

***Baby Steps: Conditions Imposed for Crop Year 2000
on Farmers Planting Bt-Transgenic Corn for ECB Control***

By:

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In letters dated December 20, 1999 the EPA set forth a set of conditions that registrants of Bt-transgenic corn varieties must adhere to in order for the agency to approve resistance management plans for the upcoming season. All Bt-corn registrants have now agreed to the EPA's terms, ending further consideration of the need for new restrictions or research requirements in year 2000.

When EPA granted registrants conditional approval of Bt-corn hybrids, it set as a primary condition that the companies must develop and put in place a science-based, proven resistance management plan. Each year the agency has become stricter and more explicit in setting forth the required or desirable components of resistance management plans. In addition, following the publication in 1998 of evidence that Bt-corn pollen can harm Monarch butterflies populations, a second ecological risk concern has emerged and shaped some of the provisions EPA has imposed for crop year 2000.

EPA claims that its actions are intended to achieve two goals: prevent resistance from occurring and second, reduce the likelihood of significant harm to Monarch butterflies and other non-target Lepidopteron insects, which include a variety of endangered or threatened species. I assess below the likely impact of specific provisions EPA has imposed relative to the attainment of these goals and highlight a number of issues that EPA needs to address more fully before a full appraisal of likely effectiveness can be made.

Provision 1 imposes a minimum 20% refuge that must be planted to non-Bt corn varieties in most regions of the Corn Belt, and restricts insecticide treatments to acres that have been scouted and where economic thresholds are exceeded.

Provision 2 imposes a minimum 50% structured refuge in cotton growing areas. Curiously, the EPA does not address whether and under what conditions the refuges may be sprayed. This EPA needs to clarify what it is requiring in cotton growing areas in the event growers see a need to treat refuge acres.

Both the Corn Belt and cotton-growing region minimum refuge requirements codify the proposals in the Industry coalition plan and are consistent with recommendations made the last few years by most professional organizations. What differs this year are the conditions imposed if Corn Belt (and presumably, also cotton area) growers wish to spray refuge acres. (Unsprayed refuges will harbor more susceptible adults and hence should be more effective in delaying resistance).

I commend EPA for requiring that grower agreements address the conditions that must apply before refuge acres are sprayed. Consistent with the proven principles of Integrated Pest Management (IPM), it is appropriate to restrict insecticide treatments to acres that are scouted and on which populations exceed economic thresholds.

EPA states that such thresholds may be set by "Extension Service agents, researchers, or crop consultants." Crop consultants follow a wide range of philosophies and strategies in managing insects and often come up with widely divergent economic thresholds for the same pest. For this reason, it is questionable whether an economic threshold set by a consultant should be accepted without any oversight. Accordingly, if the EPA is serious about avoiding unnecessary applications, economic thresholds and scouting techniques advanced by crop consultants should be subject to a one-time review by Extension IPM experts at the state level. When the methods and thresholds differ only modestly from recommended and proven methods, the approval process should be quick and straightforward, but where there deviate markedly, the scientific justification for the alternative methods and levels should be set forth and appraised.

Scientists agree that there are many unanswered questions relative to European corn borer feeding and mating behavior in the field, as well as the genetic mechanisms likely to govern the emergence, spread and stability of resistance. The list of "priority research needs" is a long one, as evident from review of the many excellent presentations by land grant university scientists during the June 1999 EPA-USDA resistance management workshop in Chicago. In order to foster applied research on ECB resistance management, the EPA should require that all scouting reports triggering the need for an insecticide application be transmitted to a designated Extension IPM specialist within a week of the insecticide application. The Extension specialist shall be directed to post the results by field on a publicly accessible website so that researchers, consultants and growers will have the benefit of detailed, field level information, both on infestation levels and the performance of various scouting techniques and thresholds.

Provision 3 requires grower agreements to specify that non-Bt refuges at least 6-rows wide be planted around Bt-fields both to improve the efficacy of resistance management practices and limit exposure to Monarch butterflies and other non-target organisms. Recent research has highlighted the importance of predominant wind speed and direction in determining where pollen lands. Accordingly, EPA should increase the width of the non-Bt refuges on the down-wind edges of corn fields. Farmers should be required to plant a minimum of 12 rows directly on the down-wind edges of fields. Such a requirement will rarely cause the grower to exceed the minimum 20% refuge requirement and will further limit pollen concentrations in the areas just outside the boundaries of corn fields.

Provision 4 requires registrants to submit their grower education programs and materials to EPA for review and approval. This is an appropriate requirement but the agency should go further to assure that its review has the benefit of the latest thinking of corn IPM specialists in the states where Bt-corn is planted. EPA also should require the registrants to post the material on a public website. Furthermore, EPA should formally

request land grant university corn IPM specialists to review and critique the materials and offer an assessment regarding adequacy to the EPA. Such a review might take 30 days but with the benefit of reviews by state specialists, the EPA should be able to progress with its own review more quickly and on a more solid foundation.

Provision 5 calls for specific regional monitoring plans “with increased sampling” where insecticide sprays are common on refuge acres. The agency should require more intensive monitoring everywhere Bt-corn is planted, although it is appropriate to sample most intensively where growers also typically treat non-Bt corn and/or refuge acres.

Provision 6 requires the registrants to “investigate the feasibility and utility of the F2 screen, sweet corn sentinel plots, and in-field screening kits during the 2000 grower season.” I applaud this requirement but urge the agency to assure that a diversity of researchers are provided a meaningful opportunity to carry out this research, including at least one research team working independently of registrants in each of four states. Such research will cost money. Given that applied field research would need to begin within just a few months, it is unlikely qualified researchers will have time to seek out and win competitive funding to support such work. Even if there were adequate time, such research has fared poorly in recent years in various competitive grant programs administered by USDA since the work is often not judged at the cutting edge of science.

Accordingly, the EPA and USDA need to take steps quickly to support needed work in crop year 2000 from appropriated FY 2000 funding. Based on our discussions with land grant scientists who are pioneering resistance management methods and screening techniques, USDA-EPA should be prepared to offer a one-year grant on the order of \$250,000.00 to each of four independent academic teams.

Given that public agricultural research dollars are scarce and should focus on advancing knowledge of the biology of highly productive, sustainable agricultural systems (and not doing product stewardship research that benefits private companies), EPA must address the need for an ongoing, reliable source of funds to carry out essential research and monitoring activities. The simplest solution is the most direct one -- Prior to extension of any Bt-corn conditional registrations for crop year 2001 or beyond, the EPA could insist that registrants agree to pay a “maintenance fee” based on bags of corn sold in the previous year. The fee per bag should be sufficient to finance necessary independent field research on resistance and other possible adverse effects. A EPA-USDA committee should begin work now to settle the details since there is no chance that research in crop year 2000 will resolve outstanding issues.

If independent public researchers do not have an opportunity to independently assess the performance and impacts of Bt-corn and other agricultural biotechnologies, the science base supporting regulatory decisions will grow much more slowly than needed to address legitimate grower, public and risk concerns. Given the nature of these technologies and the large profits they generate, it is not realistic to expect public research agencies to redirect funding from programs serving the broader grower and

public interest in order to support product stewardship programs that largely benefit private companies and their shareholders.

Provision 7 states that the current working definition of insect resistance must be used and that any changes in the definition must be approved by EPA. I support this provision, but urge EPA to explicitly address a key question repeatedly raised over the last three years – What is the goal of Bt-corn resistance management plans and by what standard will a plan be judged to be adequate or inadequate? The goal should be to avoid the emergence of stable resistance in any pest population. A resistance monitoring and management plan would therefore be judged acceptable if it is capable of detecting the early stages of resistance soon enough for proven remedial actions to prevent the genes conferring resistance from getting established in a population and spreading to other regions.

This goal statement and standard for adequacy frames the challenge the industry coalition and university researchers must meet. It does so in a way that can be tested with well-designed experiments, but only if needed research moves forward quickly. In the past, such research has typically been required and completed before the widespread commercialization of a technology. Here we have the cart before the horse and must play “catch up” in order to preserve whatever degrees of freedom exist to manage resistance after it is first detected.

Provision 8 describes the remedial action plan registrants must put in place in the event a resistant population of ECBs is found. This and other provisions raise a basic question separate from the adequacy of remedial plans – Are they enforceable, and if so, by whom? Do primary registrants (the recipients of these letters, like Monsanto and Novartis) have authority to impose and enforce the terms of the current agreements with EPA on the many seed companies to whom they have licensed ECB-Bt gene technology? EPA must address this critical issue, which has come up before yet still has not been resolved.

The remedial actions set forth in the current agreement include destruction of crop residue immediately after harvest (i.e., within 30 days of harvest), presumably via chopping and/or primary tillage. I am unaware of convincing evidence that such actions will eliminate over-wintering ECBs.

The agreement states that “Grower guides must require the immediate use of alternate control measures..”, i.e. in most cases insecticide applications. This requirement could trigger unnecessary, ineffective and environmentally damaging insecticide applications. There is significant evidence that adult ECB populations are very difficult if not impossible to control with mid-season foliar insecticides; the EPA should not compel registrants to force farmers to buy and apply their products under conditions when efficacy is doubtful. It is ironic, and from the perspective of farmers perverse that the need to manage resistance could mandate increased reliance on insecticides, the reverse of what the technology was supposed to accomplish.

Given the EPA's efforts to reduce exposure to OP and carbamate insecticides in response to the FQPA, the agency should, at a minimum, encourage selection of one of the several newer, less toxic soil insecticides. Plus, the agency should emphasize that any insecticide applications should be made in the context of an Integrated Pest Management system that is designed to reduce populations through multiple tactics, and that pesticide applications should be timed in ways that maximum efficacy while minimizing non-target and other unintended environmental impacts. In most cases, additional practices in the next two to four production seasons will be essential including, at a minimum –

- Ongoing monitoring of ECB populations in the area to assess the level and spread of resistance;
- A prohibition of planting Bt-transgenic varieties for at least three years, or until there is clear evidence the resistant ECBs have disappeared from the population;
- In hot-spots, growers should be required to adopt more diverse rotations including non-ECB hosts and they should be compensated for any loss in net income potential; and
- Multitactic IPM programs should be implemented in the areas where resistant ECBs are found. These should utilize area-wide approaches and combinations of practices in conjunction with intensive monitoring to determine the feasibility of containing and eliminating resistant populations.

The tenth provision calls upon the Industry coalition to proceed with their annual survey of grower compliance with the terms of resistance management and other planting restrictions and requirements. Multiple methods should be used to survey and monitor grower compliance. The EPA and USDA should assure that independent researchers in key corn producing states are awarded realistic funding to develop and apply novel methods to track compliance that are not subject to possible bias as a result of grower concerns about being found “out-of-compliance” and hence subject to some adverse consequence. In the absence of independent, well supported monitoring efforts, the EPA should rely most heavily on physical evidence of compliance – in particular, the absence of resistant ECBs.

Provision 11 calls upon registrants to intensify grower education programs focusing on the unique regional requirements set forth elsewhere in the agreement. Since the provisions of the agreement go well beyond assuring compliance with resistance management plans, encompassing for example steps to mitigate a number of ecological impacts, the EPA and USDA and land grant university specialists must also assume an active role in grower education. It is not realistic to expect a company marketing a product to take on the task of educating growers on how to recognize and document adverse effects of the technology that might lead to regulatory restrictions.

Provision 12 calls upon registrants to provide to EPA detailed sales and market penetration data by county and state, as well as data on grower compliance with resistance management plans and the impacts of grower education programs. These requirements are appropriate but EPA should go one step further – these data should

be made publicly available in a timely manner in order to help target research and monitoring efforts. All scientists working to understand how the feeding and mating behaviors and genetics of ECB populations impact the emergence of resistance will need detailed information on where various varieties are planted. For this reason, the EPA Administrator should disclose this data as a result of a public interest finding. While registrant's typically claim that such information is confidential business information not subject to public disclosure, the companies have been describing in some detail their sales figures in the agricultural media and for investors, and there are a variety of sources of information on the acreage planted to Bt-corn hybrids. The overriding need to advance scientific understanding of the possible mechanics of resistance and the efficacy of resistance management plans justifies a public interest finding and disclosure of these data.

Provision 14 "requests" that registrant's instruct growers to place refugia in a way that also limits exposure of Monarch butterflies to possibly toxic Bt-transgenic pollen. As stated earlier, refugia should be laid out so that there are at least 12 rows – rather than 6 – of non-Bt corn on the down-wind edges of cornfields. The agency should "require" rather than just "request" that growers comply with this commonsense and low-cost measure. Ample evidence suggests that planting refugia in such a manner will limit the concentrations of toxic pollen near cornfields. While perhaps not the total answer in all circumstances, such a step will surely reduce Monarch mortality in the next few years while more definitive risk assessments are carried out.