Bt Sweet Corn Technical Committee Report to the Board of Pesticides Control

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Acronyms	
Acronym	**Definition**
A	Acre
ai	Active Ingredient
β	beta
BPC	Board of Pesticides Control
BRAD	Biopesticides Registration Action Document
Bt	*Bacillus thuringiensis*
CEW	Corn Ear Worm
ECB	European Corn Borer
EPA	Environmental Protection Agency
FAW	Fall Army Worm
γ	gamma
IRM	Insect Resistance Management
kg	kilogram
λ	lambda
lbs	Pounds
LD_{50}	Median Lethal Dose (mg/kg)
LOAEL	Lowest Observable Adverse Effect Level (mg/kg/day)
mg	milligram
MON	Monsanto
NASS	National Agricultural Statistics Survey
ND	No Data
ng	nanogram
NOAEL	No Observable Adverse Effect Level (mg/kg/day)
PIP	Plant Incorporated Protectant
RfD	Reference Dose (mg/kg/day)
SP	Soluble Powder

Acronyms	
Acronym	**Definition**
ug	microgram
UM	University of Maine
UMCE	University of Maine Cooperative Extension

BT SWEET CORN TECHNICAL COMMITTEE

At the August 2008 meeting of the Board of Pesticides Control (BPC), the Board established a technical committee to review registration requests for *Bacillus thuringiensis* (Bt) sweet corn events. The committee makeup is:

- John Jemison, PhD, agronomist, UMCE and BPC member (Chair)
- Andrei Alyokhin, PhD, entomologist, UM
- Jim Dill, PhD, entomologist, UMCE and UM Pest Management Office Director
- Lauchlin Titus, certified crop advisor, Ag Matters
- David Handley, PhD, sweet corn specialist, UMCE
- Eric Sideman, PhD, technical advisor, Maine Organic Farmers and Gardeners Association
- Lebelle Hicks, PhD DABT, toxicologist, BPC (Staff)

SCOPE

Issues to be considered by this technical committee include:

- refuge requirements for Bt modified sweet corn,
- characterization of sweet corn in Maine,
- a definition of "large" and "commercial" growers,
- characterization of chemical treatments currently used on conventional sweet corn, and
- the potential for interactions between Bt proteins, including cross resistance between the new Bt proteins and those currently in use, and toxicological interactions in the target species between the two proteins in MON 89034—Cry1A.105 and Cry2Ab2.

In July of 2008, Monsanto submitted requests to register two new genetic events for use in sweet corn to the BPC. One genetic event, MON 89034 (EPA# 524-575), is a novel event creating two different Bt proteins, Cry1A.105 and Cry2Ab2, for lepidopteran control (EPA 2008a, Monsanto 2008a). The second event results from a classic breeding cross of MON 89034 and MON 88017 (EPA# 524-576). The MON 88017 is currently approved in Maine for use in field corn and controls root worm with the Bt protein Cry1Ab1 (EPA 20008b, Monsanto 2008b). Syngenta submitted a request for registration of the event Bt 11, Cry 1Ab producing sweet corn, on October 8, 2008 (EPA# 65268-1). The Bt 11 event has been registered in sweet corn since 1996 and was registered in Maine for field corn in 2007 (EPA# 67979-8).

There are three major pests in sweet corn in Maine: European corn borer (ECB), corn earworm (CEW) and fall armyworm (FAW) (UMCE 1996). The pests controlled on the MON 89034 label include: ECB, Southwestern corn borer, Southern corn stalk borer, CEW, FAW, corn stalk borer and sugarcane borer (Monsanto 2008a). The MON 89034 × MON 88017 cross includes those listed above for MON 89034 and Western corn root worm, Northern corn root worm and the Mexican corn root worm (Monsanto 2008b). Attribute, Bt 11, controls ECB and CEW, and suppresses FAW (Syngenta 2008).

The discussion and committee recommendations relating to the registration of MON 89034 (EPA# 524-575) and MON 89034 and MON 88017 (EPA# 524-576) in field corn will be addressed at the end of the sweet corn discussion.

REFUGE REQUIREMENTS (OR LACK THEREOF)

As a reminder, Bt field corn requires a 20% refuge consisting of non-Bt corn to slow down the process of insect resistance (EPA 2001, BPC 2007). Instead of the 20% refuge, the Bt sweet corn growers are required to destroy any stalks that remain in the field following harvest via rotary mowing, discing or plow-down within one month of harvest; in other words, no requirement for a refuge, rather a destruction of any potential refuge offered by the crop. The arguments for not requiring a refuge in sweet corn are the short time to harvest following silking, the generally small size of the plots and the likelihood that other crops may also serve as host for the lepidoteran pests. For sweet corn the time from silking to harvest is 18 to 23 days whereas, for field corn, the grain is allowed to mature and dry in the field (Hull 2008a). The Environmental Protection Agency (EPA) adopted this strategy on page IID28 in the Insect Resistance Management section of their 2001 *Biopesticides Registration Action Document* (BRAD) for Bt Plant Incorporated Protectants (EPA 2001)

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At that point in time, the sole Bt sweet corn variety under discussion contained Syngenta's event, Bt 11. The rationale for not requiring a refuge is based on specific sweet corn characteristics and is independent of the genetics.

In the 2001 EPA BRAD, there are also extensive insect monitoring requirements on the registrants, including susceptibility studies using Cry1Ab to evaluate resistance development. In addition, annual field monitoring will also take place and EPA will be notified if resistance is found. If resistance is identified, the mitigation strategy includes some or all of the following elements: informing the customers and extension in the affected area, increasing the monitoring, recommending control measures and implementing a structured refuge area. If these efforts do not mitigate resistance, then sales will cease (EPA 2001). Sales will be tracked on a county-by-county basis and the registrant will provide an education program for the growers (EPA 2001).

As part of the resistance management section in the *Notices of Registration* (EPA 2008a and 2008b) for the two Monsanto events, MON 89034 (EPA# 524-575) and MON 89034 × MON 88017 (EPA# 524-576), similar baseline studies, monitoring resistance studies and reporting of resistance development are required. Tracking sales and an educational program are also conditions of the Monsanto registration for these products (EPA 2008a and 2008b).

SWEET CORN GROWN IN MAINE

The National Agricultural Statistics Survey (NASS) estimates the number of acres of sweet and field corn grown in Maine on an annual basis. Annual acreage between 2003 and 2007 for sweet corn ranged from 2,100 acres in 2006 to 2,300 acres in 2004. For the same time frame, the acreage for field corn was reported as 26,000 acres per year in 2005 and 2006 and 28,000 in 2003, 2004 and 2007 (Table 1) (NASS 2008).

Another way to estimate the acreage of sweet corn is based on the sales (and presumable use) of Lannate SP. Lannate SP is a 90% methomyl water-soluble powder in water-soluble packets used on sweet corn at 8 oz/A (0.5 lbs product/A; 0.45 lbs ai/A) (DuPont 2008a). According to Lauchlin Titus and David Handley (*see* Bt Sweet Corn Technical Committee*, page 4*), more than

90% of the Lannate SP used in Maine is on sweet corn, with repeated treatments 3 to 6 times per season (Titus 2008). Review of the restricted-use-dealer sales reports indicated that, on an annual basis, between 2,635 and 3,807 lbs of Lannate SP were sold between 2003 and 2007. At 0.5 lbs per acre, this results in a range of 5,270 to 7,614 Lannate SP treated sweet corn acres. Assuming that there were 5 applications per year, this would be between 1,054 and 1,523 acres treated with sweet corn. The other assumption made was that half the acreage was treated with Lannate and the other half with one of several synthetic pyrethroids. This results in total acreage of between 2,108 and 3,046 acres of sweet corn in Maine. This estimate is comparable to the NASS estimates above. The data for sweet and field corn production in Maine is summarized in Table 1. Handley (UMCE 2008), considers the NASS estimates regarding total sweet corn acreage too conservative, with total acreage being closer to 3,500.

While the data in Table 1 indicate that about 10% of the corn grown in Maine is sweet corn and 90% field corn, that is not the case regionally. In the southern one-third of the state, the acreage would be closer to 50:50. In the mid-coast counties there is most likely a heavier percentage of sweet corn versus field corn. On the other hand, in the central Maine (dairy belt) there is relatively little sweet corn compared to field corn. Both sweet corn and field corn are grown in northern Maine in small quantities and are fairly widely dispersed (Titus 2008).

The number of organic sweet corn acres, rounded to the closest hundred, is about 100 acres per year. These farms are primarily located in the lower one-third of the state, hugging the coast (Sideman 2008). The best guess from the UMCE sweet corn specialist is that the certified acreage would be less than 5% of the total produced in Maine (Handley 2008). Using the UMCE estimates, total sweet corn grown in Maine is approximately 3,500 acres, and less than 5% of that is organic (175 acres) (Handley 2008).

Table 1. Annual Estimates of Acres[(a)] of Corn Raised in Maine from 2003 to 2007

Year	NASS (2008)		Lannate SP Calculated			
	Field	Sweet	0.5-lb units[(b)]	Lannate SP[(c)]	Pyrethroid[(d)]	Total
2003	28,000	2,200	7,600	1,500	1,400	3,000
2004	28,000	2,300	6,600	1,300	1,200	2,600
2005	26,000	2,200	5,700	1,100	1,000	2,200
2006	26,000	2,100	5,300	1,100	1,000	2,100
2007	28,000	2,200	5,700	1,100	1,000	2,200

(a) Rounded to closest hundred.
(b) From the Restricted Use Dealer Sales reports.
(c) Assumptions: Use rate was 0.5 lbs/A, Lannate SP acres equals the number of 0.5-lb units divided by 5 treatments per year, and one-half of the total sweet corn acreage was treated with Lannate SP (Titus 2008).

(d) The estimated acreage treated with synthetic pyrethroid is the total acreage from the Lannate SP sales data minus the organic acreage (Sideman 2008).

SIZE OF COMMERCIAL GROWERS

The Bt sweet corn labels and registration decisions have a requirement that Bt-modified seed may only be sold directly to processors or through commercial dealers to large growers; sweet corn may not be sold to small roadside or home growers. In the EPA 2001 BRAD, for Bt events, there is a reference to "Appendix A of a Jellinek, Schwartz & Connolly, Inc. letter to EPA dated 2/13/98," that relates to the definition of commercial sweet corn production relating to then Novartis, now Syngenta, Bt 11 sweet corn (Jellinek *et al*., 1998):

> "CryIA(b) sweet corn may be sold only for commercial sweet corn production. The Novartis Seeds (Vegetables) sales and distribution system for CryIA(b) sweet corn seed will be strictly limited to commercial growers for the processing and fresh market. Sales to the wholesale fresh market, which serves home gardeners and small growers through mail order or local retailers, will not be permitted. Novartis Seeds (Vegetables) will require and instruct all CryIA(b) sweet corn customers to comply with all applicable restrictions and requirements as detailed elsewhere in this letter. Repackaging, transferring, or reselling CryIA(b) sweet corn seed to other parties will be prohibited due to the potential increased risk of insect resistance occurring if the product is not grown and monitored to meet commercial standards. Customer non-compliance with this or any other condition of sale will result in discontinued sales to the customer (Jellinek *et al.,* 1998)."

EPA's current view on the grower size issue was summarized by Dr. Janet Andersen in a 2008 e-mail:

> "We [EPA] mean growers who send their sweet corn to commercial facilities like food processors or other operations where there is confidence that they would plow down the stocks once the corn is harvested. I just checked with Monsanto to be sure this was right. Every grower who would buy the seed from Monsanto or the seed for those 2 varieties, would have to sign a contract. All growers of biotech crops do actually. That would trigger a system where Monsanto would make a decision whether or not to allow the grower to buy the sweet corn seed based on how they were farming. We wanted to prevent Bt sweet corn in small seed packages where it was less likely that the IRM requirements would be followed. You have to buy a lot of seed, so it would likely not be for 1/4 acre plots, etc. (Andersen 2008)."

CHEMICAL TREATMENT OF SWEET CORN

As indicated in Table 1, Lannate SP (90% methomyl by weight) is used on at least 50% of the sweet corn raised in Maine. In general, growers will put on one, perhaps two, pre-tassel sprays on early–midseason corn for ECB. In a best-case scenario, they may find no sprays required if pest pressure is low. Later pre-tassel corn might be under higher pressure from fall armyworm and might get an additional spray (2–3 total pre-tassel). Once corn reaches the silk stage, the number of sprays for early corn can range from 0 to 4, depending on the level of pressure from corn earworm, which depends on when this species arrives in Maine in any given year and at what

population levels. This is always an unknown factor and varies greatly from year to year, thus keeping scouting programs such as ours relevant. Later corn tends to be under higher pressure, as corn earworm populations tend to be higher late in the season, and because of the arrival of fall armyworm, so the number of sprays for a given planting may range from 2 to 5. This means that a single planting may receive anywhere from 1 to 8 sprays, depending on the season, level of pressure, and assuming that the grower is monitoring the pest populations (Handley 2008). Growers not using IPM will probably follow a 5-day schedule (Titus 2008, UMCE 2008). The products likely to be used (Titus 2008, UMCE 2008) on conventional sweet corn are summarized in Table 2. The acute toxicity of these active ingredients is summarized in Table 3.

Use of Bt sweet corn will decrease the amount of chemical pesticides used by sweet corn growers in Maine. The potential reduction in chemical pesticide use in sweet corn is summarized in Table 4. These reductions are limited to those used on ECB, FAW and CEW. The Bt sweet corn will reduce, but not eliminate the use of chemical insecticides.

Table 2. Sweet Corn Insecticides Used on Sweet Corn in Maine [(a)]

Product	EPA #	Active Ingredients	Lbs ai/A	Lbs ai/A/yr	Reference
Synthetic Pyrethroids					
Asana XL	352-515	8.4% esfenvalerate	0.05	0.5	DuPont 2007
Baythroid 2E	264-745	25% cyfluthrin	0.044	0.44	Bayer 2007a
Baythroid XL	264-840	12.7% β-cyfluthrin	0.022	0.22	Bayer 2007b
Warrior	100-1112	11.4% λ-cyhalothrin	0.03	0.48	Syngenta 2007
Proaxis	74921-3	5.9% γ-cyhalothrin	0.015	0.24	Pytech 2005
Carbamate					
Lannate	352-342	90% methomyl	0.45	6.3	DuPont 2008

(a) UMCE 1996.

Table 3. Toxicological Summary of Sweet Corn Insecticides

Chemical Class; Restricted Use	Active Ingredients	aRfD[(a)] mg/kg/day	Rat Oral LD_{50}s mg/kg
Pyrethroid; Aquatic	cyfluthrin	0.02	500 (in Xylol); 900 (in polyethyleneglycol)[(b)(c)]
Pyrethroid; Aquatic	β-cyfluthrin	0.02	211 (in Xylene); 380 (in Polyethyleneglycol)[(b) (c)]

Table 3. Toxicological Summary of Sweet Corn Insecticides			
Chemical Class; Restricted Use	**Active Ingredients**	**aRfD[(a)] mg/kg/day**	**Rat Oral LD_{50}s mg/kg**
Pyrethroid; Aquatic	cyhalothrin	na[(d)]	166 (Males); 114 (Females)[(b)]
Pyrethroid; Aquatic	γ-cyhalothrin	0.0025[(e)]	50 Males; 55 (Females)[(d)]
Pyrethroid; Aquatic	λ-cyhalothrin	0.005	79 (Male); 56 (Female)[(b)]
Pyrethroid; Aquatic	esfenvalerate	0.002	75 to 88 (range)[(b)]
Carbamate; High toxicity in humans[(g)]	methomyl	0.06[(f)]	34 (Male); 30 (Female)[(b)]

(a) aRfD = acute reference dose is used as a maximum allowable level for dietary consumption. To derive the aRfD, the acute No Observable Adverse Effect Level (NOAEL) in mg/kg/day is divided by uncertainty factors (usually a factor of 10 for interspecies extrapolation and 10 for intraspecies extrapolation) (EPA 2002, EPA 2004a, 2004b).

(b) LD_{50} = Median Lethal dose in mg/kg (Pesticide Manual 2003).

(c) Lower LD_{50}s were seen for cyfluthrin and beta-cyfluthrin when the solvent was Cremophor (20 mg/kg, cyfluthrin and 11mg/kg for beta-cyfluthrin) (EPA 2007a). Cremophor is a BASF polyethoxylated castor oil compound that is used to increase the solubility of drugs and is not on the inert (EPA 2008c) or active ingredient lists for pesticides (SPIRS 2007).

(d) γ-cyhalothrin and λ-cyhalothrin are contained within the chemical cyhalothrin. Cyhalothrin consists of four isomers, λ-cyhalothrin consists of two of these isomers and γ-cyhalothrin is the single active isomer contained in both. The chronic studies were conducted on cyhalothrin (EPA 2004a).

(e) EPA 2004b.

(f) EPA 1998b.

(g) Signal word for Lannate SP is “Danger; skull and cross bones” indicating high risk of lethality to humans.

Table 4. Estimates of Chemical Pesticides which Would Not Be Used If Bt Sweet Corn Were Planted						
Active Ingredients (ai)	MAX Acres[(a)]	Lbs ai /Acres	# Treatments/ year[(b)]		Statewide lbs ai/ year[(b)]	
			Label	Typical	Label	Typical
Esfenvalerate	280	0.05	10	5	140	70
Cyfluthrin	280	0.044	10	5	123	62
β-cyfluthrin	280	0.022	10	5	62	31
λ-cyhalothrin	280	0.048	16	5	134	42
γ-cyhalothrin	280	0.024	16	5	67	21
Methomyl	1,500	0.45	14	5	9,450	3,375

(a) Estimate of acreage from Table 1; the 1,400 acres treated with pyrethroids (280 acres/ pyrethroid) were equally distributed between the 5 active ingredients.

(b) Assuming that all sweet corn growers adopt the technology at 100%. Label = maximum label rate; typical = an estimate of 5 treatments per year from UMCE

PROTEINS

Potential for Cross-Resistance

In the Notices of Registration for MON 89034 (EPA# 524-575) and MON 89034 × MON 88017 (EPA# 524-576), EPA is requiring that Monsanto perform studies evaluating the potential for cross-resistance between Cry1A.105 and other Bt proteins in genetically modified commodities. MON 89034 produces Cry1A.105, a chimeric protein composed of portions of Cry1Ab, Cry1Ac, and Cry1F proteins (EPA 2006). Cry1A.105 is intended to provide protection from lepidopteran pests of corn. Because there are portions of Cry1Ab, Cry1Ac and Cry1F proteins in the chimera, the question of potential cross-resistance needs to be addressed (EPA 2008a, EPA 2008b). Data from these studies are not currently available (Hull 2008b).

Gene Expression

MON 89034 has one copy of each of the Cry1A.105 and Cry2Ab2 expression cassettes (EPA 2006, EPA 2007b). There is significant amino acid homology, and structural, biochemical and functional similarities between Cry1A.105 and other CryA proteins (Monsanto 2005a). The overall amino acid homology between Cry1A.105 and Cry1Ac, Cry1Ab and Cry1F is 93.6%, 90% and 76.7%, respectively. Tissue expression of the Cry1A.105 protein in MON 89034 (EPA 2007b) and MON 89034 × MON 88017 (EPA 2007c) is summarized in Table 5, and tissue expression of Cry2Ab2 protein in MON 89034 (EPA 2007b) and MON 89034 × MON 88017 (EPA 2007c) is summarized in Table 6. Exposure to high levels of the toxin happens through

feeding on leaves (Iowa State 2000). Bt 11 expresses Cry1Ab as a result of its genetic modification. The tissue expression of this protein in Syngenta's Bt 11, Attribute sweet corn is summarized in Table 7.

Table 5. Expression of Cry1A.105 Protein MON 89034 and MON 89034 × 88017 ug/g dwt ± SD

Tissue	MON 89034 (EPA 2007b)	MON 89034 × MON 88017 (EPA 2007c)
Leaf[(a)]	72 ± 14 to 520 ± 130	430 ± 71
Root[(a)]	11 ± 1.4 to 79 ± 17	83 ± 18
Whole plant[(a)]	100 ± 26 to 380 ± 90	140 ± 28
Pollen	12 ±1.7	16 ± 1.7
Forage root	ND[(b)]	13 ± 3.5
Silk	26 ± 3.9	ND[(b)]
Forage	42 ± 9.4	48 ±13
Grain	5.9 ± 0.77	5.6 ± 1.3

(a) Ranges reflect averages for different growth periods
(b) ND = No data

Table 6. Expression of Cry2Ab2 Protein MON 89034 and MON 89034 × 88017 ug/g dwt ± SD

Tissue	MON 89034 (EPA 2007b)	MON 89034 × MON 88017 (EPA 2007c)
Leaf[(a)]	130 ± 34 to 180 ± 59	170 ± 69
Root[(a)]	21 ± 5.9 to 58 ± 18	53 ± 27
Whole plant[(a)]	39 ± 16 to 130 ± 51	54 ± 15
Pollen	0.64 ± 0.91	0.62 ± 0.13
Silk	71 ± 35	ND[(b)]
Forage root	ND[(b)]	24 ± 9.3

Table 6. Expression of Cry2Ab2 Protein MON 89034 and MON 89034 × 88017 ug/g dwt ± SD		
Tissue	**MON 89034 (EPA 2007b)**	**MON 89034 × MON 88017 (EPA 2007c)**
Forage	38 ± 14	44 ± 7.4
Grain	1.3 ± 0.36	1.3 ± 0.26

(a) Ranges reflect averages for different growth periods
(b) ND = No data

Table 7. Expression of Cry1Ab Protein Attribute (Bt 11) Sweet Corn ng/mg fresh tissue wt (EPA 2001)	
Tissue	**ng Cry1Ab/mg fresh tissue wt at maturity**
Leaf	3.3
Root	2.2 to 37
Whole plant	ND
Pollen	< 90 ng/ g dry wt
Grain (seed)	1.4

The major sweet corn pests in Maine are ECB, CEW and FAW. The biological activity of the Bt proteins, Cry1A.105 and related proteins are summarized in Table 8 (Monsanto 2005b). While ECB was the primary target pest for Bt corn producing CRY1Ab, CEW and FAW are susceptible to Bt corn to a lesser extent. The Cry1Ab producing Bt lines investigated were MON 810, Bt 11 and Event 176. The following discussion is limited to the Bt11 data. Several studies have evaluated the efficacy of Bt 11 in the suppression of CEW and FAW (Chilcutt *et al.,* 2007, Divley and Patton 2003).

Table 8. Biological Activity of Selected Bt Proteins on CEW, FAW and ECB (Monsanto 2005b)					
Pest	**Cry1A.105**	**Cry1Ac/ Cry1F**	**Cry1Ac**	**Cry1Ab**	**Cry1F**
ECB	Yes	Yes	Yes	Yes	Yes
CEW	Yes	Yes	Yes	Yes	Yes
FAW	Yes	Yes	No	Yes	Yes

CRY1Ab toxin expression in ears is often not sufficient to kill CEW immediately, although many larvae probably do not complete development to adulthood (Allen and Pitre 2006). However, it has a pronounced sublethal effects (Lynch *et al.,* 1999; Dively and Patton 2003; Horner *et al.,* 2003), in particular delayed development (Horner *et al.,* 2003; O'Rourke and Hutchison 2004; Allen and Pitre 2006). This, by the way, is not good from the resistance management standpoint, but probably does not matter in Maine because of the migratory nature of this species (it cannot survive winter here). Several studies actually found more larvae in the ears of Bt corn than in the ears of non-transgenic corn (Horner *et al.,* 2003; Allen and Pitre 2006; Chilcutt *et al.,* 2007), but it was probably due to lower development and reduced levels of cannibalism.

FAW larvae are also found at lower levels on Bt 11 ears than on ears of non-Bt modified corn (Chilcutt *et al.,* 2007)

Potential for Interactions Between the Two Bt Proteins in 89034

Interaction between Cry1A.105 and Cry2Ab2 were investigated by Monsanto in support of the registration of MON 89034 and MON 89034 × MON 88017. Studies were performed with ECB and CEW. The results of these studies, with respect to lethality, molt inhibition and inhibition of the third instar interactions were additive (Monsanto 2005c).

Biological Activity on Non-Target Insects

There was no biological activity in studies looking at Cry1A.105 and Southern corn rootworm, Western tarnish plant bug, honey bees, green lace wings, parasitic hymenoptera, ladybird beetles, earthworms, collembola and *Daphnia* (Monsanto 2005b).

CONCLUSIONS AND RECOMMENDATIONS

The first meeting of the Bt Sweet Corn Technical Committee was held on October 27, 2008, at the UM Pest Management Office, Orono, Maine. The discussion began with an itemization of the strengths and the weaknesses of the Bt sweet corn technology. The summary of this discussion is found in Table 9.

Table 9. Summary of the Technical Committee's Views on Bt Sweet Corn

Strengths	Weaknesses	Recommendations
Decrease chemical pesticide use	Undesirable contamination of non-Bt sweet corn with limited options for prevention	Training session, stressing the usefulness of vegetative buffers and staggering times to harvest
More pest management strategies available	Potential for insect resistance	Training session; necessity of destroying plant residue within 30 days of harvest

Table 9. Summary of the Technical Committee's Views on Bt Sweet Corn		
Strengths	**Weaknesses**	**Recommendations**
Decrease cost/ Increase profit $6.50 to $8.00/A for diesel $10.00 to $12.00/A for insecticides 4 times a year ($66.00 to $80.00/A/yr)	Need for oversight on crop residue destruction	Board enforcement oversight
People who save seed in sweet corn are practically non-existent in Maine	Lack of genetic traits in early harvest lines	

The technical committee recommends that training and an accompanying certificate similar to that currently required for Bt field corn be developed for Bt sweet corn, and that use of Bt sweet corn be limited to growers with greater than 1 acre of sweet corn.

MON 89034 and MON 89034 × MON 88017 Field Corn

The technical committee recommends that the registration of the Monsanto MON 89034 (EPA# 524-575) and MON 89034 and MON 88017 (EPA# 524-576) in field corn be approved if the company will develop a label specific to field corn. At the Bt sweet corn technical committee meeting, the possibility of a 24(c) special local need for the event MON 89034 and MON 89034 × MON 88017 in field corn (same label with references to sweet corn removed) was discussed. The Board registrar pointed out that this type of registration would not meet the criteria for a 24(c) and suggested a cleaner way to accomplish the same thing would be for Monsanto to submit a label with just the field corn uses. This, pending Board approval, would allow the registration of the field corn while the Board continues the review of the sweet corn use. Since this meeting, Monsanto has indicated that they would like to register the field and sweet corn labels concurrently, unless the Medical Advisory Committee review takes longer than the next three months, in which case we will revisit this issue.

The committee discussed the nature of the new protein, Cry1A.105, and concluded that the presence of the components of three different Cry proteins in this one molecule was not very different that a tank mix containing those three different proteins. They also concluded that the existing training, label requirements and oversight currently in effect for the registered technologies offer adequate protections for use of this product.

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EPA 2004b Lambda-cyhalothrin and an Isomer Gamma-Cyhalothrin; Tolerances for Residues; Federal Register: April 8, 2004 (Volume 69, Number 68) Page 18480-18489.
EPA 2006 Review of Human Health and Product Characterization Data for a Temporary Tolerance Exemption for Bt Cry 1A.105 and Cry2Ab2 in corn and an EUP Request for Insect-Protected Corn MON 89034, MON 89017, and MON 89034 × MON 89017.
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