17-4, PVR-195, Shyamla Dhepa, and Banaras Long Purple *raise seedlings under row covers and/or nets to prevent the moths from directly laying eggs on them * crop rotation. * proper field sanitation - destroy or burn all plant residues as they may harbor the pupating pest * prune immediately any larvae-infested shoots - burn or cut them into small pieces; continue pruning the shoots at least once a week before the final harvest. * uproot all old plants after harvest and burn them * pheromone traps **Pests: diamond back moth** * pheromone traps * *Bacillus thuringiensis* spray * parasitoids *Diadegma semiclausum*, *D. insulare, D. mollipla, D. fenestral, Cotesia* sp. * spray with decoction of *Eupatorium odoratum* leaves **Pest: Jassids** * *Chrysoperla carnea* **3. Health and environmental effects**

---

[1] Bissdorf J. 2010. Field Guide to Non-chemical Pest Management in Eggplant Production. PAN Germany. http://www.oisat.org/downloads/field_guide_eggplant.pdf

[2] Bissdorf J. 2008. How to Grow Crops Without Endosulfan. PAN Germany. http://www.oisat.org/downloads/field_guide_without_endosulfan.pdf

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(29) CROP: BEANS[1] [2]** **1. Description of the alternatives** **Pest: aphids** * control ants (ants cultivate aphids to gain access to plant sugars); cultivate and flood the field to destroy ant colonies and expose eggs and larvae to predators and sunlight; ants use the aphids to gain access to nutrients from the plants * avoid using heavy doses of highly soluble nitrogen fertilizers; * use sticky board traps: 1-4 per 300 sq m field area; replace at least once a week * yellow basin trap with soapy water * spray with ginger rhizome extract, custard apple leaf extract, neem leaf extract, need seed extract, ammonia spray (1part in 7 parts water), or soap spray **Pest: leaf miner:** * greased yellow traps * spray with neem seed extract * spray with ginger, garlic and chilli extract **Pest: whitefly** * plant *Nicotiana* as a trap crop * spray with garlic oil spray, Madre de caco and neem leave spray, neem oil, soap spray, or ammonia spray * use yellow sticky board traps *release parasitoid *Encarsia* spp *release predators *Chrysoperla carnea, Chrysopa rufilabris, Harmonia conformis, Harmonia axyridis, Hippodamia convegens* **2. Technical feasibility** Health and environmental effects are less than those of endosulfan and likely to be negligible **3. Health and environmental effects** **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(30) CROP: TEA[3]** **1. Description of the alternatives** **Pest: caterpillars:**

---

[1] Bissdorf J. 2005. Field Guide to Non-chemical Pest Management in String bean Production. PAN Germany. http://www.oisat.org/downloads/field_guide_string_beans.pdf

[2] Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany. http://www.oisat.org/pestsmap.htm

[3] Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany. http://www.oisat.org/pestsmap.htm

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* spray with *Bacillus thuringiensis* **Pest: Tea mosquito bug** * encourage or release weaver ants * spray with neem seed extract **Pest: mealybugs** * release Cryptolaemus montrouzieri, Chrysoperla carnea, Chrysopa rufilabris, *Harmonia conformis, Harmonia axyridis, Hippodamia convegens* * spray with chilli extract, soap spray, citrus peel spray **Pest: scale insects** * release parasitic wasps *Aphytis melinus* or *Metaphycus helvolus* or predators *Eristalis* spp., *Volucell*a spp., *Chrysoperla carnea, Chrysopa rufilabris, Harmonia conformis, Harmonia axyridis, Hippodamia convegens, Orius tristicolor,* or *Orius insidiosus* * spray with neem or Horticultural spraying oil **Pest: Thrips** * release predators *Chrysoperla carnea, Chrysopa rufilabris, Orius tristicolor,* or *Orius insidiosus* * spray with neem extract **Pest: green leafhopper** * release and encourage predators: *Chrysoperla carnea, Chrysopa rufilabris, Harmonia conformis, Harmonia axyridis, Hippodamia convegens, Orius tristicolor, Orius insidiosus,* generaliset preadatory spiders and birds * spray with neem, or garlic **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(31) CROP: TEA**[1] **1. Description of the alternatives** **Pest: Flushworm** * release parasitoid *Apanteles* sp. **Pest: Aphids** * release predators *Leis dimidiata, Menocillus sexmaculatusw, Verania vincta, Syrphid* **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(32) CROP: PIGEONPEA**[1 2]

---

[1] Pest Management in Tea. Tea Research Association, India. http://www.tocklai.net/cultivation/pests.aspx

Submitter	Information on alternatives to endosulfan
PAN & IPEN	**1. Description of the alternatives** **Pest: podborer** * 5% spray of neem seed kernel extract * erect bird perches * apply shaking method * deep summer ploughing **Pests: pod bug, pod fly, defoliators** * 5% spray of neem seed kernel extract * 3% spray of neem oil **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** These methods have been found to be cost-effective by the farmers practicing CMSA. **5. Efficacy** The Community Managed Sustainable Agriculture practiced, initially, in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **(33) CROP: JUTE[3] [4]** **1. Description of the alternatives** **Pest: semilooper,**

---

[1] Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

[2] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

[3] Kumar TV, Raidu DV, Killi J, Pillai M, Shah P, Kalavadonda V, Lakhey S. 2009. Ecologically Sound, Economically Viable Community Managed Sustainable Agriculture in Andra Pradesh, India. The World Bank, Washington DC.

[4] Ramamjaneyulu GV & Raghunath TAVS. 2011. Government of India Recommended Use of Endosulfan and Available Alternatives. Centre for Sustainable Agriculture, Secunderabad.

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* 5% spray of neem seed kernel extract **Pests: Bihar hairy caterpillar, Indigo caterpillar** * 5% spray of neem seed kernel extract * deep summer ploughing * erecting bird perches * chillie-garlic spray **Pest: mites** * spray with 2% wettable sulphur **2. Technical feasibility** These methods are technically feasible: they are practised by, initially more than 300,000 farmers implementing Community Managed Sustainable Agriculture (CMSA) in the state of Andra Pradesh, India, on more than 1.36 million acres of farmland. This represents 5.1% of the cropped area of the state and was achieved in just four years. **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **4. Cost-effectiveness** These methods have been found to be cost-effective by the farmers practicing CMSA. **5. Efficacy** The Community Managed Sustainable Agriculture practiced, initially, in 5.1% of the cropped area of Andra Pradesh, India, is achieving “a significant net increase in farmers’ incomes in addition to significant health and ecological benefits”, without “significantly reducing the productivity and yields”. This demonstrates the efficacy of the practices. **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **7. Availability** These methods are available: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **8. Accessibility** These methods are accessible: they are practised by more than 10 million farmers in the state of Andra Pradesh, India, on more than 10 million acres of farmland. **SECTION 2: PEST CONTROL, NOT CROP-SPECIFIC** **(1) PEST: APHIDS**[1] **1. Description of the alternatives** **Crops: cotton, tea, cowpeas, beans, tomato, gram, arhar, maize, wheat, groundnuts, mustard, onion, potato, chillies** * control ants (ants cultivate aphids to gain access to plant sugars); cultivate and flood the field to destroy ant colonies and expose eggs and larvae to predators and sunlight; ants use the aphids to gain access to nutrients from the plants * plant trap crops such as lupine, dill, nasturtiums, and timothy grass near the crop to be protected

---

[1] Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany. http://www.oisat.org/pests/insect_pests/soft_bodied/aphids/preventive_control.html

Submitter	Information on alternatives to endosulfan
PAN & IPEN	* avoid using heavy doses of highly soluble nitrogen fertilizers * use sticky board traps: 1-4 per 300 sq m field area; replace at least once a week. * yellow basin trap with soapy water * spray with ginger rhizome extract, custard apple leaf extract, neem leaf extract, need seed extract, ammonia spray (1part in 7 parts water), or soap spray * release Braconid wasps * encourage or release predators: Aphid midge, Damsel bug, Hoverfly, Lacewing, Ladybird beetle **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(2) PEST: JASSIDS/LEAFHOPPERS**[1] **1. Description of the alternatives** **Crops: okra, tomato, eggplant, cotton, onion, potato, chillies, paddy/rice** * release and encourage predators: *Chrysoperla carnea, Chrysopa rufilabris, Harmonia conformis, Harmonia axyridis, Hippodamia convegens, Orius tristicolor, Orius insidiosus,* generaliset preadatory spiders and birds * spray with neem, or garlic **3. Health and environmental effects** Health and environmental effects are less than those of endosulfan and likely to be negligible **6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **(3) PEST: WHITEFLY**[2] **1. Description of the alternatives** **Crops: tomato, cotton, beans, cowpeas** **Pest: whitefly** * plant *Nicotiana* as at trap crop * spray with garlic oil spray, Madre de caco and neem leave spray, neem oil, soap spray, or ammonia spray * use yellow sticky board traps *release parasitoid *Encarsia* spp *release predators *Chrysoperla carnea, Chrysopa rufilabris, Harmonia conformis, Harmonia axyridis, Hippodamia convegens* **3. Health and environmental effects**

---

[1] Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany. http://www.oisat.org/pests/insect_pests/hoppers/leafhoppers/preventive_control.html

[2] Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany. http://www.oisat.org/pestsmap.htm

Submitter	Information on alternatives to endosulfan
PAN & IPEN	Health and environmental effects are less than those of endosulfan and likely to be negligible **<u>6. Risk, taking into account the characteristics of potential persistent organic pollutants as specified in Annex D to the Convention</u>** Zero potential for POPs characteristics; risk considerably less than that of endosulfan **ADDITIONAL DOCUMENTS SUBMITTED BY PAN & IPEN:** The documents below are posted on the Stockholm Convention's website: http://chm.pops.int/tabid/2269/Default.aspx: 1) List of BioPesticides Recommended by the Government of India 2) Ecologically Sound, Economically Viable- Community Managed Sustainable Agriculture in Andhra Pradesh India 3) Does endosulfan have an alternative? Non-pesticidal management – A large scale success story from Andhra, Pradesh, India 4) Government of India recommended use of endosulfan and available alternatives 2011 5) Organic farming for sustainable livelihoods in developing countries 6) Alternatives to endosulfan in Latin America Summary 7) Field guide to non-chemical pest management in mango production 8) Field guide to non-chemical pest management in eggplant production 9) How to grow crops without endosulfan 10) Field guide to non-chemical pest management in string bean production

Annex III

Submission by the European Union

“Support related to the international work on Persistent Organic Pollutants”

1 Background and objectives

Background

The present report is related to the additional task to support DG Environment in the assessment of the chemical alternative to endosulfan.

Objectives and Tasks

To update and finalise the screening risk assessment of chemical alternatives compared to endosulfan (see Annex III of the supporting document for the draft risk management evaluation on endosulfan: UNEP/POPS/POPRC.6/INF/12[1]).

2 Update and finalization of the screening risk assessment

The screening risk assessment of chemical alternatives compared to endosulfan was updated. Basis for this task is the screening risk assessment as compiled in Annex III of the supporting document for the draft risk management evaluation on endosulfan (UNEP/POPS/POPRC.6/INF/23).

First, the information available in the screening risk assessment was analysed and any potential to improve the data background for the assessment. The screening risk assessment is based on specific information sources. The sources contribute specific information on the hazard indicators (POP criteria and criteria on adverse effects) of a list of 84 possible chemical alternatives to endosulfan. For several substances and hazard indicators information is lacking.

In addition, information sources that are appropriate to improve the screening risk assessment were identified and evaluated. With the evaluation of the additional information it was possible to reduce the above mentioned data gaps in the assessment.

The following information sources were identified and evaluated for updating the screening risk assessment:

- FOOTPRINT Pesticide Properties Database (FOOTPRINT PPDB) (http://sitem.herts.ac.uk/aeru/footprint/en/index.htm)
- WHO Pesticides List (http://www.wpro.who.int/hse/pages/wholistpertype.html)
- Commission Regulation (EC) No 790/2009 of 10 August 2009 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures

Finally, the conclusions of the screening risk assessment as drawn in Annex III of the supporting document for the draft risk management evaluation on endosulfan (UNEP/POPS/POPRC.6/INF/23) were adjusted according to the updated information. As an outcome, the following updated screening risk assessment results:

Results from the screening risk assessment of chemical alternatives compared to endosulfan

For an evaluation of the safety of alternatives information on several hazard indicators for possible adverse effects on the environment and health can be used. Appropriate hazard indicators are POPs screening criteria (persistence, bioaccumulation, toxicity and potential for long-range transport) and several other hazardousness criteria (mutagenicity, carcinogenicity, reproductive and developmental toxicity, endocrine disruption, immune suppression, neuro-toxicity) (see UNEP/POPS/POPRC.5/10/Add.1). As additional information with particular relevance for alternatives for endosulfan information on the toxicity of the alternatives to bees is relevant.

Given the multitude of available alternatives a comprehensive assessment of possible risks related to alternatives is difficult. Risks are possible as a result of the exposure to hazardous alternatives. For a screening assessment of the possible risks related to the identified chemical alternatives, available information on a set of hazard indicators (i.e. on the POP properties and the hazardous properties as mentioned above) has been compiled. On the basis of the compilation it is possible to evaluate the possible risks related to the identified alternatives and to indicate priorities for more and less appropriate alternatives (concerning their possible risks to environment and health) and to identify alternatives for which information on hazard indicators is lacking.

---

[1] The document was updated at POPRC 6 (updated version of the document: UNEP/POPS/POPRC.6/INF/23)

The results of the screening risk assessment of chemical alternatives to endosulfan are presented in Table 1.

For the assessment information on the POP screening criteria of identified alternative substances was investigated on the basis of several sources as indicated in the footnotes to Table 1.

The criterion “Bioccumulation” is furthermore based on the evaluation of the Log Kow values of the corresponding substances. The criterion is considered to be fulfilled if the Log Kow is > 4.

The criterion “Toxicity” is furthermore based on the classification according to Regulation (EC) No 1272/2007. The criterion is considered to be fulfilled if (1st priority) according to Regulation (EC) No 1272/2007 the acute toxicity of the corresponding substance is classified 1 or 2 or if acute or chronic aquatic toxity is classified 1 or (2nd priority, if the substance is not classified according to Regulation (EC) No 1272/2007) if the substance is class Ia, Ib or II according to WHO toxicity classification (Ia = Extremely hazardous; Ib = Highly hazardous; II = Moderately hazardous). The information on the WHO classification is taken from [IOBC 2005].

Information on the hazard indicators is compiled from the classification according to Regulation (EC) No 1272/2007 including Regulation (EC) No 790/2009 (related to mutagenicity (M), carcinogenicity (C) and reproductive and developmental toxicity (R). The criterion is considered to be fulfilled if classified C, M or R according to Regulation (EC) No 1272/2007 and Regulation (EC) No 790/2009 or not considered to be fulfilled if not classified C, M or R (first priority), from [IOBC 2005], [Greenpeace 2010] and other information sources as indicated in the footnotes to Table 1 (second priority).

A ranking has been established by summing up for endosulfan and each chemical alternative the number of criteria fulfilled.

According to this ranking procedure endosulfan obtains 5 points in the ranking because it fulfils the four POPs criteria “persistence”, “bioaccumulation”, “toxicity” and “potential for long range transport” as well as the criterion “neurotoxicity”. Out of the identified chemical alternatives no other substance fulfils all 4 POPs criteria. One substance (Bifenthrin) fulfils 6 criteria, Besides endosulfan 3 other substances fulfil 5 criteria (Diazinon, Deltamethrin and Lambda cyhalothrin) and another 12 substances fulfil 4 criteria. 25 substances fulfil 3 criteria, 23 substances fulfil 2 criteria, 11 substances fulfil 1 criterion and 3 substances do not fulfil any of the criteria.

Against the background of the screening assessment it can be assumed that if endosulfan will be replaced by a substance with a lower ranking it will be replaced by a safer alternative. This is the case for 74 chemical alternatives with a lower ranking than endosulfan (i.e. those substances fulfilling no or 1 to 4 criteria). For 6 substances a conclusion is not possible (i.e. those substances where no data are available). 4 substances may cause equal (i.e. those 3 substances which fulfil 5 criteria) or higher (i.e. the substance which fulfils 6 criteria) risks as endosulfan. However, these 4 substances do not fulfil the criterion “potential for long range transport”; they could therefore be considered less hazardous than endosulfan which fulfils all POP criteria). It can therefore be concluded that if endosulfan would not be available for plant protection it would be replaceable by safer alternatives in all or at least in the majority of cases because in the majority of cases it will be replaceable by one of the 74 chemical alternatives with a lower ranking than endosulfan. Where reasonably possible, it should be attempted to replace it by a substance with a low ranking.

The substance Spinetoram (substance no 76 in Table 1) may be of particular importance for Argentina as it can be used to control *Spodoptera frugiperda* on the economically important crops soybean and sunflower. According to [Bahena 2011] spinetoram is an efficient and cheap alternative with low environmental impact. According to the screening risk assessment it is related to low risks (not persistent, not bio-accumulative, not toxic, ranking: zero)

As additional information Table 1 contains an overview on the bee toxicity properties of identified chemical alternatives to endosulfan. 45 of the alternatives are toxic to bees whereas 29 of the alternatives are not toxic to bees (in case of contradictory information both events are counted). For 13 alternatives information on bee toxicity has not been identified. The information on the bee toxicity of endosulfan itself is contradictory. According to IPEN, endosulfan is toxic to bees [PAN & IPEN 2010]. According to other sources it is not. A clear conclusion whether alternatives to endosulfan are more or less toxic to bees is not possible on the basis of the present information. However the distribution of bee toxic properties among possible chemical alternatives allows the assumption that in many situations it will be possible to replace endosulfan by alternatives without or lower bee toxicity.

In this context it is noteworthy, that according to a recently published UNEP report on global honey bee disorders and other threats to insect pollinators, the use of broad spectrum insecticides (note: such as endosulfan) is related to adverse effects on bees: ”... various broad-spectrum insecticides are not only applied on agricultural fields but also in residential gardens, recreational areas, forests as well as mosquito-ridden marshes and swamps. These chemicals can be equally toxic to beneficial insects as to the target species. Chronic or sub-lethal exposure to agricultural or beekeeper-applied pesticides can weaken the honey bee’s immune system, and hamper bees’ ability to fight infection”(agricultural practices; page 7 [UNEP 2011]).

3 Conclusions

Screening risk assessment

Against the background of the screening assessment it can be assumed that if endosulfan will be replaced by a substance with a lower ranking it will be replaced by a safer alternative. This is the case for 74 chemical alternatives with a lower ranking than endosulfan (i.e. those substances fulfilling no or 1 to 4 criteria). For 6 substances a conclusion is not possible (i.e. those substances where no data are available). 4 substances may cause equal (i.e. those 3 substances which fulfil 5 criteria) or higher (i.e. the substance which fulfils 6 criteria) risks as endosulfan. However, these 4 substances do not fulfil the criterion “potential for long range transport”; they could therefore be considered less hazardous than endosulfan which fulfils all POP criteria). It can therefore be concluded that if endosulfan would not be available for plant protection it would be replaceable by safer alternatives in all or at least in the majority of cases because in the majority of cases it will be replaceable by one of the 74 chemical alternatives with a lower ranking than endosulfan. Where reasonably possible, it should be attempted to replace it by a substance with a low ranking.

The substance Spinetoram (substance no 76 in Table 1) may be of particular importance for Argentina as it can be used to control *Spodoptera frugiperda* on the economically important crops soybean and sunflower. According to [Bahena 2011] spinetoram is an efficient and cheap alternative with low environmental impact. According to the screening risk assessment it is related to low risks (not persistent, not bio-accumulative, not toxic, ranking: zero)

As additional information Table 1 contains an overview on the bee toxicity properties of identified chemical alternatives to endosulfan. 45 of the alternatives are toxic to bees whereas 29 of the alternatives are not toxic to bees (in case of contradictory information both events are counted). For 13 alternatives information on bee toxicity has not been identified. The information on the bee toxicity of endosulfan itself is contradictory. According to IPEN, endosulfan is toxic to bees [PAN & IPEN 2010]. According to other sources it is not. A clear conclusion whether alternatives to endosulfan are more or less toxic to bees is not possible on the basis of the present information. However the distribution of bee toxic properties among possible chemical alternatives allows the assumption that in many situations it will be possible to replace endosulfan by alternatives without or lower bee toxicity.

According to a recently published UNEP report on global honey bee disorders and other threats to insect pollinators, the use of broad spectrum insecticides (note: such as endosulfan) is related to adverse effects on bees (see [UNEP 2011])

References

[Gerstel 2004]
Gerstel AppNote 4/2004 by Nobuo Ochiai, Kikuo Sasamoto, Hirooki Kanda, Takashi Yamagami, Frank David, Pat Sandra: Multi-Residue Method for Determination of 85 Pesticides in Vegetables, Fruits and Green Tea by Stir Bar Sorptive Extraction and Thermal Desorption GC-MS, 2004

[Greenpeace 2010]
Die Schwarze Liste der Pestizide II - Vergleichende Umwelt- und Gesundheitsbewertung von Pestizidwirkstoffen, Greenpeace 2010.
http://www.greenpeace.de/fileadmin/gpd/user_upload/themen/umweltgifte/Schwarze_Liste_der_Pestizide_II_2010.pdf.

[IOBC 2005]
IOBC wprs Working Group "Pesticides and Beneficial Organisms & IOBCwprs Commission “IP Guidelines and Endorsement” (05.12.2005 Comm.) and Working Document on Selectivity of Pesticides (2005); See http://www.iobc.ch/2005/IOBC_Pesticide%20Database_Toolbox.pdf and http://www.iobc.ch/2005/Working%20Document%20Pesticides_Explanations.pdf.

[PAN & IPEN 2010]
PAN & IPEN 2010, Format for submitting pursuant to Article 8 of the Stockholm Convention the information specified in Annex F of the Convention, January 2010.

[UNEP 2011]
UNEP emerging issues - GLOBAL HONEY BEE COLONY DISORDERS AND OTHER THREATS TO INSECT POLLINATORS, UNEP, 2011

Table 1: Overview of results from the screening assessment of chemical alternatives compared to endosulfan

No.	Substance	Hazard indicators: POP criteria				Hazard indicators: adverse effects						Ranking	Other data
		P	B	T	LRT	Mutagenicity	Carcinogenicity	Repro. and/or Develop. tox.	Endocrine disruption	Immune suppression	Neuro-toxicity		Bee toxicity (3)
0	Endosulfan	**y 1)**	**y 1) [3,6 to 4,7] 1)**	**y 2)**	**y 1)**	n 2)	n 2) possibly 9)	n 2) possibly 9)	possibly 9)		**y 9)**	**5**	**y 5) / n**
1	Bifenthrin	**y 9) (a, b, c)**	**y 4) [>6-8.15] 8)**	**y 9)**		no data 9)	possibly 9)	**y 4)**	**y 4) 9)**		**y 4)** possibly 9)	**6**	**y 9)**
2	Diazinon	**y 9) (a)**	**y 4) [3,86] 6)**	**y 2)**		n 2)	n 9)	**y 4)**	possibly 9)		**y 4) 9)**	**5**	**y 4) 9)**
3	Lambda cyhalothrin	**y 9) (a)**	**y 4) [6,85] 6)**	**y 2)**		n 2)	no data 9)	n 2)	**y 4)**		**y 4)**	**5**	**y 9)**
4	Deltamethrin	**y 9) (a)**	**y [6,18] 6)**	**y 2)**		n 2)	possible 9)	possible 9)	**y 4)**		**y 4)**	**5**	**y 4)**
5	Permethrin	n 9)	**y 4) [7,43] 8)**	**y 2)**		n 2)	n 2) possibly 9)	n 2) y 9)	**y 9)**		**y 9)**	**4**	**y 4)**
6	Dicofol	**y 4)**	**y [4 to 5]**	**y 2)**		n 2)	possibly 9)	no data 9)	possibly 9)		**y 4)**	**4**	**y 4)**
7	Propargite	n 9)	**y [5.57] 8)**	**y 2)**		n 2)	**y 2)**	**y 4)**	no data 9)		no data 9)	**4**	n 9)
8	Phoxim	n 9)	**y [4.39] 8)**	**y 2)**		n 2)	n 9)	**y 11)**	n 4)		**y 4) 9)**	**4**	no data 9)
9	Monocrotophos	**y (a) 9)**	n 8) [<-1]	**y 4)**		**y 2)**	n 2) 9)	n 2) possibly 9)	no data 9)		**y 4) 9)**	**4**	**y 4) 9)**
10	Flucythrinate	**y 4)**	**y [6,56] 6)**	**y 2)**		no data 9)	n 2) possible 9)	n 2) possible 9)	n 2) possible 9)		**y 4) 9)**	**4**	**y 9)**
11	Carbaryl	n 4) 9)	2.36 4) 8) 9)	**y 2)**		n 2)	**y 11)**	n 2) no data 9)	**y 4) 9)**		**y 4)** possibly 9)	**4**	**y 9)**
12	Profenophos	**y (a) 9)**	**y 4) [4.82] 8)**	**y 10)**		n 2) 9)	n 2) 9)	n 2) 9)	no data 9)		**y 4)**	**4**	**y 9)**

No.	Substance	Hazard indicators: POP criteria				Hazard indicators: adverse effects						Ranking	Other data
		P	B	T	LRT	Mutagenicity	Carcinogenicity	Repro. and/or Develop. tox.	Endocrine disruption	Immune suppression	Neuro-toxicity		Bee toxicity (3)
13	Fenvalerat	**y (a) 9)**	**y [6,76] 6)**	**y 3) 11)**		n 2)	n 9)	n 9)	**y 9)**			**4**	**y**
14	Spinosad	**y (a) 9)**	**y 4,0 9)**	**y 11)**		n 2)	n 9)	n 9)	n 9)		**y**	**4**	**y**
15	Carbofuran	**y (a) 9)**	n [2,32] 8)	**y 2)**		n 2)	n 9)	n 9)	**y 9)**		**y 4)**	**4**	**y**
16	Phosalone	**y (a) 9)**	**y 6) [4,29] 8)**	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**4**	n
17	Chlorpyrifos	n 9)	**y 4) 6) [4,66] 8)**	**y 2)**		n 2)	n 2) 9)	**y 9)**	possibly 9)		**y 4)** n 9)	**3-4**	**y 4) 9)**
18	Beta-cyfluthrin	no data 9)	**y [6,18]**	**y 2)**		no data (2) 9)	no data (2) 9)	no data (2) 9)	possile 9)		**y 9)**	**3**	**y 9)**
19	Quinalphos	n 9)	n [3,04] 6)	**y 2)**		n 2)	n 2) possible 9)	n 2) possible 9)	**y 4)** no data 9)		**y 4)**	**3**	**y 4)**
20	Dimethoate	**y (a) 9)**	n [0.28] 8)	**y 10)**		n 2)	n 9)	n 9)	possible 9)		**y**	**3**	**y**
21	Cypermethrin	n 9)	**y 4) [6,38] 6)**	**y 2)**		n 2)	n 2)	n 2)	possible 9)		**y 4)**	**3**	**n / y 4)**
22	Formetanate hydrochloride	**y (a) 9)**	n 8)	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**3**	**y**
23	Pyridaben	**y (a) 9)**	**y [5,47] 6)**	**y 2)**		n 2)	n 9)	n 9)	no data 9)		possibly 9)	**3**	**y 9)**
24	Fenpropathrin	**y (a) 9)**	**y [6,0]**	**y 3) 10)**		n 2)	n 9)	no date 9)	no data 9)		possibly 9)	**3**	**y 9)**
25	Thiacloprid	**y (a) 9)**	n [1,26]	**y 3)**		n 2)	**y 4)**	n 9)	n 9)		n 9)	**3**	n
26	Abamectin	**y (a) 9)**	n [2,0]	**y 3)**		n (2)	n(9)	**y 4)**	n 9)		n 9)	**3**	**y**
27	Pirimicarb	**y 4)**	n [1.4] 6) 8)	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**3**	n

No.	Substance	Hazard indicators: POP criteria				Hazard indicators: adverse effects						Ranking	Other data
		P	B	T	LRT	Mutagenicity	Carcinogenicity	Repro. and/or Develop. tox.	Endocrine disruption	Immune suppression	Neuro-toxicity		Bee toxicity (3)
28	Triazophos	**y (a) 9)**	n [3,55]	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**3**	n
29	Fenobucarb	**y (a) 9)**	n [2,79] 6)	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**3**	no data 9)
30	Methomyl	**y (a) 9)**	n [0,13]	**y 2) /9**		n 2)	n 9)	n 9)	possible 9)		**y 4)**	**3**	**y**
31	Nicotin	no data 9)	n [1,17]	**y 2)**		n 2)	n 9)	**y 4)**	no data 9)		**y 4)**	**3**	no data 9)
32	Spirodiclofen	**y (a) 9)**	**y 5.83**	n 3)		no data 9)	**y 4)**	n 9)	possible 9)		possible 9)	**3**	**y**
33	Etofenprox	**y (a) 9)**	**y 6.09 9)**	n (7, 14, 6, 2)		no data 9)	n (2) 9)	**y 4)**	possible 9)		n 9)	**3**	**y 9)**
34	Malathion	**y (a) 9)**	n [2,36 to 3,25]	**y 2)**		n 2)	possible 9)	possible 9)	possible 9)		**y 8**	**3**	**y 8**
35	Beta-cypermethrin	n 9)	**y 4,7 9)**	**y 10)**		n 2)	possible 9)	no data 9)	possible 9)		**y 4)**	**3**	**y 9)**
36	Zeta cypermethrin	n 9)	**y 4) 6.6**	**y 10)**		no data 9)	possibly 9)	possibly 9)	no data 9)		**y 4)**	**3**	**y 4)**
37	Tralomethrin	n 9)	**y 4) [7.56] 8)**	**y 10)**		no data 9)	no data (2) n 9)	no data (2) possibly 9)	no data 9)		**y 4)**	**3**	**y 4)**
38	Oxydemeton-S-Methyl	n 9)	n 8) [-1.03]	**y 2)**		n 2)	n 9)	**y 4)**	n 9)		**y 4)**	**3**	**y 9)**
39	Trichlorphon	**y (a) 9)**	n 8) [0.51] 8)	**y 2)**		n (2)	possible 9)	possible 9)	possible 9)		**y 9)**	**3**	n
40	Fipronil	**y (a) 9)**		**y 11)**		n 2)	possible 9)	no data 9)	possible 9)		**y 9)**	**3**	**y 4)**
41	Flubendiamide	no data 9)	**y 4.2**	n 3)		n 2)	no data 9)	**y 9)**	**y 9)**		no data 9)	**3**	n
42	Esfenvalerat	n 9)	**y 4)**	**y 2)**		n 2)	n 6) 9)	n 6)	possibly 9)		**y 4)**	**2-3**	**y 4) 9)**

No.	Substance	Hazard indicators: POP criteria				Hazard indicators: adverse effects						Ranking	Other data
		P	B	T	LRT	Mutageni-city	Carcinogenicity	Repro. and/or Develop. tox.	Endocrine disruption	Immune suppression	Neuro-toxicity		Bee toxicity (3)
			[6,22]					possibly 9)			n 9)		
43	Dicrotophos	no data 9)	n [-0.5 to -1.1] 8)	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**2**	**y 4)**
44	Naled	n 9)	n [1,38]	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**2**	**y 4)**
45	Methidathion	n 9)	n 8) [1.58]	**y 2)**		n 2) 9)	n 2) possibly 9)	n 2) possibly 9)	no data 9)		**y 4)**	**2**	**y**
46	Azinphos-methyl	n 9)	n 8)	**y 2)**		n 2)	n 9)	n 9)	n 9)		**y 4)**	**2**	**y**
47	Parathion-Methyl	n 9)	n 8) [2,75] 6)	**y 2)**		n 2)	n 9)	n 9)	possible 9)		**y 4)**	**2**	n 9)
48	Methamidophos	n 9)	n 8) [-0.8 to -0.93]	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**2**	**y**
49	Dichlorvos	n (13	n [1,9] 6)	**y 2)**		n 2)	n 9)	n 9)	possible 9)		**y 4)**	**2**	**y 9)**
50	Oxamyl	n 9)	n [-1.2] 8)	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 4)**	**2**	**y**
51	Phosmet	n 9)	n [2.48] 8)	**y 2)**		n 2)	n 9)	n 9)	possible 9)		**y 4)**	**2**	n 9)
52	Imidacloprid	**y (a, s) 9)**	n 8) [0.56]	**y 3)11)**		n 2)	n 9)	n 9)	no data 9)		possible 9)	**2**	**y**
53	Pymetrozin	**y (a) 9)**	n [-0,18]	n 3)		n 2)	**y 6)**	n 9)	no data 9)		no data 9)	**2**	n
54	Neem base pesticide = Azadirachtin = NKSE (Neem kernel seed extract)	**y (a) 9)**	n 9)	n 3)		n 2)	no data 9)	n 9)	n 9)		**y**	**2**	n
55	Tebufenozide	**y 4)**	**y**	n 2)		n 2)	n 9)		no data 9)		no data	**2**	n 9)

No.	Substance	Hazard indicators: POP criteria				Hazard indicators: adverse effects						Ranking	Other data
		P	B	T	LRT	Mutagenicity	Carcinogenicity	Repro. and/or Develop. tox.	Endocrine disruption	Immune suppression	Neuro-toxicity		Bee toxicity (3)
			4.25								9)		
56	Thiomethoxam Thiamethoxam	**y 9)**	n 9)	**y 11)**		n 2)	possible 9)	n 9)	possible 9)		n 9)	**2**	**y 4)**
57	Novaluron	**y (a) 9)**	**y 4.3 (6.34)**	n 9)		n 2)	n 9)	n 9)	no data 9)		n 9)	**2**	n 9)
58	Emamectin benzoate	no data 9)	**y 5.0 (6.64)**	**y 9)**		n 2)	n 9)	possible 9)	n 9)		no data 9)	**2**	no data 9)
59	Diafenthiuron	**y (a) 9)**	**y 5.75**	n 3)		n 2)	n 9)	no data 9)	no data 9)		no data 9)	**2**	**y**
60	Cyromazine	**y 4)**	n 8) [0.96]	n 3)		n 2)	n 9)	**y 9)**	no data 9)		n 9)	**2**	**y**
61	Mancozeb	n 9)	n [1,33] 8)	n 3)		n 2)	**y 9)**	**y 11)**	n 9)		n 9)	**2**	n 9)
62	Isoprocarb	no data 9)	n [2,30] 6)	**y 2)**		n 2)	n 9)	n 9)	no data 9)		**y 9)**	**2**	no data 9)
63	Buprofezin	**y (a) 9)**	**y [4,3] 6)**	n 2)		n 2)	possible 9)	possible 9)	n 9)		n 9)	**2**	n 9)
64	Indoxacarb	n 9)	**y 4.65**	n 3)		n 2)	n 9)	n 9)	no data 9)		**y**	**2**	n
65	Spiromesifen	n 9)	**y 4)**	n (6, 13, 7, 10)		n 2)	n 9)	possible 9)	no data 9)		n 9)	**1**	n 9)
66	Acephate	no data 9)	n 8)	n 2) 3)		n 2)	possible 9)	no data 9)	no data 9)		**y 9)**	**1**	**y**
67	Pyriproxyfen	n 9)	**y 8) [5,55] 6)**	n 2)		n 2)	n 9)	n 9)	no data 9)		n 9)	**1**	n 9)
68	Clofentezine	**y (c) 9)**	n 9)	n 3)		n 2)	possible 9)	possible 9)	n 9)		n 9)	**1**	n
69	Acetamiprid	**y (a) 9)**	n 9)	n 3)		n 2)	n 9)	n 9)	no data 9)		n 9)	**1**	n
70	Methoxyfenozide	**y (a, c)**	n 9)	n 3)		n 2)	n 9)	n 9)	possible 9)		n 9)	**1**	n

No.	Substance	Hazard indicators: POP criteria				Hazard indicators: adverse effects						Ranking	Other data
		P	B	T	LRT	Mutagenicity	Carcinogenicity	Repro. and/or Develop. tox.	Endocrine disruption	Immune suppression	Neuro-toxicity		Bee toxicity (3)
		9)											
71	Sulphur	**y (a) 9)**	0.23 9)	n 3)		n 2)	n 9)	n 9)	no data 9)		n 9)	**1**	n
72	Flonicamid	**y (a) 9)**	n 0.3	no data 9)		n 2)	possible 9)	possible 9)	no data 9)		n 9)	**1**	n 9)
73	Chlorantraniliprole	**y (c) 9)**	n 9)	n 9)		n 2)	n 9)	n 9)	n 9)		n 9)	**1**	n 9)
74	Kinoprene	no data 9)	**y 6.69 9)**	n 9)		n 2)	n 9)	n 9)	no data 9)		n 9)	**1**	n 9)
75	Dinotefuran	**y (a) 9)**	n -0,55	n 9)		n 2)	n 9)	possible 9)	no data 9)		n 9)	**1**	**y 9)**
76	Spinetoram	possible 4) n 9)	possible 4) n 9)	possible 4)		possible 4) no data 9)	n 4) n9)	possible 4) n9)	possible 4) no data 9)	possible 4)	n 9)	**0**	possible 4) no data 9)
77	Lime sulphur			n 3)								**0**	N
78	Insectical soap			n 3)								**0**	N
79	Imidaclothiz											**no data**	
80	Thian											**no data**	
81	Kaolin clay											**no data**	
82	Mineral oil											**no data**	
83	Pyrethrin/Piperonyl butoxide											**no data**	
84	Brofluthrinate											**no data**	

Annex IV

Submission by India

SN	Substance	Risk indicators: adverse effects							Other data
		Mutageni-city	Carcinogenicity	Reproduction	Developmental tox	Endocrine disruption	Immune suppression	Neuro-toxicity	Bee toxicity
1	Chlorantraniliprole	Non-mutagenic	NOAEL-Rat Male – 805 mg/kg/day Female- 1076 mg/kg/day **NOEL- Mice** Male – 935 mg/kg/day Female- 1155 mg/kg/day	NOAEL – Rat 20000 ppm	NOEL – Rat 1000mg/kg/day	Not available	Not available	NOEL – 2000 mg/kg	LD_{50} > 200 µg/bee
2	Buprofezin	Non-mutagenic	NOEL-Mice Male – 1.82 mg/kg/day Female- 17.9 mg/kg/day	NOAEL- Rat 100 ppm	Not tertogenic (NOEL/NOAEL not calculated)	Not available	Not available	Not available	-
3	Thiomethoxam	Non-mutagenic	NOEL- Rat Male – 500 ppm Female- 1000 ppm	NOEL – Rat Male – 1.3 to 4.3 mg/kg Female- 59.3 to 219.6 mg/kg	NOEL- Rat For dams 30mg/kg/day For fetuses 200mg/kg/day	Not available	Not available	Not available	LD_{50} : 0.005µg/bee
4	Profenofos	Non-mutagenic	NOEL-Rat 0.3 ppm	(NOEL/NOAEL not calculated)	NOEL- Rat 120 mg/kg	Not available	Not available	Not available	*******
5	Bifenthrin	Non-mutagenic however, marginally positive in unscheduled DNA synthesis in rat primary hepatocytes	NOEL- Rat Male - 2.3 mg/kg/day Female – 3.0 mg/kg/day	NOEL- Rat 1.5 mg/kg/day	NOEL – Rat 2 mg/kg/day	Not available	Not available	Not available	Mild and short term toxic on honey bees.

SN	Substance	Risk indicators: adverse effects							Other data
		Mutageni-city	**Carcinogenicity**	**Reproduction**	**Developmental tox**	**Endocrine disruption**	**Immune suppression**	**Neuro-toxicity**	**Bee toxicity**
6	Acetamiprid	Non-mutagenic	NOEL- Rat Male – 7.1 mg/kg/day Female – 8.8 mg/kg/day NOEL- Mice 130 ppm	NOEL- Rat 100 ppm	NOEL- Rat 50 mg/kg/day	Not available	Not available	NOEL- Chicken 25 mg/kg	**LC 50: 67.2 ppm**
7	Clothianidin	Non-mutagenic	NOAEL- Rat Male – 27.36 mg/kg/day Female – 9.73 mg/kg/day	NOAEL- Rat Male – 179.6 mg/kg/day Female – 212.9 mg/kg/day	NOEL – Rat 125 mg/kg/day	Not available	Not available	NOEL-Rat Male – 60 mg/kg/day Female – 71 mg/kg/day	LD_{50} : 0.04426 µg/bee
8	Lambdacyhalothrin	Non-mutagenic	NOEL- Rat Male – 1.81 mg/kg/day Female – 2.03 mg/kg/day	NOEL – Rat 1.5 to 1.9 mg/kg/day	NOEL – Rat 15 mg/kg/day	Not available	Not available	Moderately toxic to chicken	LD_{50} : 38 ng/bee
9.	Fluvalinate	Non-mutagenic	NOEL- Rat 1.0 mg/kg/day	NOEL-Rat 20 ppm	(NOEL/NOAEL not calculated)	Not available	Not available	Not available	LD_{50} : 18.43 µg/bee