HKDNACHIPS

HONG KONG DNA CHIPS LIMITED
香港基因晶片開發有限公司

SERVING THE WORLD WITH BIOTECHNOLOGY

Our ref: HKDNA/SM/TL/130201-1

Hon Fred LI Wah-ming, JP
Chairman
Legco Panel on Food Safety and Environmental Hygiene
Room 401, West Wing
Central Government Offices
Hong Kong

BY FAX: 2537-2560 & BY POST

13 February 2001

Labelling of Genetically Modified Foods

Dear Mr LI,

I understand the Legislative Council is about to discuss the labelling of genetically modified (GM) foods. As an internationally accredited GM testing facility in Hong Kong, Hong Kong DNA Chips Ltd would like to offer its support to members in understanding the issues presented by labelling GM foods.

Hong Kong DNA Chips Ltd is a local biotechnology company that offers a comprehensive analysis of food samples for the presence of GM ingredients. We use the latest technology to detect and quantify the minute amounts of GM ingredients that may be present. We have very rapidly established an enviable reputation in Hong Kong and the rest of Asia as a provider of high quality GM testing services, so we are very well qualified to offer advice and guidance on this complex subject.

Regular reports in the local and international media indicate that there is great concern among food producers, retailers and consumers about GM foods. Despite the many benefits offered by GM foods, the public reaction to them is often very negative. There is a clear need for all parties in the GM food debate to be better informed. Through our extensive contacts with the food industry, we became aware of the confusion and lack of knowledge about the advances in biotechnology and the implications of upcoming legislation. We also found there was a great concern over the cost of such a programme and most companies were very keen to find out ways to limit their expenses. We believe a consistent and well-regulated policy would be well

1805-6, 18/F, Lu Plaza, 2 Wing Yip Street, Kowloon, Hong Kong 香港九龍榮業街2號振萬廣場18樓1805-6室
Tel : (852) 2111 2123 · Fax : (852) 2111 9762 · Email : dnachips@dnachip.com.hk · URL : http://www.dnachip.com.hk

received by the food industry.

We understand that several groups favour:

1) A voluntary labelling scheme; and
2) A threshold for labelling of 5% by weight of GM ingredient.

Our experience in the GM testing field indicates that both of these suggestions will not sufficiently address the concerns raised by the GM issue. Voluntary labelling is in essence a permit not to label at all, as companies who produce food from GM ingredients will be reluctant to declare this fact on the label in the current anti-GM climate, especially when their competitors have no obligation to follow suit. The current trend in all responsible jurisdictions that have studied the GM issue is to enforce mandatory labelling. This is true in the European Union in addition to many Asian countries, such as Japan, Korea and Taiwan. The only exception is the United States, where powerful agriculture/biotechnology lobbyists have prevented the necessary legislation being passed. One US company produced almost 90% of GM seeds grown globally in 1999. Hong Kong has no such industry to protect and should be encouraged to pursue a policy appropriate to local needs.

After reviewing international guidelines on the permissible levels of GM ingredients in other countries and territories, we feel that considerable resistance to the 5% limit for GM content drafted in the Hong Kong legislation will also be encountered. For example, the European Union has very stringent testing and labelling requirements for food found to contain GM ingredients. The US voluntary labelling threshold is 1%. It should be noted that the Japanese and Korean labelling threshold is also 5%, but this labelling is mandatory. For greater public support and to ease acceptability of food imports from Hong Kong to Europe, the level for reporting GM content should be carefully considered.

The time taken to introduce and enforce legislation in Hong Kong may also provoke action by some groups. Korea and Japan will introduce mandatory labelling of GM foods in March and April this year, respectively. The issue has only been openly discussed in these countries for the past 18-24 months. Similarly, in Taiwan, the decision to proceed with GM labelling was discussed and approved in less than 6 months. Some parties may suggest that the speed at which Hong Kong is responding to this issue is unnecessarily slow and this will only act to increase the public's

1805-6, 18/F, Lu Plaza, 2 Wing Yip Street, Kowloon, Hong Kong 香港九龍榮業街2號振萬廣場18樓1805-6室
Tel : (852) 2111 2123 · Fax : (852) 2111 9762 · Email : dnachips@dnachip.com.hk · URL : http://www.dnachip.com.hk

concern over GM food. It may be that fears over the technology are behind the delay in introducing legislation. Current technology available in Hong Kong can detect GM ingredients at very low levels (0.1% by weight), similar to laboratories in Europe. Furthermore, some foods containing the products of GM ingredients, e.g. corn oil, are exempt from labelling in Europe directly as a consequence of the product nature (oil does not contain DNA or protein). Such an exemption would be understandable in Hong Kong. A well-designed labelling strategy will have benefits for food producers and consumers and will enhance the reputation of Hong Kong as a major exporter of quality food products.

As you can see, the GM issue covers a wide range of complex issues that I have only touched on here. In order for Hong Kong to have the most appropriate labelling legislation a wide range of issues need to be addressed. As an independent GM testing centre, Hong Kong DNA Chips Ltd is able to provide all parties interested in GM foods with balanced information. If you would like further information on GM foods, e.g. the technology involved, the regulatory policies of other countries, please do not hesitate to contact me.

Please find enclosed an article on "Public concerns and testing of genetically modified food" from the 3rd Anniversary Commemorative Publication of the Hong Kong Food Science & Technology Association Ltd, which I hope will be of interest.

Sincerely,

Terence L. T. Lau
General Manager

1805-6, 18/F, Lu Plaza, 2 Wing Yip Street, Kowloon, Hong Kong 香港九龍榮業街2號振萬廣場18樓1805-6室
Tel : (852) 2111 2123 · Fax : (852) 2111 9762 · Email : dnachips@dnachip.com.hk · URL : http://www.dnachip.com.hk

基因改造食品的關注和檢定

Public Concerns and Testing of Genetically Modified Food

香港基因晶片開發有限公司

劉樂庭

Abstract:

The increasing use of GMOs (Genetically Modified Organisms) is one of the most complex issues challenging the global food industry today. Consumers' concerns and forthcoming legislation in many countries, including Hong Kong and other Asian regions, pose unavoidable questions to raw material suppliers, food manufacturers, traders, and even retailers. Improper planning and implementation of a strategy covering GMO issues may lead to unexpected market losses and damage the profitability. Identifying GMOs in food can be easily achieved by testing the presence of transgenic markers such as the CaMV 35S promoter, NOS terminator, nptII antibiotic resistance marker, or even the specific transgene such as the Round-up Ready gene. Food companies may consider implementing a program to eliminate GMOs in manufacturing processes in order to label their products with non-GMO ingredients.

基因改造食品是20世紀90年代起至今，農業技術不斷提高的標誌。改良基因使農作物更易於適應自然環境，以提高產量和質量；以水稻為例，經過基因改造後，其果實更加豐滿，產量增加2倍以上。其他基因改造農產品包括有抗寒冷、抗除草劑、抗害蟲、抗乾旱等不同品種，當中又以抗除草劑和抗害蟲品種最為廣泛應用。

基因改造食品就是以基因改造農產品製造出來的食品。然而，在這1~2年間，基因改造食品引起了很大的關注，使食品公司及製造商面對很多問題。本文嘗試以深入淺出的角度去探討基因改造食品，以加強各界對基因改造食品的了解及制定相應的策略。

基因改造農作物

• 抗除草劑的兩大類基因農作物

眾所周知，除草劑是抑制雜草的農藥，在農田裡，雜草與農作物一起生長，與農作物爭奪陽光、化肥等養分，對農作物的生長不利，從而減低了糧食產量。由於雜草與農作物外型相似，機械除草方法不能派上用場，而用手工除草的效率又低，因此使用除草劑是迫不得已的方法。雜草一旦接觸到除草劑，就會枯萎死亡。兩種極具知名度的除草劑，分別是含有Glyphosate的「Roundup」除草劑和含有Glufosinate的「Basta」除草劑。

然而，由於雜草和農作物同屬植物，因此除草劑的施加也抑制了農作物的生長，減低了農作物的生存能力及糧食產量。為了解決這個問題，可以利用科學方法改造農作物的基因，例如，在農作物中加入EPSPS基因，可以抵抗「Roundup」除草劑，該農作物品種便稱為「Roundup Ready」；在農作物中加入PAT基因或BAR基因，可以抵抗「Basta」除草劑，該農作物品種稱為「Liberty」。這兩類基因改造農作物已非常普遍。

• 抗害蟲的基因農作物

害蟲引起的蟲災往往給農民帶來無可估量的損失。舉例來說，番茄農田的敵人是番茄甲蟲，而美國共有50萬公頃番茄農田，政府平均每年需耗資1億美元，利用大量殺蟲劑來控制番茄甲蟲。基因研究中發現，在蘇力菌中的一種CRY（晶體蛋白）能有效殺死害蟲，如果把製造這個蛋白的基因加入農產品中，該產品就具有抗害蟲的能力。其機理是當害蟲進食含晶體蛋白基因的農作物後，晶體蛋白會在害蟲的消化道內活躍起來，破壞其消化道的表皮細胞，使害蟲失去消化功能，繼而饑餓至死。目前有很多農產品也已利用這方法來對抗害蟲，例如番茄、棉花和粟米。

基因農作物的分佈

1996年，美國已率先種植轉基因抗除草劑和抗害蟲農作物，當時，美國有接近20%的棉花都是轉基因抗害蟲的品種；1997年，美國種植的大豆中，一半都是著名的Roundup Ready抗除草劑大豆；1998年又出現了一種抗Basta除草劑的Liberty芥花籽，目前市場上抗除草劑的農作物已超越了所有基因改造農

作物總量的一半。現在，有種植基因農作物的國家以美國為主，佔世界市場的72%，其次是加拿大佔17%、阿根廷佔10%；至於種類方面，大豆佔全球總面積的54%、粟米佔28%、芥花籽佔9%。

基因改造食品引起健康關注

有些科學研究指出基因改造食物是安全的，對人體無害；而且生產基因改造食物的原意是惠及生產商和消費者。例如，在一般花生中含有一種化學成分，部分消費者進食後會引起過敏反應，而基因改造花生則去除了這種毒素，進食後不會有過敏反應。

然而，有報告顯示，基因改造食物有損老鼠等動物的健康，因此有人擔心基因改造食品會危害人類。曾經有研究發現，老鼠進食了基因改造薯仔後，損壞了其腸臟及胃部等多個身體器官組織；另一種含抗蟲害基因的改造粟仔中，不但會令老鼠的生長受阻，也抑制了其免疫系統。由於不少基因改造食物未經審慎而全面的測試便匆匆推出市場，不少消費者便質疑基因工程把他們當白老鼠般進行實驗。

另外，有指基因改造食物對生態環境存在某程度的影響，如一種基因改造的三文魚，其生長速度比一般三文魚快數倍，如果混入野生同類當中，會令野生三文魚絕種；也有人質疑基因改造三文魚是否食用安全。此外，據一份研究報告指出，含抗害蟲基因的農田中，帝王蝶的數量大幅減少，嚴重破壞了生態食物鏈。而類似的問題對生態環境的長遠影響無法估計。

歐盟如何管制基因改造食品

為了管治基因改造食品，歐盟從90年代初期開始，歐盟委員會已頒佈了一系列管理法令，而當中最具代表性的分別為1997年的新食品管理法及1998年針對Roundup Ready大豆及Bt粟米的法令，指明所有基因改造食品必須加上說明標籤。1998年5月，實施了1139/98號法令，針對兩種基因改造農作物，分別是「Roundup Ready」大豆和「Bt」與「Liberty」粟米。法令頒佈後，以這兩種基因改造農作物製成的食品必須貼上「用基因改造大豆製造」或「用基因改造粟米製造」的標籤。

今年4月，歐盟又實施了49/2000/EC號法令，指明在食品中，每一種成分的基因改造含量（蛋白質或DNA）不可超過總量的1%。該法令旨在控制所有類別的食品（包括1139/98號法令控制的基因改造大豆與粟米），這是針對所有經過基因改造的農作物而訂立的法令。而50/2000/EC號法令更將限制延伸至包括所有食品添加劑。

除歐盟成員國外，世界很多國家亦開始對基因改造食品作出監管。在亞洲方面，日本及南韓已表示會於2001年初推行強制性標籤法，指定所有基因改造食品必須加上標籤，而台灣亦希望可於明年推行標籤法。

基因改造食品的測試

要鑑別食品當中是否經過基因改造，最直接的做法就是進行測試。一般來說，基因改造食品測試主要分為蛋白質測試和DNA測試（或稱基因測試），而由於準確性的關係，大部分的測試都採用基因測試方法。

基因測試主要分為定性測試和定量測試。在定性測試中主要是檢測食品中是否含有改造的基因，方法是透過檢測三種不同的標誌基因，去推斷食物樣本中是否含有基因改造成分。這三種標誌基因分別是：(1)佛菜花葉病毒基因的啓動子的部分序列（CaMV 35S Promoter）；(2)農桿菌中胭脂鹼基因終結子的部分序列（NOS Terminator）；(3)轉座子基因所含新黴素磷酸轉移基因（NPT II）。

為甚麼測試這三種標誌基因便可確定食物中是否含有基因改造成分？其原理是這些標誌基因均來自細菌或病毒，食物中是應該不存有這些基因的。而在基因改造過程中，需要這些基因作為媒體，所以，基因改造食物一定會含有這些外來的細菌或病毒基因。然而，定性測試只可以判斷該食品中是否含有基因改造成分，卻不可以得知食品中含有多少基因改造成分。

若有需要知道食品中基因改造成分的含量，便需要進行定量測試。目前一般的定量測試都會針對兩種主要的基因含量，分別是「Bt」抗害蟲基因和「Roundup Ready」抗除草劑基因。現在，在許多國家實行或建議的基因成分標籤制中，均確定了不同的基因改造成分的上限。例如，在歐盟，該上限是1%；在南韓，該上限是3%。因此，如果有需要出口食品到這些國家，就必須進行基因定量測試。

非基因改造食品認證計劃

• 原理

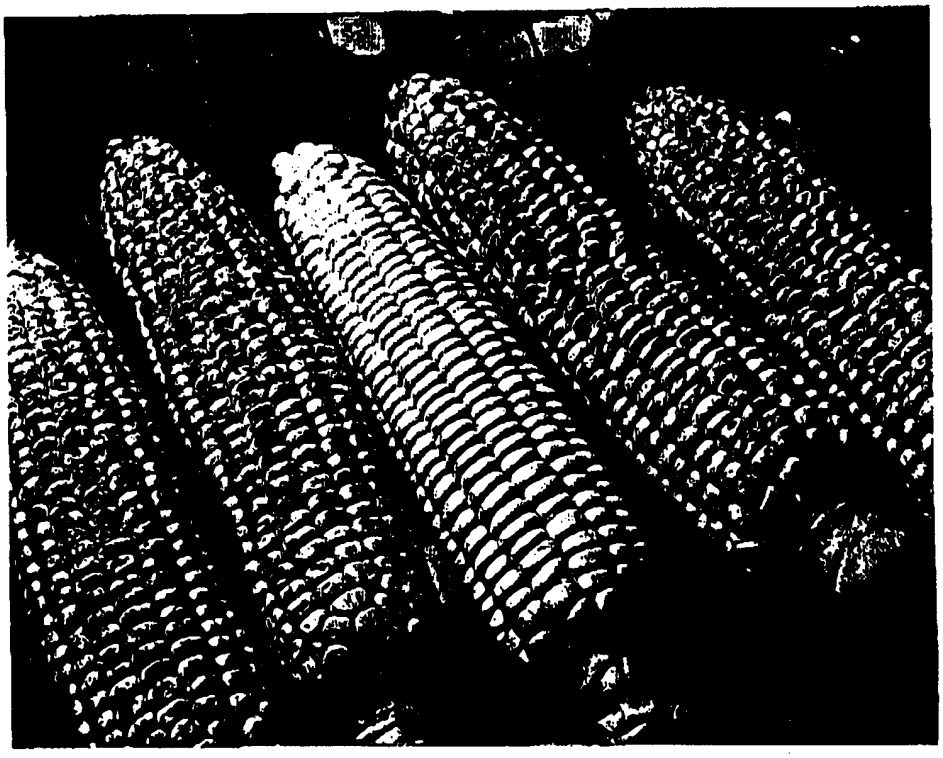
基因改造食品目前正成為全球關注的焦點之一。農民、食品加工和零售商都受到衝擊。消費者們呼籲為基因改造的食品加標籤才是恰當的做法，這樣可以讓消費者選擇所喜歡的種類；而對於食品生產商來說，則要考慮是否在整個生產程序中完全採用非基因改造原料，或者僅允許基因改造成分佔有限的比例。如果食品生產商希望生產完全非基因改造的食品，剔除所有基因改造成分，必須要推行一套全面的監控系統來監察整個食品生產過程，這並非只作一兩次檢測便可以做到的。

很多食品公司會有這樣的一個疑問：我們生產的食品產品不含大豆或粟米成分，那為甚麼會有基因改造成分呢？然而在現實環境中，很多食品均有可能含有大豆或粟米成分。舉個例說，麵包的主要材料是水、小麥和糖，為甚麼也有機會含有基因改造成分呢？原因是麵包中可能有一些添加劑，例如發粉或香料，這些東西都有可能含有基因改造大豆或其他基因改造成分，從而導致麵包中含有基因改造成分。認證計劃就是針對食品製造的整個程序去剔除食品中的基因改造成分，確保食品不含任何基因改造成分。

• 保證食品並非基因改造

在檢定過程中，一般會涉及樣本收集、監查、審核，以及測試生產線中所有原料及製成品，然後根據檢定結果頒發證書。在頒予證書之前，專家會仔細核查每一個生產步驟，並向食品公司建議有關的注意事項，完全排除製造基因改造食品的可能性。此後，公司仍必須繼續監察生產程序。實際上，認證公司會根據食品製造過程的複雜性，每年作一次或多次抽樣檢查，確保食品中不會摻入基因改造成分。對食品公司而言，其所考慮的因素主要是收費，一般來說，認證計劃的收費會取決於生產步驟的複雜程度及原材料的數量。

在未來的日子，將會有更多國家對基因改造食品作出監管。食品生產商必須增進對基因改造食品的了解，從而採取相應的措施，以確保其產品在這競爭激烈的市場上佔一席位。



要鑑別食品當中是否經過基因改造，最直接的方法是進行測試