



*Genetic Engineering
and Genome Editing
in DOA part*



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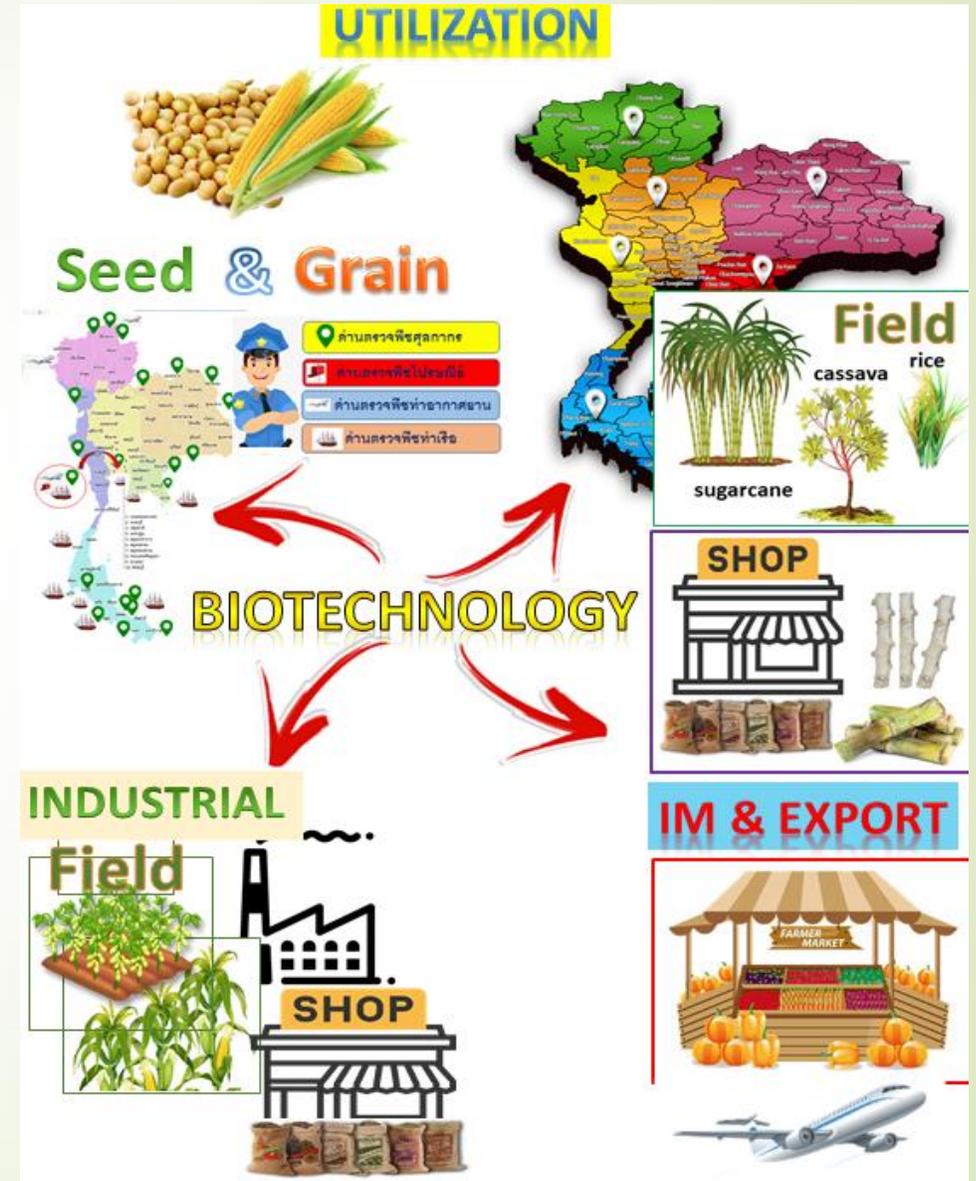
**Webinar: Biotechnology Approaches in Crop Improvement in Thailand ,
7 December 2021**

Genetic Engineering and Genome Editing in DOA part

Research

Communi-
-cation

Regulation



Research and Application: GM and GE

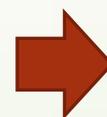
Plant Disease and Insect control

GM and GE detection kit

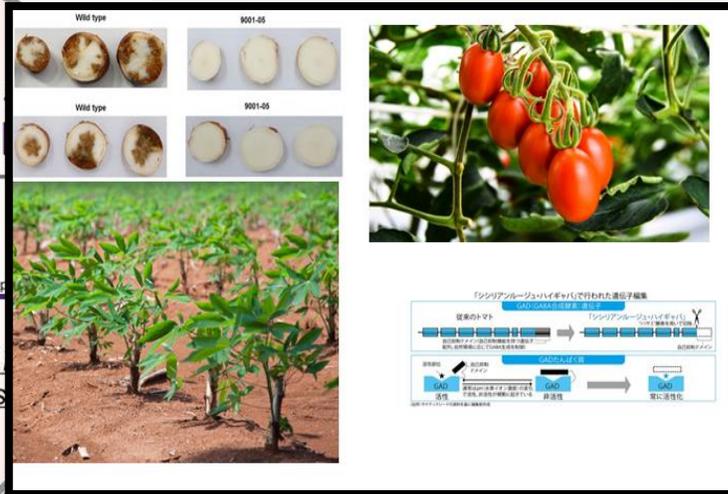
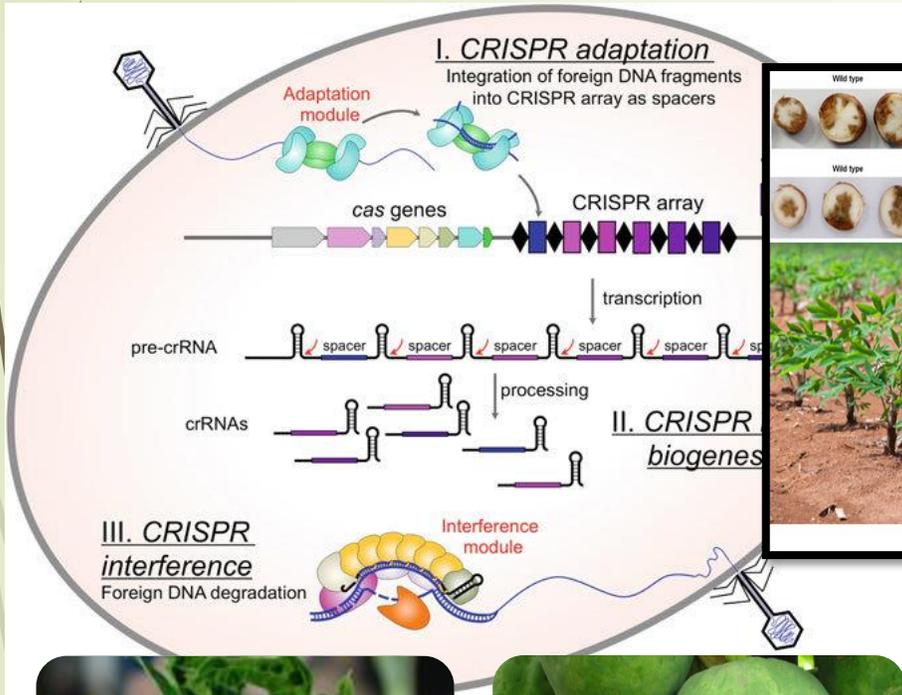
Value Adding

GM and GE detection method

Research and Application: GM and GE



Genome Editing by CRISPR Cas9



Papaya Ring Spot Virus Disease



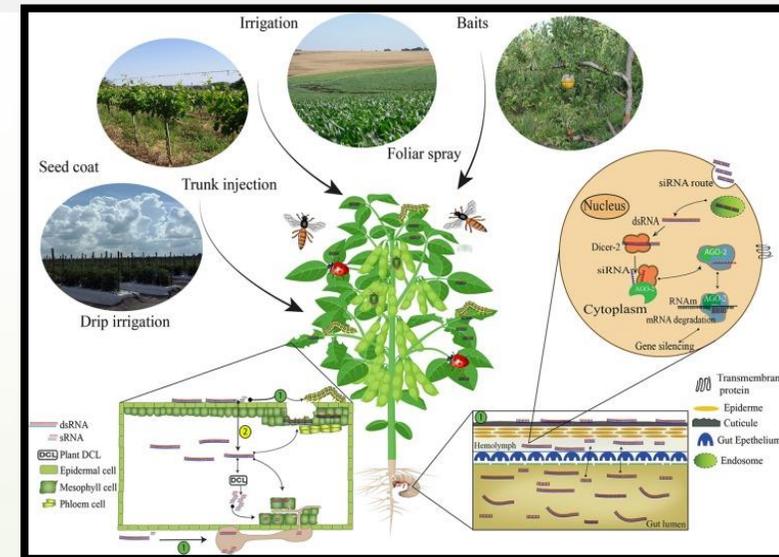
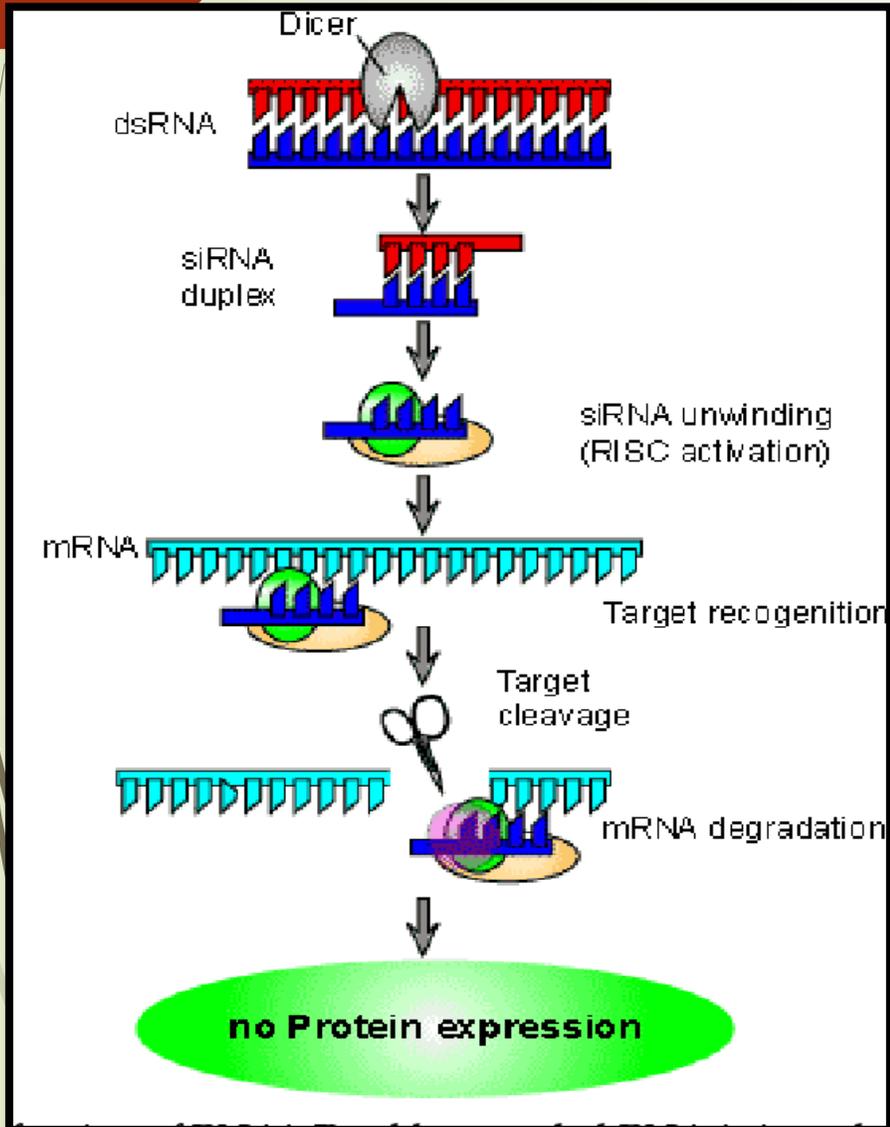
More Cannabinoid Cannabis



PPO reducing Pineapple

RNAi technology

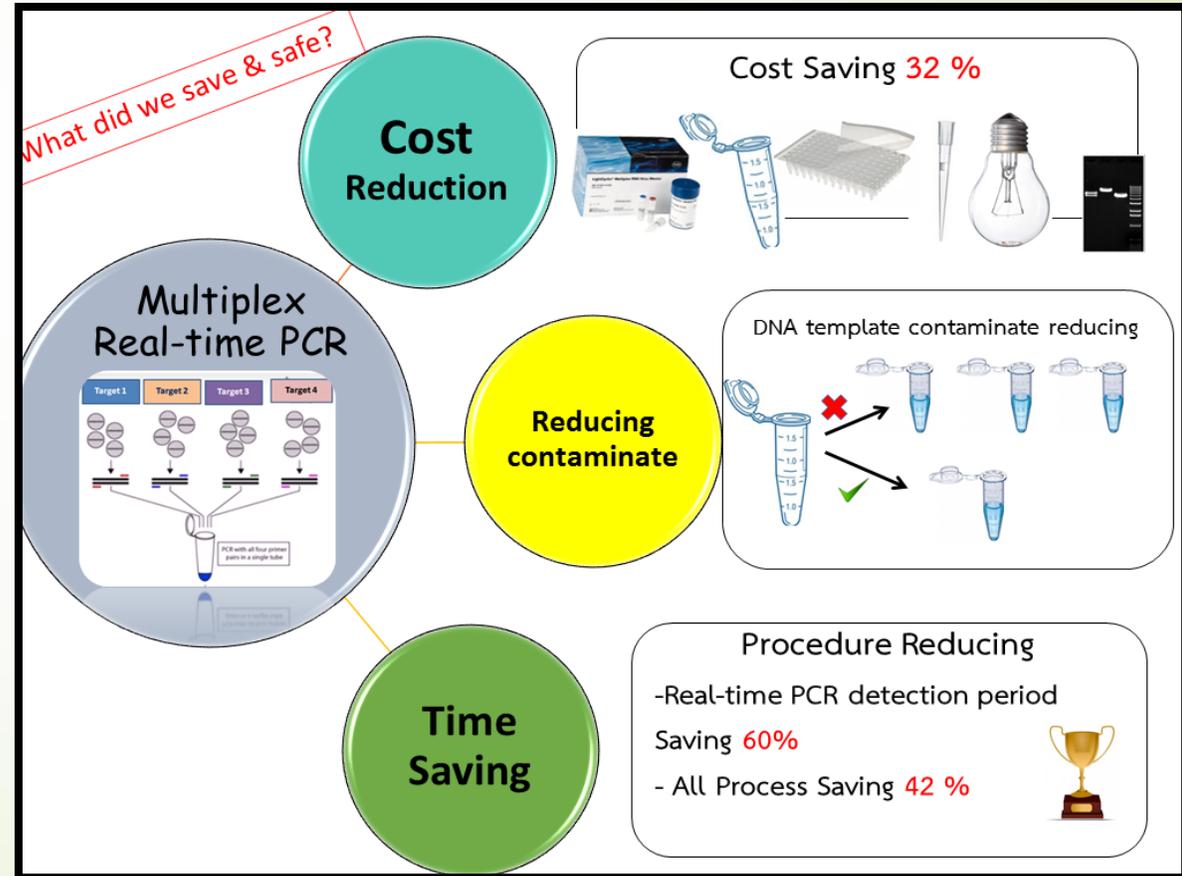
RNA interference (RNAi) is a regulatory mechanism of most eukaryotic cells that uses small double-stranded RNA (dsRNA) molecules as triggers to direct homology-dependent control of gene activity



GMO detection methods

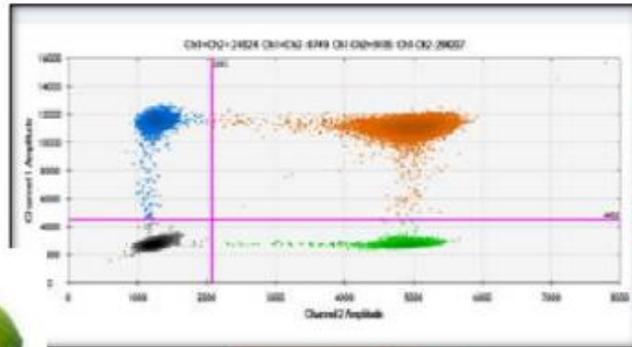
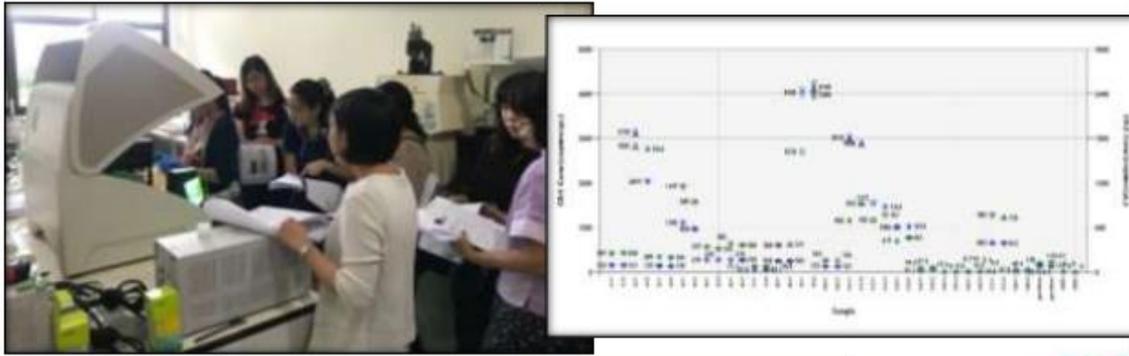


The Multiplex Real time PCR technique was successful in GMO detection to certify the export and import products.



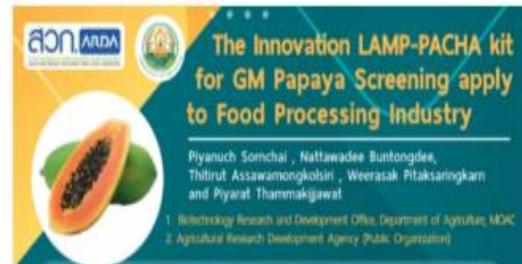
GM AND GE DETECTION METHOD

2. Developing GMOs detection method using Digital Droplet PCR



- ❑ The ddPCR system is a useful technique to detect target gene and provide absolute quantification data for gmo detection.
 - ❑ Values are accurately measured in absolute copies/ul
 - ❑ No standard curve needed.
- ❑ The unknown samples which is low amount of target are detectable by using ddPCR technology
- ❑ The ddPCR system is a useful tech. and high sensitivity for Genome Editing detection

Developing GMOs detection method for Surveillance : LAMP (Screening, Event Specific), Kanamycin Gel, PACHA kit



The Innovation LAMP-PACHA kit for GM Papaya Screening apply to Food Processing Industry

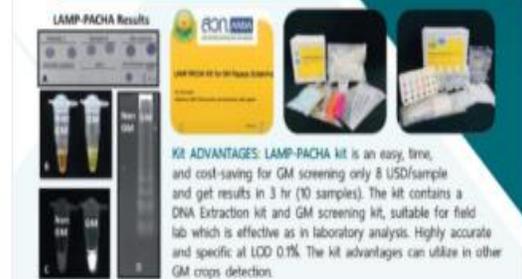
Piyanuch Sornchai, Nattawadee Buntongdee, Thitirut Assawamongkolsiri, Weerasak Pitaksaringkarn and Piyarat Thammakijawat

Biotechnology Research and Development Office, Department of Agriculture MOA
Agriculture Research Development Agency (Public Organization)

According to the papaya processing industry in Thailand affected by GM papaya contamination detected in processed papaya products causing the product to be rejected to export affecting the agriculture and industrial sector and the huge export. The processing industry needs to screen for non-GM papaya fruit before processing. From this approach, operators have increased costs and time for sampling and GM analyzing in the laboratory. Nowadays GM screening uses Real-time PCR techniques that take time and high cost (60 USD/sample). The innovation of the LAMP-PACHA kit was developed from collaboration between primer labeling, LAMP and hybridization techniques. LAMP primers were designed to amplify 855CAAV promoter, Nos terminator and Neomycinphosphotransferase resistance gene (nptII) in a short time before the membrane examination. The test results were sensitive and specific compared with the standard method. The kit uses simple tools suitable to apply in the field lab. There is an easy process that farmers and entrepreneurs can use to test for controlling the quality of produce and products according to the market demand. Affect the ability to produce commercial competitiveness.



LAMP-PACHA Results



Kit ADVANTAGES: LAMP-PACHA kit is an easy, time, and cost-saving for GM screening only 8 USD/sample and get results in 3 hr (10 samples). The kit contains a DNA Extraction kit and GM screening kit, suitable for field lab which is effective as in laboratory analysis. Highly accurate and specific at LOD 0.1%. The kit advantages can utilize in other GM crops detection.

The innovation LAMP-PACHA kit for GM Papaya Screening apply to Food Processing Industry

Description: LAMP-PACHA kit is an easy, time, and cost-saving for GM screening only 8 USD/sample and get results in 3 hr. The kit contains a DNA Extraction kit and GM screening kit, suitable for field lab which is effective as in laboratory analysis. Highly accurate and specific at LOD 0.1%. The kit advantages can utilize in other GM crops detection.

Organisation: Agricultural Research Development Agency (Public Organization)

Innovator(s): Piyanuch Sornchai, Nattawadee Buntongdee, Thitirut Assawamongkolsiri, Weerasak Pitaksaringkarn and Piyarat Thammakijawat

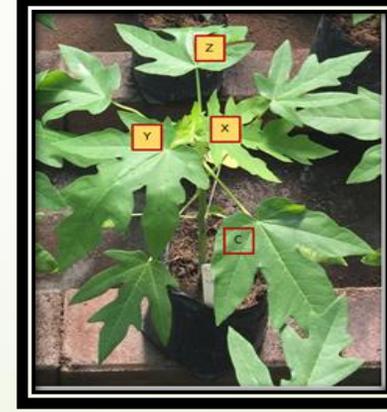
Category: Biotechnology

Country: Thailand

GOLD AWARD



- : For GM detection at small lab, Plant Quarantine Station
- : For GM detection at planting area (Farmer Field)
- : For GM detection at Food processing Industrial



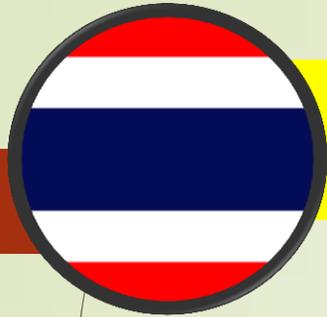


Regulation: GM and GE



Status of importation, usage and cultivation

1. Importation of GM seeds only allow for research purpose under Plant Quarantine Act. regulate by Department of Agriculture.
2. GM soybean and corn grains are permitted to be imported for foods feeds and industrial purpose
3. The Thai FDA notified a labelling regulation for food containing ingredients derived from GM soy and corn. (Threshold 5%) (Under Food Act B.E. 2522) (1979)
4. Do not permit to grow GM crops commercially in the country (under Plant Quarantine Act.)



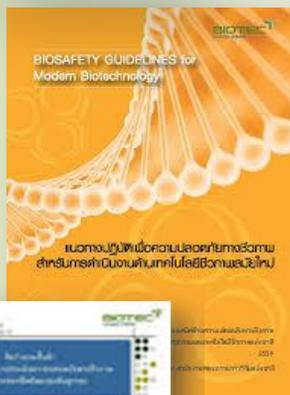
Biosafety legislation and Risk assessment

1. Existing biosafety related laws

- **Plant Quarantine Act** B.E. 2507 (1964) amend ed **B.E. 2542 (1999); B.E. 2551 (2008)** : to prohibit 33 species 51 genus and 1 family to be imported into the Kingdom except for R&D.
- **Plant Variety Protection** B.E. 2542 (1999) : to register and assess for potential risk of living modified plants.
- **Food Act** B.E. 2522 (1979) : to **label food** containing ingredients (e.g. soybean & corn starch) derived from GMOs.

2. Biosafety Guidelines : Guidelines for R&D, Food biosafety guidelines, guidelines for industrial application of GM microorganisms

3. National Bureau of Agricultural commodity and Food Standards (ACFS) Issue the Guidelines for food safety assessment of food derived from recombinant DNA Plants (Adopted Codex guidelines)





Updated Notification on GM Foods

- Ministry of Public Health (MOPH) is proposing the draft notification on Genetically Modified Foods (GMFs), in order to ensure the high level of protection of human health and consumer's concerns while providing fair marketing.
- This notification sets the control measures for food containing or consisting of Genetically Modified Organisms (GMOs) or produced from GMOs including plants, animals and microorganisms.
- The notification has been circulated for public hearing since July 2019 that followed by the notification concerning "The Labelling of GMFs" being circulated in November 2019.
- The notifications are in the process of being revised and announced.

Application for permission to import genetically modified crops for experimentation and research

GM crops is prohibited under the Plant Quarantine Act, B.E. 2507 (No. 10), B.E. 2551 (2008).

Importer

The office of Agricultural Regulation (NSW)

Plant Quarantine
committee, DOA

IBC DOA

Permission Report

Research period

Clear after Process finished

Biosafety assessment
subcommittee
: Proposal evaluation

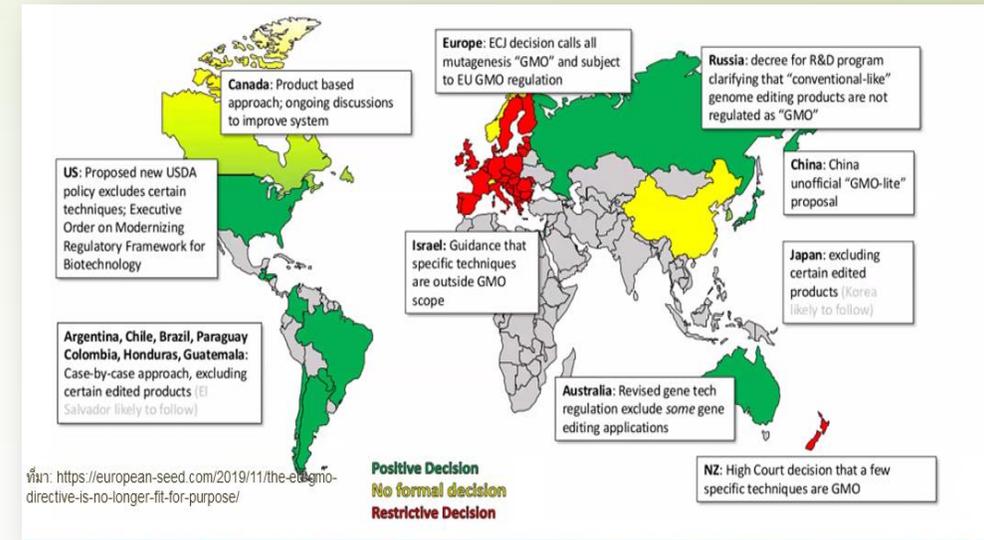
Field monitoring for Biosafety
Working group
: Laboratory evaluation

Biosafety working group
: Secretariat

Implementation Committee
Public hearing (field test cases)

Regulation: GE

❖ The Agricultural Biosafety Technical Working Group was appointed by IBC MoAC that find out the Biosafety guideline and regulations for Gene editing research and importation, and also co-operate with BIOTEC and another involved sector such as FDA to find out the GE regulation and guidelines for Thailand.



country	SDN1	SDN2	SDN3
USA	Not GMO	Not GMO	GMO
Argentina	Not GMO	Not GMO	GMO
UK	GMO	GMO	GMO
Australia	Not GMO	GMO	GMO
Japan	Not GMO	Not GMO /GMO	GMO
Philippine	Not GMO	Not GMO	GMO
Thailand	?	?	?
>>>>>>	Not GMO	Not GMO /GMO	GMO



Communication : GM and GE

Although GM crops are beneficial and have been widely accepted

but GMOs are new knowledge for consumer and manufacturer that cause to worry about effect of GMOs to environment and health from use and consumption.

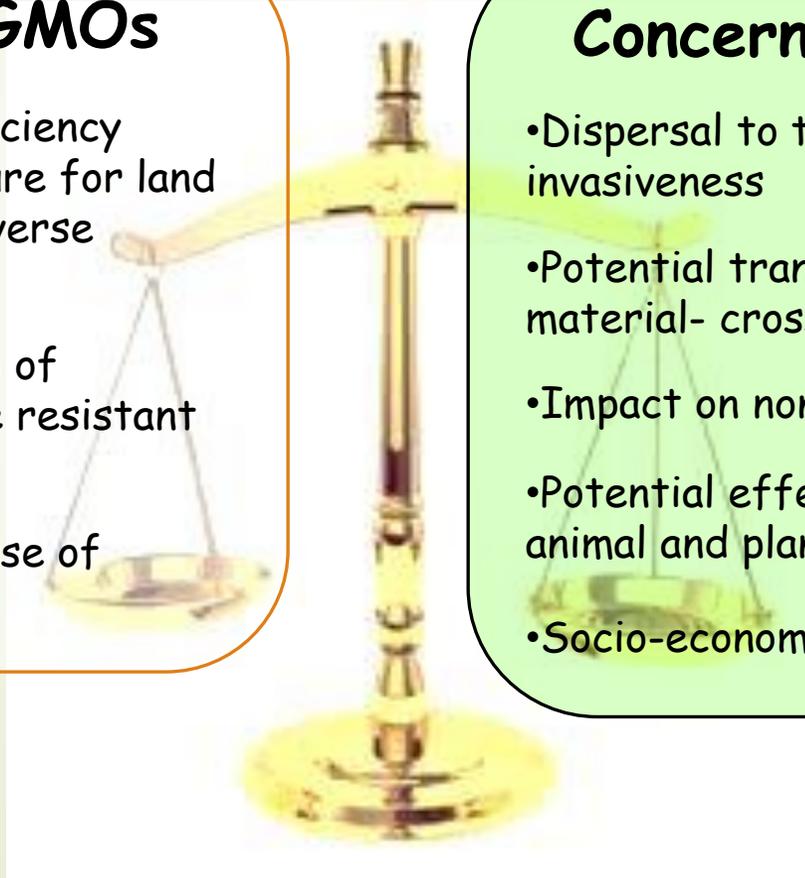
GMOs

Benefits of GMOs

- Better agriculture efficiency could reduce the pressure for land and thus reduce the adverse impact on biodiversity
- Reduce the application of pesticides and pesticide resistant insect
- Industrial application use of microbes

Concerns on GMOs

- Dispersal to the environment- invasiveness
- Potential transfer of genetic material- cross pollination
- Impact on non-targeted species
- Potential effect on human, animal and plant health
- Socio-economic impacts



1. Communicate within Biosafety committee

Get Knowledge

Go Discuss

Got Result

Give Science



Right and Light Communication





Sawasdee ka

