SUSPECT GENETICALLY MODIFIED CORN INVESTIGATION REPORT

Report Date: 17 July 2003
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Site(s): Site A, Site B, Site C, and Site D properties growing "Variety A" corn, Gisborne.
Field Operations leader: Paul Badger, AgriQuality.

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Site details

Four fields belonging to different growers (Site A, Site B, Site C and Site D) within the Gisborne region were identified as having had sweetcorn "Variety A" grown in them during the 2002/2003 season. "Variety A" was grown on contract to "Company A" and was traced to GM-positive product identified in Japan.

Field Inspections

All four fields containing "Variety A" corn in Gisborne were visually inspected on the 5th July 2003. The inspection team consisted of an Inspector from MAF Quarantine Service, and three staff from AgriQuality. A representative from "Company A" provided the inspection team with maps of each property and accompanied the inspection team to each property to ensure they were in the correct fields. He returned to his office before the inspections commenced.

Visual inspections consisted of systematic walking 'sweeps' of the fields as four person teams which entirely covered each field. Inspectors were looking for evidence of corn seed, remaining corn vegetation (stubble) or growth of volunteer corn plants. In addition to covering the entire field, visual inspections were made to 3m beyond the field perimeter on all four sides of every field. Differences in methods used between fields are detailed below along with the results for each field.

A repeat inspection on the square field at Site D and new inspections on two cornfields North of Site A's field were conducted on the 10th July 2003. These methods and results are also detailed below.

Site A 05/07/2003

GM-positive product in Japan was traced and found to have been grown in the Site A field. This field was therefore subjected to an intensive inspection. The inspection team walked four abreast, approx. 1 to 1.5m apart, up the field starting in the SW corner by the gate. Approximately 12 sweeps of the field were needed to completely cover the field.

The field consisted predominantly of dried sweetcorn stubble, well-grazed grass and bare ground there were no visual barriers to inspection. **No** evidence of corn seed or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. The field team reported a **high** level of confidence that nothing was missed due to good visibility of the ground.

"Variety D" and "Variety C" cornfields North of Site A 10/07/2003

The inspection team walked five abreast at a distance of 2m apart, and entirely covered both fields.

The inspection team reported that the field was planted in broccoli, which was being harvested following consultation with MAF, NZFSA and ERMA New Zealand. Where the broccoli had been harvested, sheep were in the field to graze on the remaining vegetation.

There were no visual barriers to inspection.

No evidence of corn seed, stubble or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. The field team reported a **high** level of confidence that nothing was missed due to good visibility of the ground.

Site B 05/07/2003

The inspection team walked four abreast at a distance of 4-5m apart covering the entire field.

The inspection team reported that the ground was bare, as sheep had recently heavily grazed it.

The ground cover consisted of turnip remains and some new grass with bare earth in between. There were no visual barriers to inspection.

No evidence of corn seed, stubble or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. The field team reported a **high** level of confidence that nothing was missed due to good visibility of the ground.

Site C 05/07/2003

The inspection team walked four abreast at a distance of 4-5m apart covering the entire field.

The field was covered with pasture and a stock feed brassica crop and was under very intensive grazing by sheep. There were no visual barriers to inspection.

No evidence of corn seed, stubble or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. The field team reported a **high** level of confidence that nothing was missed due to good visibility of the ground.

Site D

This site consisted of two fields, one triangular shaped field and a second larger square shaped field. Inspections methods differed between the two fields.

Triangular Field 05/07/2003

The inspection team walked four abreast at a distance of 4-5m apart covering the entire field.

The field was fallow and had very recently been disced. There was no vegetation and no visual barriers to inspection.

No evidence of corn seed, stubble or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. The field team reported a **high** level of confidence that nothing was missed due to good visibility of the ground.

Square Field 05/07/2003

The inspection team walked four abreast at a distance of 3m apart covering the entire field.

The field was in pasture cover and was being grazed by sheep. The grass was approximately 50-80mm in height. This inspection was conducted late in the afternoon, as it was the last site visited and was completed at 5:15pm on a dull afternoon. There was some concern of visual barriers to inspection due to the length of the grass and time of the day, which is why a 3m distance between inspectors was chosen.

No evidence of corn seed, stubble or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. However, the field team reported a **low** level of confidence of inspection accuracy due to **poor** visibility of the ground.

Square Field repeat 10/07/2003

The inspection team walked five abreast at a distance of 2m apart entirely covering the field.

The field remained as pasture and was still being grazed by sheep. The pasture was approx. 50-80mm in height. There were no visual barriers to inspection.

No evidence of corn seed, stubble or volunteer plant growth was seen either within the field or within the 3m boundary around the perimeter of the field. The field team reported a **high** level of confidence that nothing was missed due to good visibility on the ground on this occasion.

Tracing

Land-use tracing was conducted between 5-10th July 2003. Data was collected from all properties, within a 300m radius, of the boundaries of the four "Variety A" cornfields in Gisborne. The choice of 300m was based on scientific literature (Luna et al., 2001; Khadr and Kassem, 1972; Sreekanteshwara, 1987) and confirmed for relevance to New Zealand conditions by Dr Allan Hardacre, Crop and Food Research (Appendix 2). Brief abstracts from the scientific literature are attached in Appendix 1. Specifications for tracing are given in Appendix 3.

AgriQuality staff conducted the tracing and their information has been combined with information supplied by the seed companies and MAF. Major details are summarised in Table 1 and given for each site below. MAF Plants Biosecurity hold the full details from the tracing. Tracing of green waste from the four "Variety A" fields was conducted and a brief summary is below on the distribution of waste to pig farms for feed and to dairy farms for silage.

Table 1. Summary of land use information from properties within 300m of the four "Variety A" field sites.

	Site A	Site B	Site C	Site D
Area with "Variety A"	8ha	3.6ha	4.12ha	5.9ha
Corn planting date	29/09/02	25/09/02	25/09/02	10/10/02
Corn Flowering date	27/12/02	27/12/02	26/12/02	01/01/03
Corn harvest date	26-29/01/03	21-22/01/03	25-26/01/03	31/01/03
Number of fields /properties within 300m	11	8	5	14
Sweetcorn within 300m	2 (1) †	1(0) †	5(0) †	0
Maize within 300m	1 (0) †	2(0) †	0	5(2) †

†Numbers in brackets indicate the number of fields with synchronised flowering times to the "Variety A" corn.

SITE A

Land use since "Variety A" harvest (Jan 2003)

The field had some remaining dried sweetcorn stubble and grass. Immediately after harvest the field was disced, left for a week and then re-disced and sown in H1 grass (temporary grass crop) and turnips. During the inspection there was a flock of sheep (106 lambs) in the field. These sheep had been in the field since 13 June 2003 and were moved on the 11th July 2003 following consultation with MAF, NZFSA and ERMA New Zealand. The sheep are to be sold at the end of July 2003. Prior to the recently moved lambs, a flock of 193 lambs grazed the turnips and grass on this field. These lambs were sent for slaughter at "Works A" on 3rd June 2003 and were designated for human consumption.

Planned use of the field for spring summer 2003/2004

The owner of the field intends to sow the field in sweetcorn or maize the 2003/04 season.

Previous History of Field

Planted in Maize in the 2001/02 season and "Company B" sweetcorn in the 2000/01 season.

Property Land use within 300m

Sweetcorn x1, maize x1, citrus x2, kiwifruit x2, squash/pasture x2, squash/lettuce x1, wine-grapes x2, sheep/cattle grazing x2, water treatment plant.

Only three fields within 300m of the Site A "Variety A" cornfield contained either sweetcorn or maize. The maize field is directly adjacent to the "Variety A" field to the South. The field to the far North East of the "Variety A" field was planted in "Variety C" sweetcorn. The second sweetcorn field was L-shaped, with a small section of the L immediately adjacent to the "Variety A" field and the rest of the paddock separated by a citrus block and pasture (approx. 100m wide). See Table 2 for an analysis of the risk of cross-pollination between the "Variety A" and these three fields.

Table 2. Risk of cross-pollination between "Variety A" and corn/maize within 300m

Assuming a 10-day pollen shed period with >60% of pollen shed +/- 2.5 days either side of the peak pollen shed period (50% silk).

	Flowering (50% silk)	**High risk period for pollination**	**Risk of cross pollination with "Variety A"**
"Variety A"	27/12/02	24-30/12	-
"Variety C" corn	17/12/02	14-20/12	Extremely low
"Variety D" corn	23/12/02	20-26/12	Possible
Maize	Between 15-21/01/03	12-24/1	No Risk

From: Allan Hardacre, Crop and Food Research.

““Variety A” is not a bicolour and the outcrosses are evident as darker coloured kernels. In discussion with “Company A” it appears that the outcrossing is much higher than expected ~5-10% which leads me to think that the pollen viability of “Variety A” is lower than that of the contaminating crops. NB. At worst, this still represents a 10-20 to 1 dilution rate”, Allan Hardacre, Crop and Food Research.

SITE A – ADJACENT FIELDS (“VARIETY C” AND “VARIETY D”)

Land use since harvest

Both fields were planted in broccoli, which was harvested in the second week of July 2003. Sheep were grazing areas that had been harvested.

Planned use of the fields for spring summer 2003/2004

The grower intends to replant both fields with sweetcorn in the 2003/04 season.

Previous History of Fields

“Variety D” field: 2001/02 season had a squash crop and winter grass.
“Variety C” field: 2001/02 season had sweetcorn that went to “Company A” and winter grass.

SITE B

Land use since “Variety A” harvest (Jan 2003)

Sheep grazing on turnip crop and grass (unknown stock number as owner is overseas – all information was gained from the owner’s father and was estimated at 400 lambs) all lambs had been fattened and sent for slaughter at “Works B” (unknown date but prior to this investigation).

Planned use of the field for spring summer 2003/2004

It is believed that the grower intends to crop with sweetcorn and maize in this field in the 2003/04 season.

Previous History of Field

In the previous season 2001/2002 the field was planted in squash, which was harvested, replaced with winter grass and grazed for lambs that went for slaughter.

Property Land use within 300m

Sweetcorn x1, maize x2, citrus x2, wine-grapes x3, sheep and cattle grazing x2, oak and hazel tree plantings, lifestyle block with lawn grass.

Only three fields within 300m of the Site B “Variety A” cornfield contained either sweetcorn or maize. One property had one Maize field that flowered in Mid January. The second property had one field in “Company A” “Variety E” sweetcorn, which flowered on 03/02/03 and one field in “Company C” inbred parent 1 maize, which flowered on 14/02/03.

There was no overlap in flowering times between Site B's "Variety A" corn and any other corn or maize within 300m (Table 1.).

SITE C

Land use since "Variety A" harvest (Jan 2003)

Following harvest of "Variety A" and the harvest of the other half of the field planted with sweetcorn "Variety E" (flowered 24/01/03), the field was disced twice and returned to pasture and a stock feed brassica crop. Lambs (approx. 300) have been grazing pasture and are still on the property and are rotated among a group of fields and occasionally under the neighbour's grapevines to keep the grass down. All lambs are to be sent for slaughter prior to sowing the 2003/04 crops.

Livestock (lambs) movements on Site C property:
220 in on 21/03/03
440 in on 11/04/03
294 in on 24/04/03
221 in on 02/05/03
189 in on 09/05/03
20 in on 20/06/03
264 in on 27/06/03

252 sent to "Works A" for slaughter on 24/06/03
149 sent to "Works A" for slaughter on 27/05/03
134 sent to "Works B" for slaughter on 02/07/03

Planned use of the field for spring summer 2003/2004

The owner intends to replant this group of fields with sweetcorn, maize, brassica crops and squash in the 2003/04 season. As he rotates his crops it is unknown whether the "Variety A" field will contain either sweetcorn or maize although he did indicate that the land could be left in pasture. This can be confirmed closer to planting time.

Previous History of Field

The grower rotates his crops each year; fields are cropped over summer and returned to pasture over winter for lamb grazing.

Property Land use within 300m

Sweetcorn x5, citrus x, kiwifruit x1, squash x2, wine-grapes x2, broccoli x1, sheep and cattle grazing x3.

Only five fields within 300m of the Site C "Variety A" cornfield contained sweetcorn and none contained maize. Two fields adjacent to Site C's "Variety A" cornfield were planted in sweetcorn "Variety E" which flowered on 08/01/03 and 24/01/03 a third field was planted in

sweetcorn "Variety B" which flowered on 08/02/03. Two fields of sweetcorn were planted in a neighbouring property in "Variety F", which flowered on 30/01/03.

There was no overlap in flowering times between Site Cs's "Variety A" corn and any other corn within 300m (Table 1.).

SITE D

Land use since "Variety A" harvest (Jan 2003)

Immediately after harvest the square field was sown with grass and 150 lambs for sale or slaughter were grazing on this pasture. The triangular field was fallow having recently been disced and was due to be planted with pasture.

Planned use of the field for spring summer 2003/2004

The lease of the square field is to revert back to a local Maori land trust at the end of August 2003 and the owner believes that they intend to leave the property in pasture. The triangular field had already reverted back to Maori control and was intended to be kept in pasture.

Previous History of Field

In the 2001/02 season the square field was in squash and sweetcorn and the triangular field was in squash.

Property Land use within 300m

Maize x5, tomatoes x1, squash x2 and lettuce x1, wine-grapes x2, sheep and cattle grazing x1, sawmill, freezing works.

Five varieties of maize were planted within 300m of the "Variety A" field at site D. Table 3 shows the likelihood of cross-pollination events occurring between the "Variety A" sweetcorn and the maize fields.

Table 3. Risk of cross-pollination between "Variety A" and corn/maize within 300m of Site D.

Assuming a 10-day pollen shed period with >60% of pollen shed +/- 2.5 days either side of the peak pollen shed period (50% silk).

	Flowering (50% silk)	**High risk period for pollination**	**Risk of cross pollination with "Variety A"**
"Variety A"	01/01/03	29/12 – 4/1	-
"Maize 1"	11/01/03	8/01/-14/01	Extremely low
"Maize 2"	11/01-20/01	8/01-23/01	Extremely low
"Maize 3"	20/01/03	17/01/- 23/01	No Risk
"Maize 4"	26/12/02	23/12 – 29/12	Low - possible
"Maize 5"	2/01/03	29/12 – 5/01	Possible

From: Allan Hardacre, Crop and Food Research.

Green waste

An estimated 253.03 Tonnes of green waste was produced during processing of the four "Variety A" fields. The green waste cannot be traced to individual "Variety A" fields, as it was combined with other green waste. Table 4 lists the types, quantities and fate of the green waste that included all of the waste from the four "Variety A" fields. The waste was sent to 4 pig farms as feed and to 3 dairy farms for silage.

Table 4. Green waste tracing results

Type	Details
1. Pig Farm	• Small pig farm, with 4 sows, 1 boar and 31 piglets. • No pigs sold since Nov 2002. **FEED** • 1.6 tonnes of whole corn-cobs vacuum packed (rejected because of colour problem) acquired from "Company A" from Feb-May 2003. Estimate that 400kg still on hand. • Five bags of damp maize screenings from "Company D" in Gisborne. NB. This product does not contain whole kernels.
2. Pig Farm	• This is a small pig farm, with 2 sows to be kept for breeding. • Nil pigs sold this year. **FEED** • 1 bin (trailer load) acquired from "Company A" in early March • Product – whole corn cobs (singles and doubles) vacuum packed plus a few 1kg bags of kernel. Understood to have been export product rejected due to a color problem. • No product remaining.
3. Pig Farm	• This is a small pig farm, with 2 boars fattened for home consumption. • No live pigs at present • Nil pigs sold. **FEED** • 6 bins (trailer loads) acquired from "Company A" from April to June • Product – whole corn-cobs vacuum packed; plus approx. 10 x1kg bags of kernel. Understood to have been export product rejected due to a color problem. • No product is still on hand. • 8 laying fowls also fed on corn. All fowls are now dead and disposed of down an offal hole.
4. Pig Farm	• This is a small pig farm, with 2 breeding sows and 5 fattening pigs. • Nil pigs sold 2003. • All pigs for home consumption. **FEED** • 10 bins (trailer load) acquired from "Company A", April to July • Product – whole corn-cobs (singles and doubles) vacuum packed; plus a some 1kg bags of kernel. • Understood to have been export product rejected due to a color

	problem. • 3 bin loads of product still on hand.
1. Dairy Farm	• Town supply dairy herd milking approx. 200 cows. **FEED** • 500 Tonnes of green-waste acquired from "Company E" • 500 Tonnes acquired from "Company A" • 250 Tonnes fed out green onto tracks and along fence lines. The corn waste was totally eaten with no growth of seed seen. • 750 Tonnes made into silage – stored in the open and covered with black polythene with tyres – 500 Tonnes of this still on hand..
2. Dairy Farm	• Town supply dairy herd milking approx. 180 cows. **FEED** • 2000 Tonnes acquired from "Company E" • 1000 Tonnes acquired from "Company A" • 200 Tonnes fed out green into paddocks. The corn waste was totally eaten with no growth of seed seen. • 2800 Tonnes made into silage. Stored in silage pit and covered with a black/white silage cover and tyres. 1000 Tonnes still on hand.
4. Dairy Farm	• Town supply dairy herd milking approx. 300 cows. **FEED** • 2300 Tonnes acquired from "Company E"/ "Company A" (approx. 50/50) acquired from mid Jan-late April. • 600 Tonnes fed out green in paddocks. There was very little waste and sprouting corn has never been seen. • 1700 Tonnes made into silage. Stored in a silage pit and covered with a black and white silage cover and tyres. 1000 Tonnes still on hand from the "Company E" lot.

NB. Interviews with farmers conducted by Paul Badger, AgriQuality.

Recommendations

For sites that are to be replanted with corn or maize in the 2003/2004 growing season it is recommended that the cultivation programme given in Appendix 2 be implemented to ensure destruction of any volunteer growth:

Appendix 1. Supporting scientific literature for the 300m land use survey

Luna, V.S.; Figueroa, M.J.; Baltazar, M.B.; Gomez, L.R.; Townsend, R.; Schoper, J.B. 2001. Maize pollen longevity and distance isolation requirements for effective pollen control. ***Crop Sci. Madison, Wis. : Crop Science Society of America, 1961-. Sept/Oct 2001.*** **v. 41 (5) p. 1551-1557.**

Pollen maintained viability for 1 to 2 h after dehiscence depending on atmospheric water potential. Cross pollinations occurred at a maximum distance of 200 m from the source planting, and only a limited number of cross pollinations occurred at the shortest distance (100 m). No cross pollinations occurred at 300 m from the source planting. The results are consistent with conclusions that maize pollen is desiccation intolerant and has a high settling rate. The results indicate isolation distance can be a useful tool for controlling gene flow via pollination in research scale plantings.

Khadr, H.O.; Kassem, E.S. 1972. Isolation distance and planting ratio in seed production of hybrid maize. ***Assiut Journal of Agricultural Sciences*** **3: 1, 47-64; 16 ref.**

It is concluded that for any hybrid variety the seed parent must be not less than 200 m from any other maize.

Sreekanteshwara-Das, K.G. 1987. Vicinity distance studies of hybrid seed production in maize (Zea mays L.) at Bangalore. ***Mysore Journal of Agricultural Sciences.*** **20: 4, 340.**

The male inbred CM105 was grown surrounded by the female inbred CM400 in all directions, at different distances up to 600 m. The pollen was dispersed in all directions, irrespective of wind direction, but not beyond 300 m from the pollen source. Average grain set was 51, 11, 1.5 and 0.016% at 50, 100, 150 and 200 m, respectively, from the pollen source. Grain was set only on plants up to 200 m from the pollen source.

Appendix 2. Technical comments and recommendations from Allan Hardacre (Crop and Food Research Ltd.)

Proposed Post Entry Control Procedures for maize crops.

This refers to the inadvertent planting of maize crops containing various GE events.

Introduction: *Zea mays* is a species that germinates once soil temperatures are above about 12C, germination is very slow below 12C. The seed is not dormant and therefore will not persist in the ground in an ungerminated and viable state for longer than the winter following the year of seed production. The crop is readily killed by ground frosts below 2.5C. It is an annual crop and no viable plant material or germplasm, other than seeds will persist over the winter. The seeds are large and are rapidly eaten by birds, insects and other animals including rodents, few residual seeds will therefore survive the winter. In a typical seed production nursery of 1 ha in area it is expected that approximately 0.06% of dropped seed will survive the winter and the first ploughing. At 3 dropped seeds /m^2 at harvest this equates to a maximum of about 20 plants per ha or .025% of the final crop. If another cultivation to produce a seed bed occurs at least 10 days after the soil temperature at a depth of 10cm has reached 12^oC, survival of residual seed will be reduced still further. A second cultivation, 10 days after the first, should reduce the survival of residual seed effectively to zero.

Maize is a monotypic genus in NZ this means that it will not naturally cross with any other plant species in NZ. The seed is large and does not naturally shatter as the husk leaves retain it on the ear even after the crop reaches maturity. Dispersal is therefore by man or over short distances by birds and animals.

The pollen is wind dispersed and although it has been proven to be blown large distances, frequency of cross pollination by single rogue plants in a crop is typically less than .005% (CP_f) or less than 5 seeds per 100,000 at 30m and about 1/3rd this at 200m. Low but measurable quantities of pollen are detected 500m down-wind of maize crops. It is therefore clear that after the initial 30m or so of separation of the crops the rate of cross-pollination decreases only slowly but levels are very low. For example, for a separation of 200m between two crops, A and B where the frequency of a GE event in A (GE_A) is 0.5% the expected frequency of this event in seed produced by crop B will be less than;

$$GE_B = CP_f \times GE_A$$

$$GE_B = .00005 \times .002$$

$$GE_B = 0.0000010 \text{ or } < 0.0001\%$$

This is well below the reliably detectable threshold accepted in all laboratories carrying out testing for GE events in maize. For New Zealand seed crops, it is accepted that the cross-pollination of maize or sweet-corn crops separated by at least 200m is negligible. These figures assume that the two crops are synchronous with respect to flowering and pollen shed. Where there is a 5% overlap in flowering and pollen shed in adjacent crops, the above levels

fall to <0.000005%. Increasing the distance between crops, shelter belts, wind run and border rows in production fields will reduce these levels of cross pollination still further.
Spatial isolation can be modified by the addition of non-harvested border rows, planting adjacent crops across the prevailing wind direction and by interspersing shelter belts between crops. It is difficult to quantify the effects of these precautions but the following figures can be used as a conservative guide.

Border rows, equivalent to 10m separation per row
Shelter belts, >10m high equivalent to 50 m additional separation
Across wind direction equivalent to 50m additional separation.

The maize varieties planted in NZ range in relative maturity ratings from about 75 days to 115 days. For crops planted on the same day, this translates to about 3 weeks difference in flowering and pollen-shed date. In most crops flowering and pollen shed occur together. Pollen shed in a crop typically lasts for about 10 days with peak pollen shed (>60%) occurring for about a 5 day period, pollen production reduces rapidly outside this period. Therefore, crops can be isolated temporally by arranging crops to avoid flowering at similar times. This can be done by either planting crops of different maturities at similar times, or by separating planting times where crops have similar maturities.

In summary, it is very clear that the most effective method of isolating of crops to prevent cross pollination are spatial separation and temporal separation of flowering. The latter is the most effective method as once pollen shed has ceased cross pollination cannot occur. For crops separated by more than 30m and by more than 3 days between mid flowering, increasing the time between flowering dates is by far the dominant effect reducing cross pollination

In NZ, most maize crops are grown from hybrid seed and all hybrid seed is produced from inbred lines imported into NZ. All imported seed is tested for evidence of genetic modification and shipments in which evidence of GE events are detected is rejected or destroyed. Therefore, GE events in hybrid seed in NZ can only occur at detectable levels if it is present in the inbred line parents. For this reason, certification of the inbred lines as being free of evidence of GE in accordance with accredited NZ standards should apply to all crops produced from the tested inbred lines. For this reason it is suggested that all batches of inbred seed and where appropriate hybrid seed imported to be sown in NZ are tested for evidence of GE.

In all cases, except a major failure of border control, the proportion of GE plants in a crop, if present at all, is likely to be very low and certainly below the level of reliable detection. The sampling and testing process is designed to detect with a high level of confidence (p>95%) the presence of 1% or more of GE seeds. Lower concentrations of GE seeds may be detected but the level of confidence will be less.

Control of an inadvertent GE release.

Grain or Seed: Isolate and dispose by burning or burying to a depth of at least 1m of compacted soil to prevent consumption and distribution by rodents

Production fields:

Where the fields are fallow and maize stubble is intact –

- Stubble mulch or lightly rotary hoe as soon as possible after harvest to break up the stubble.
- Plough as soon as practically possible to incorporate stubble and to reduce the inadvertent dispersal of remnant grain.
- In the event that wet weather delays ploughing, and maize seeds remaining on the fields germinate, spray with a knockdown herbicide such as glyphosate or cultivate. Seed germinating at the end of the season will not shed pollen or produce seed till the following summer. Where frosts occur, volunteer maize plants will be killed.

Where fields are fallow with maize stubble incorporated into the soil -

- Cultivate the fields on at least two separate occasions when soil temperatures at a depth of 10cm rise above 12^{o}C in spring to remove any emerged volunteer maize plants and to encourage viable seed remaining in the soil to germinate.
- There should be a period 10 days between cultivations to allow germination to occur.

Where it is not intended to fallow the fields:

- As soon as practically possible, plant the fields with a crop to protect against erosion and limit the financial impact on farmers involved.
- The crop following the GE maize crop could be any of the major crops grown in NZ, although it must not be a hybrid maize or sweet-corn crop. It is highly recommended that crops such as Peas, squash or the small grain cereals (wheat, barley, etc) be used, as the intensive weed management programs used in these crops will kill volunteer maize plants. Similarly, for a following pasture crop, animal grazing will effectively destroy emerging maize plants. Again, it is noted that volunteer maize plants are unlikely to survive the NZ winter.

Maize seed crops

- The option of planting an inbred seed maize crop by an experienced seed crop manager is possible. However, it is also the only option with any possibility of carry over of maize genes from one year to the next. Seed crops are intensely managed from planting through to harvest. Volunteers would be closely monitored and promptly removed. Volunteers also have a very high probability of being hybrids and therefore much larger and very distinct from the smaller inbred plants of the seed crop. All plants not “in row” must also be removed.

- The fields planned for maize seed should not be seeded prior to 7 November following cultivation to kill volunteer maize and encourage remaining seeds to germinate in the September and October period.

- Maize is normally grown on a 75cm row spacing, inter-row and hand cultivation can be used to remove volunteer plants in the early stages of crop establishment and prior to canopy closure.

- Rouging for removal of any plants not identical to the seed crop or not exactly in the planted rows is common practise in seed crops, this further reduces the potential of plant carry over from one season to the next.

Inspections:

- Crops, other than maize on all affected sites should be inspected on a monthly cycle from 1 September through 31 March. Inspections should include an area 10m outside the boundaries of the area in which the crop was grown and the route taken by harvesting and cultivating equipment to and from the cropped area.

- The inspecting agency shall maintain written records of each inspection and where a maize seed crop is not planted, shall include a count of the number of maize plants located at each site on each inspection.

- All maize surviving plants shall be removed/controlled within 10 days of that inspection.

- MAF shall provide an auditing procedure during the summer. If maize seed is to be grown at any site on which GE material was detected, MAF will inspect and sign off the site as acceptable for maize seed crop production before planting occurs, which in any case, shall not be earlier than 7 November following MAF inspection and 3 cultivations of each field in the period from 1 September to 31 October.

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- Provided no volunteer maize plants are observed in the last two inspections (February-March), monitoring shall cease at this time and landowners will have no further restrictions applied.

- If volunteer maize plants are observed in these last two inspections, a mutually agreeable strategy should be determined at such time, between, the seed producer, MAF and the landowner.

Specific examples:

Site 1 Gisborne: GE maize crop bordered by sweet corn north and south with a 20m spatial separation and a12 day difference in mid silking and pollen shed between donor and receptor crops.

Reference values for crops with a spatial separation of 200m and no difference in mid silk time. The *distance factor* is the proportion of pollen from the donor crop likely to fertilize the receptor crop at a specified distance down wind of the donor crop.

Cross pollination (CP) = Frequency of donor plants (Qd) x distance factor

CP = Qd x .002

For a 20 m spatial separation

CP = Qd x 0.008

For a 20 m isolation with a 12 day separation of mid silk between donor and receptor crops it is estimated that <1% of the plants are shedding pollen

CP< Qd x .008 x .01

CP< Qd x .0008

Therefore the effect of a 20m isolation plus a 12 day difference to mid silk is much greater than a 200m isolation with synchronous flowering. The sweet corn crops surrounding the GM crop are regarded as safe.

Site 2 Gisborne: GE maize crop with a 75m spatial separation and a 21 day difference in mid silking and pollen shed between the donor crop to an adjacent maize crop.

For a 75 m spatial separation distance factor = 0.004

CP = Qd x 0.004

For a 75 m isolation with a 21 day separation to mid silk. It is estimated that 0% of the plants are shedding pollen

CP< Qd x .004 x 0

CP< Qd x 0

Therefore the effect of a 75m isolation plus a 21day difference to mid silk presents a negligible risk of cross pollination. The corn crop adjacent to the GM crop is safe.

Site 3 Pukekohe.

GE maize crop with a 110m spatial separation and 1 tall shelter belt and a 9 day difference in mid silking and pollen shed between the donor crop and the nearest maize crop.

The shelter belt is equivalent to another 50m of spatial separation
Total separation is equivalent to 160m separation

For a 160 m spatial separation the separation distance factor = 0.003

$$CP = Qd \times 0.003$$

For a 110 m isolation with a 9 day separation to mid silk. It is estimated that <10% of the plants are shedding pollen

$$CP < Qd \times .003 \times .1$$

$$\mathbf{CP < Qd \times .0003}$$

Therefore the effect of a 110m isolation plus a shelter belt plus a 9 day difference to mid silk between donor and receptor crops is much greater than a 200m isolation with synchronous flowering. The corn crop adjacent to the GM crop is regarded as safe.

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Appendix 3. Specifications for Tracing and Site Visits - 9 July 2003

Thanks for your efforts over the weekend. We need some further clarification on some points. Please ensure that the table is completed and add as much detail as possible.

1. Phone or visit each grower again.
2. Record time on each call/visit.
3. **Clarify and confirm crop history records from growers for the four fields growing the line of "Variety A" and for the adjacent fields within 200 m.**
6. **Visit fields and conduct inspections:**
    - **Record wind breaks surrounding all four sides of each field**
    - **Inspect neighbouring fields within 300m radius of boundary, and complete table.**
    - **Fill in attached table with full details of corn/maize paddocks, including varieties, seed source, flowering date's etc.**
7. Record finish time.
8. Before departing sort papers, check pages are dated and marked with property name and address and are numbered.

Equipment
Field clothing
Rain coats
Clip boards
A4 paper
Pens
Clear plastic bags to place over clip board in wet weather

End of day

- Phone Karyn Froud (025 893 913) and provide update
- Arrange for papers to be Faxed through to Barney at Plants Biosecurity, 04 4744 257
- Send originals to Barney Stephenson, MAF Biosecurity, PO Box 2526, Wellington.

Instructions: **Using the maps that were developed on the weekend complete the following table for each field/paddock for the four "Variety A" fields and all fields that are either adjacent (or over the road) from the four "Variety A" field sites and all fields within a 300m radius from the "Variety A" field sites:**

Property Name:
Address:
Paddock (identify on map):
Contact (if available):
Start time:

Finish Time:

Current use:	
Area:	
Windbreaks: (all four sides – detail)	
What was grown in field between September 2002 and March 2003? (crop and variety)	
If corn, maize or pop corn when did it flower?	
If corn, maize or pop corn when was it harvested?	
If corn, maize or pop corn what was the seed source?	
If corn, maize or pop corn where did the harvested product go (company and end product details)?	
Previous History of field	
History of field post harvest	