

# Agricultural Biotechnology in Thailand

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The government of Thailand has recognized biotechnology as an important tool for improving agricultural development since 1983, establishing the National Center for Genetic Engineering and Biotechnology (BIOTECH) in the same year to spearhead activities in this area. The National Biosafety Committee (NBC) is tasked to regulate genetic engineering and other related work. Guidelines for laboratory practices, field trials, and planned release of genetically modified (GM) organisms have been set up and implemented. As of the year 2000, six limited field trials of GM crops (Bt cotton and Bt corn) and confined experiments of GM tomato, rice, corn, and papaya with various traits had been conducted in Thailand. Importation of transgenic crops covering 40 species is allowed only for experimentation and not commercialization. However, the importation of processed GM food and GM soybean and corn for the food, feed and other industries is allowed.

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Recognizing biotechnology to be of great potential for improving agricultural development as well as for the country's competency, the National Center for Genetic Engineering and Biotechnology (BIOTECH) was established in 1983 under the Ministry of Science, Technology and Environment (MOSTE). At present, BIOTECH is affiliated with the established autonomous agency, the National Science and Technology Development Agency (NSTDA).

## Biosafety Regulations

Since there has been social controversy over the creation and the use of genetically modified organisms (GMOs), the issue of biosafety has become one of the main concerns of the country. The National Biosafety Committee (NBC), which has the technical advisory function, has been established to assess risks and to develop guidelines for genetic engineering and works relevant to biotechnology. Guidelines for laboratory practices, field trials, and planned release of GMOs have been set up and implemented. Scope of the guidelines embraces all work related to gene manipulation employing recombinant DNA technology for all purposes, including the improvement of transgenic plants, animals, and microorganisms; commercial and industrial manufacturing of r-DNA derived products, pharmaceuticals, and nutraceuticals; and release of transgenic materials and its products into the environment. The guidelines are considered as soft laws, with voluntary basis involvement. Separate Biosafety Sub-committees for Plants, Food, and Microorganisms have also been established. NBC also encourages the appointment of Institutional Biosafety Committee (IBC) in relevant public agencies and academic institutions to serve their own mandatory functions while it assists the IBC as technical advisory committee.

NBC and the Department of Agriculture IBC (DOA IBC) have set up guidelines for introduction permits of transgenic plants/materials for trials. The proponent files a request at the Department of Agriculture for introduction permits of transgenic plants/materials. Documentary information concerning field trial

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methodology and results, novel gene, gene transformation techniques, and relevant data are required for biosafety pre-audit before the issuance of permits. Upon approval, the proponent sets up plan and design of experiment for biosafety assessment, which will be monitored and supervised by appointed competent field working groups. Parameters and data collection will be in conformity with the Biosafety Protocol set up by the Department of Agriculture. Results of the trials will be evaluated and reported by appointed committee for further approval by competent higher authorities. Steps of procedures are illustrated in Figures 1 and 2.

## **Commercialization**

Anticipating future commercialization in the country, the government and private sectors are involved in the introduction of transgenic plants/materials for research purposes and for local biosafety assessment. Examples are insect resistant cotton (Bt cotton) and herbicide resistant corn. From 1995 to the present, 16 transgenic plants/materials had been permitted to be introduced and to undergo biosafety assessment/investigation under competent supervision (Table 1). Stages of investigation ranges from laboratory, confined containment, and field trials. Nevertheless, none of the items had ever been deregulated for commercialization. In the case of the Bt cotton introduced by the Monsanto (Thailand) Ltd. in 1995, it has become a controversial issue as raised by ecologists and activists. Despite the various biosafety trial results, deregulation of the crop for commercialization requires results from additional large scale field trial to gain a higher degree of faith and public acceptance.

To regulate importation of genetically modified plants/materials, the Ministry of Agriculture and Cooperatives issued the Ministerial Notification regarding the specification of plants, plant pests, and pest carriers from certain sources as prohibited materials under the Plant Quarantine Acts B.E. 2507, Amended 2542. The Notification covers 40 species of GMOs known to have undergone genetic transformation worldwide as prohibited materials, with the exception of processed food. Soybean and corn grains for the purposes of food, feed, and industries are also exempted (Table 2). Additional GMO species will be listed and notified as deemed necessary. The listed GMO species are not allowed to be imported into the country except for experimental purposes. At present, there is no issue of deregulation of any imported GMO species being made for further investigation toward commercialization.

The export of produce/products and importation of raw materials for food, feed, and industrial use are regulated by Acts administered by the Ministry of Commerce (MOC). Since soybean and corn grains are exempted by the Ministry of Agriculture and Cooperatives (MOAC) Ministerial Notification, guidelines and rules are to be set up to prevent contamination of the imported materials into agricultural production sector. Collaborative action and enforcement are to be undertaken seriously by both MOAC and MOC. Table 3 illustrates soybean and maize sources of import.

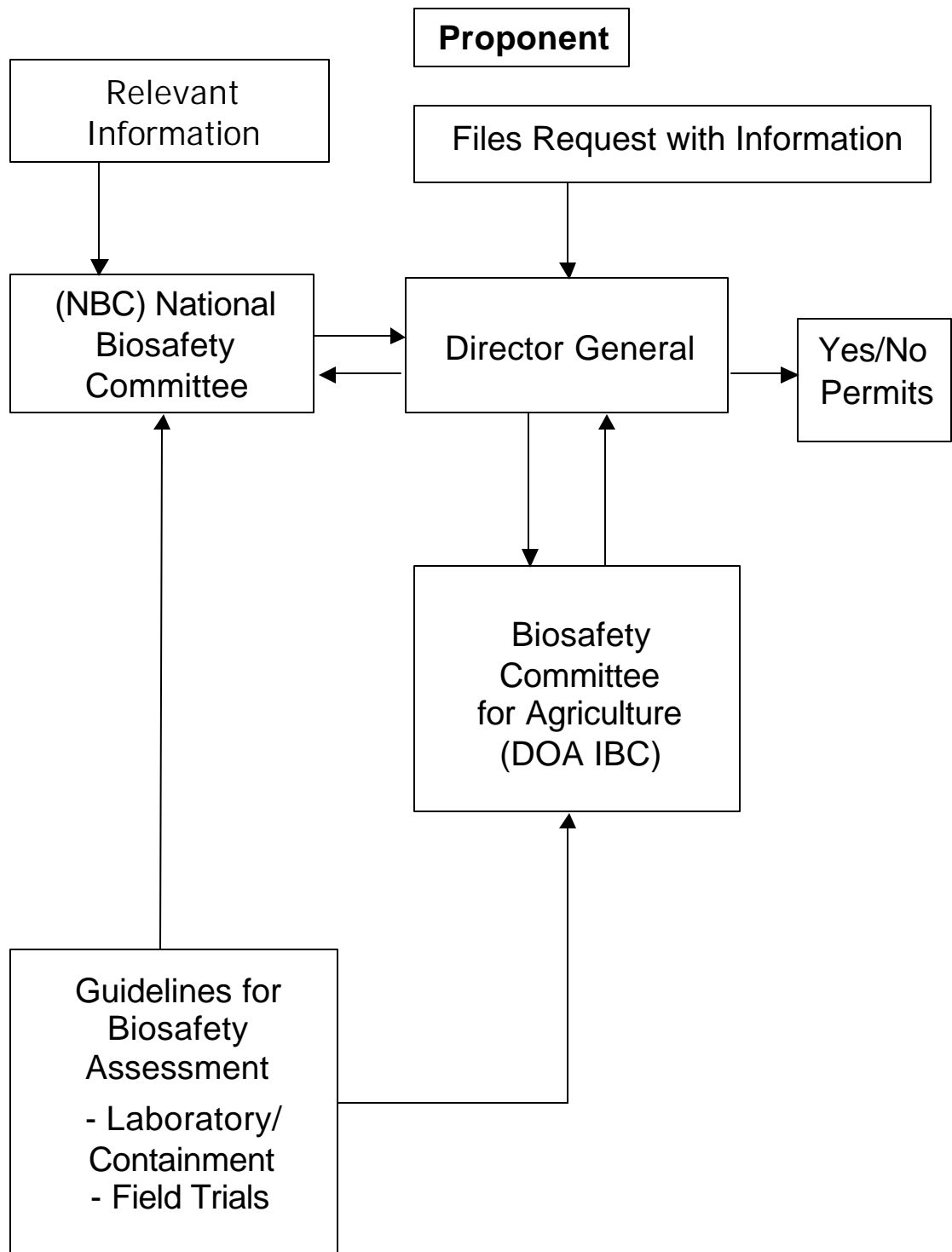
Biotechnology research activities are encouraged and undertaken by MOAC, **MOSTE** and MOH as well as by the various academic institutes. Accordingly, the MOAC has placed biotechnology as high priority research area under long-term policy. The Department of Agriculture (DOA) has been assigned as nucleus unit with research function as well as intra/inter MOAC coordination activities. A Central Biotechnology Laboratory with satellite labs located in relevant research centers

under the DOA was established to provide research facilities and to carry out research activities. Collaborative research programs are encouraged to strengthen outputs and outcome and to minimize duplication. International collaborative research programs are also undertaken. Figure 3 illustrates collaborative approach.

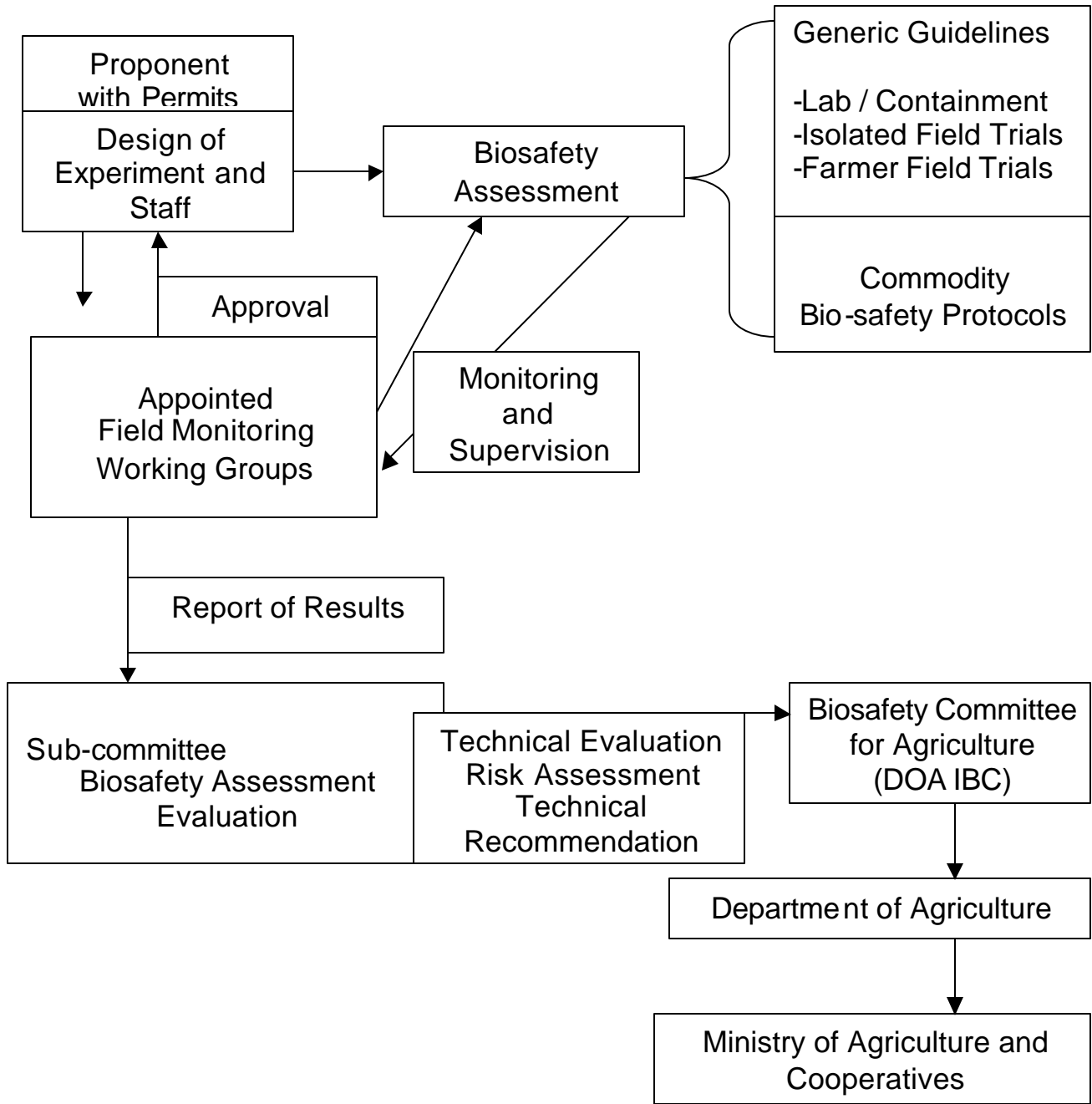
In order to facilitate trade, certification for non-GM produce/products requested by bilateral trade partners can be issued by relevant competent authorities. Certification can either be to certify as tested samples or to certify as lot. Testing procedures for the detection of GM materials are standardized among the competent laboratories and bench marking with international standards.

The social controversy over the creation and the use of GMOs throughout the world is no exception for Thailand. Public attitudes toward the risks have developed into an important area of concern and causes rising demands to explain the likely consequences of potential hazard of the products to the consumers, general public, and the environment. In terms of food safety derived from GM food, Thailand's Food and Drug Administration is responsible for the risk assessment as well as for food labeling. The position of Thailand's FDA toward GM food labeling is still under process.

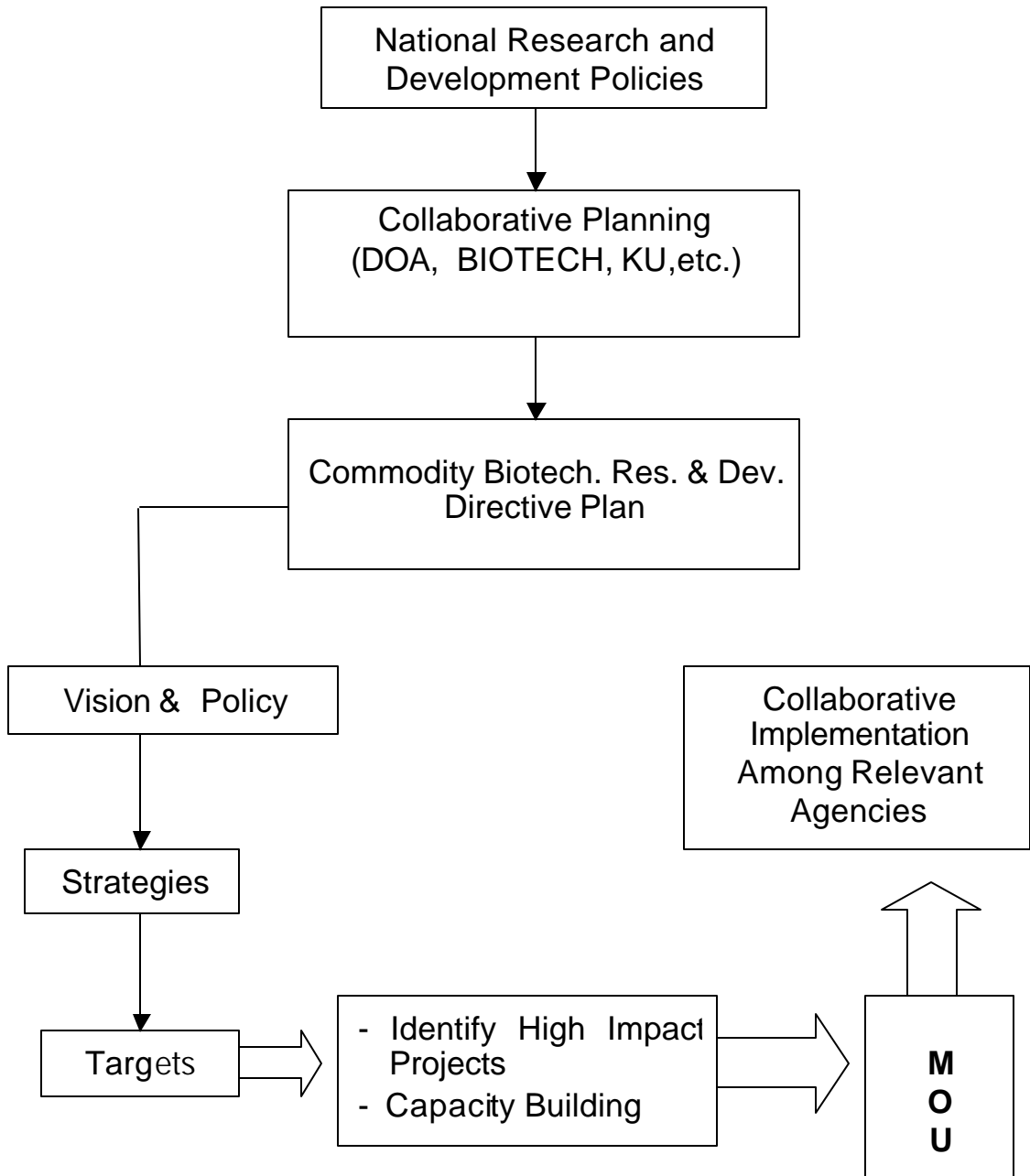
Since Thailand is an agricultural-based country, cautious steps toward GMOs have been taken and that no commercialization of GM plant production is one of the national policies being issued. Moreover, public awareness programs about GMOs have been strengthened.



**Fig. 1. Procedures for introduction permits of transgenic plants/materials for trials**



**Fig. 2. Procedures for genetically modified organisms biosafety assessment.**



**Fig. 3. Collaborative research and development approach among relevant agencies.**

**Table 1 .** Introduction permits for GM plants/material into Thailand since 1995.

Date	Proponent	Transgenic Items	Assessment Location	Status of Assessment
2 Aug 95	Upjohn Co.	Tomato seed pCGN 4109 Pcgn 1436 FLAVRSAVR	Sakol Nakom	Final
18 Oct 95	Monsanto (Thailand) Ltd.	Cotton seed Cry 1A(c) Bt. Var. Kurstaki (B.T.K.) USA. endotoxin toxic to Lepidoptera	Confined containment	Bio-safety Assessment
10 Jul 96	Monsanto (Thailand) Ltd.	Cotton seed Cry 1A(c) Bt. Var. Kurstaki (B.T.K.) USA. endotoxin toxic to Lepidoptera	Field trials	Bio-safety Assessment
8 Oct 96	Novartis (Thailand) Ltd.	Maize seed Bt.	Confined containment Field trial Nakom Sawan	Bio-safety Assessment
30 Sep 96	Plant Pathology Div. DOA	Callus, Cucurbit Coat protein Papaya ring-spot Virus Thai strains	Laboratory Confined containment	Bio-safety Assessment
22 Apr 97	Monsanto (Thailand) Ltd.	Cotton seed NUCOTN 32B NUCOTN 33B Bt	DOA Field trial Farmer Field trial	Bio-safety Assessment
15 May 97	Hort. Res. Institute DOA	Tissue, seedlings Papaya ring-spot Virus Thai strains	KhonKaen Confined containment	Bio-safety Assessment
27 May 97	Pioneer Oversea Corp. (Thailand) Ltd.	Maize seed Bt corn borer resistant	Confined containment	Bio-safety Assessment
11 Aug 97	Rice Res. Institute DOA	Rice Seedling KDML 105 Xa 21	Confined containment	Bio-safety Assessment
19 Feb 97	Monsanto (Thailand) Ltd.	Maize seed Round up Glyfosate resistant USA.	Confined containment	Bio-safety Assessment
1 May 98	Monsanto (Thailand) Ltd.	Maize seed Bt USA.	Confined containment	Bio-safety Assessment
24 Aug 98	Cargill Ltd.	Maize seed Bt USA.	Confined containment	Bio-safety Assessment
24 Aug 98	Novartis (Thailand) Ltd.	Maize seed Bt USA.	Isolated area field trial	Bio-safety assessment
24 Aug 98	Novartis (Thailand) Ltd.	Maize seed Hybrid Bt USA.	Isolated area field trial	Bio-safety Assessment
28 Jan 99	Cargill Ltd.	Maize seed Round up Glyfosate resistant USA.	Confined containment	Bio-safety Assessment
28 Jan 99	Monsanto (Thailand) Ltd.	Maize seed Round up Glyfosate	Confined containment	Bio-safety Assessment
10 Jun 99	Monsanto (Thailand) Ltd.	Bt corn (Mon-810)	Isolated area Field trial	During quarantine process

**Table 2.** Genetically modified species listed as prohibited materials.

No.	Plant / pest / carriers	Source of Origin	Exemption
1	<i>Oryza sativa</i> L.	All	Processed food
2	<i>Zea mays</i> L.	All	Processed food, Grains for food, feed and industries
3	<i>Gossypium</i> spp.	All	Processed food
4	<i>Linum</i> spp.	All	Processed food
5	<i>Glycine max</i> L.	All	Processed food, Grains for food, feed and industries
6	<i>Helianthus</i> spp.	All	Processed food
7	<i>Brassica napus</i> L.	All	Processed food
8	<i>Solanum tuberosum</i> L.	All	Processed food
9	<i>Asparagus officinalis</i> L.	All	Processed food
10	<i>Ribes nigrum</i> L.	All	Processed food
11	<i>Brassica</i> spp.	All	Processed food
12	<i>Daucus cerote</i> L.	All	Processed food
13	<i>Brassica oleracea</i> var/bpmutos L.	All	Processed food
14	<i>Apium graveolens</i> var. dulce (Mill.)D.C.	All	Processed food
15	<i>Cucumis sativus</i> L.	All	Processed food
16	<i>Solanum melongena</i> L.	All	Processed food
17	<i>Vitis</i> spp.	All	Processed food
18	<i>Actinidia chinensis</i> Plandon	All	Processed food
19	<i>Luctuca sativa</i> L.	All	Processed food
20	<i>Cucumis melo</i> L.	All	Processed food
21	<i>Pisum sativum</i> L.	All	Processed food
22	<i>Rubus</i> spp.	All	Processed food
23	<i>Frataria</i> spp.	All	Processed food
24	<i>Cucurbita</i> spp.	All	Processed food
25	<i>Beta vulgaris</i> L. sub sp. vulgaris	All	Processed food
26	<i>Nicotiana tabacum</i> L.	All	Processed food
27	<i>Lycopersicon esculentum</i> Miller	All	Processed food
28	<i>Dianthus caryophytus</i> L.	All	Processed food
29	<i>Chrysanthemum</i> spp.	All	Processed food
30	<i>Ipomoea</i> spp.	All	Processed food
31	<i>Medicago sativa</i> L.	All	Processed food
32	<i>Pitunia</i> spp.	All	Processed food
33	<i>A Armoracia rusticans</i> P.	All	Processed food
34	<i>Amrlanchier</i> spp.	All	Processed food
35	<i>Stylosanthes</i> spp.	All	Processed food
36	<i>Pyrus malus</i> L.	All	Processed food
37	<i>Carica papaya</i> L.	All	Processed food
38	<i>Poputos</i> spp.	All	Processed food
39	<i>Pyrus communis</i> L.	All	Processed food
40	<i>Juglans</i> spp.	All	Processed food

**Table 3.** Thailand soybean and maize sources of import, 1998.

Commodity/ Source of Import	Quantity (tons)	Presumed GMF (tons)	Value (million bahts)	Remarks
<b>Soybean</b>				
USA	414,358	149,168	4,254	GMOs
Argentina	154,760	92,856	1,504	GMOs
Brazil	118,250	0	1,384	?
Total	681,368		7,158	
<b>Maize</b>				
Argentina	96,725	0	485.8	GMOs
Indonesia	70,168	0	357.9	GMOs
Peru	59,766	0	308.7	?
USA	4,527	996	94.1	GMOs
Total	231,186		1,264.5	

Source : NFI Thailand, 1999.

Adopted from BIOTECH Report on Thailand GMOs Status, January, 2000.

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