

1. **What is Bt?**

Bt or *Bacillus thuringiensis* is a common soil bacterium that produces its own insecticidal protein. Its property was discovered in 1901 by a Japanese bacteriologist, S. Ishiwata but failed to make formal description of it. A decade later, a German, Ernst Berliner named the bacterium *Bacillus thuringiensis* after the Thuringia region of Germany, where he isolated the organism. The Bt protein has been used safely since 1950s by organic gardeners and farmers worldwide as biological insecticide.

2. **Why develop Bt-protected plants?**

Bt-protected plants meet the key criteria in developing new pest control product: technical feasibility, need, efficacy, and safety. Bt-protected plants offer promises of safe and effective insect control.

3. **What is Bt corn?**

Bt corn is a variety of corn where a specific Bt gene is inserted to produce a protein that protects the corn plant from feeding by Asiatic corn borers (ACB). This makes the corn plant naturally resistant to attack by ACB.

4. **How does the Bt protein in Bt corn control target pests?**

The Bt protein controls insects by disrupting the insect's digestive system. Once inside the alkaline gut of the target insect, the Bt protein is activated and binds to specific receptors. This mid-gut is punctured leaving the insect unable to eat. Within a few days, the insect dies.

5. **What are corn borers?**

Corn borers are the no.1 insect pests of corn in the Philippines. They cause up to 80% yield loss as they feed on the stem, leaves and corn ears even before they are harvested. Because of the injuries caused by the corn borer, plant disease-causing organisms such as fungi and bacteria can readily come in and attack the corn plants. These aflatoxin-producing fungi or molds that cause cancer may find their way into the corn seeds fed to our livestock and poultry animals.

6. **How is Bt corn different from other controls for corn borers?**

Corn farmers are free to choose from the available solutions to the corn borer problem. Most farmers use insecticides, which can make people ill. The insecticides may also adversely affect other non-

target organisms. In some areas, *Trichogramma* is not available. In other areas, labor is too expensive to make detasseling practical. During the rainy season, none of the above-mentioned solutions is feasible. Bt corn is just another option that is safer alternative to chemical pesticides and more effective than biopesticides.

7. **How much yield increase can a farmer attain using Bt corn?**

Results of the field trials of Bt corn in the Philippines are very promising. Harvests from Bt corn were found to be 30% to 68% higher than non-Bt counterparts. The computed yield increase between Bt and non-Bt corn ranged from 1.6 to 3.4 tons/ha.

8. **How much profit can farmers gain from the Bt corn?**

Based on the average farm price of corn at ₱6 per kilo, it gives farmers a potential additional income of ₱ 12,000/ha. In areas where level of infestation is not so high, an additional 10% increase in yield can give farmers ₱ 3,000/ha more income.

9. **What are the potential benefits of Bt corn?**

Higher crop yields. Result of the field trials in the Philippines shows that Bt corn can significantly increase yield to an average of 40%.

Reduced farm costs. A study by the US Department of Agriculture (USDA) reported that farmers who planted Bt crops in 1998 eliminated 8.2 million pounds of pesticide active ingredients.

Increased farm profit. Increased yield and decrease pesticide cost contribute to a higher net return for Bt corn farmers.

Improvement in the environment. Bt corn requires less pesticide use. It can play an important role in making agriculture, particularly corn, more sustainable and more productive.

Reduced labor inputs. Since Bt corn no longer requires insecticide application for corn borer, farmers will have more time for other farm management duties.

Less dependency on importation. Philippine imports an average of 300,000 to 500,000 metric tons of corn annually. Increase production of yellow corn can reduce dependency on corn importation.

10. **Is Bt corn safe for humans?**

Since Bt corn is very specific, it would not harm man. The Bt protein will only affect an organism with specific receptor sites in its **alkaline gut** where the proteins can bind. Human beings and many insects lack these receptors. Besides, the stomach of humans is acidic.

11. **Will Bt corn cause allergy?**

The Bt protein does not cause allergy because it is easily digested or degraded in heat.

12. **Will Bt corn make humans antibiotic-resistant?**

The approved Bt corn variety does not have an antibiotic resistant gene.

13. **Can we feed Bt corn to other animals?**

Bt corn is safe to poultry and livestock animals. They showed comparable performance when given Bt corn feeds.

Dogs, guinea pigs, rats, fish, frogs, salamanders and birds have shown no ill effects from eating the Bt protein.

14. **Will Bt corn affect other non-target organisms?**

Bt protein is highly specific and will only affect insects that have specific gut receptors to the protein. Similarly, honeybees and lady beetles, both beneficial insects, showed no harmful effects upon eating Bt protein.

15. **Will corn borer develop resistance to the protein produced by Bt corn?**

Available data show that after 5-year commercialization of Bt crops, no reported pest resistance occurred. Insect

Resistance Management Plan will prolong the use of Bt crops and will guard against unintended consequence.

16. **What is the effect of Bt corn on soil ecosystem and groundwater?**

The Bt protein does not move or leach with groundwater because it binds to soil particles. The proteins do not particularly last in acidic soil conditions. Under sunlight, Bt protein is destroyed very rapidly.

17. **What happens if Bt corn cross-pollinate with native varieties?**

There is no harm in cross-pollination since Bt protein will only affect the target insects. There is also less probability for cross-pollination since corn has limited pollination period of 5-10 days. Pollen viability is at most 60 minutes and is affected by weather especially high temperature. Also, cross pollination declines with distance e.g. 1% at 33.3 m to 0.03% at 53.3 m at release point. Studies show that 200 m are enough to isolate, in space, one field from the other

Still, cross-pollination may be avoided by planting Bt corn 21 days before and after the non-Bt corn is planted. White and yellow corn farmers are also following this temporal isolation to avoid cross-pollination.

18. **Why did the monarch butterfly larvae, which were fed with Bt corn die?**

Bt protein affects Lepidopteran insects like the monarch butterfly. Under **laboratory** conditions, monarch butterfly larvae died when it was forced-fed with milkweed mixed with fresh Bt corn pollen. The preliminary result, however, is not reflective of actual field conditions.

In fact, reports indicate that Monarch population in North America has increased, which coincides with the increase plantings of Bt corn. Under field conditions, direct exposure of the caterpillars to Bt protein on milkweed is minimized or prevented due to the distribution of milkweed in the field and the behavior and migration pattern of the monarch butterfly in relation to the growing season in the US.

19. **Is there international support for GM crops including Bt corn?**

More than 50 international organizations including Food and Agriculture Organization (FAO) of the United Nations, European Commission, The Third World Academy of Sciences and the national academies of science and technology of several countries declared GM crops including Bt corn as safe and pose no additional threat to human and environment.

20. **What is the government doing regarding the issues on Bt corn?**

DA has always been vigilant in assuring the entry of safe foods for the Filipino consumer. To date, it has no basis to declare Bt corn unsafe. As a policy, the department encourages further studies to provide science-based support to different claims.

Bt corn has undergone thorough testing for toxicity, allergenicity and nutritional food and feed values. Countries of the European Union, Switzerland, Japan, Korea, Australia, Canada, United States, South Africa and Argentina have approved Bt corn for food, feed, and environment.

From 1996 to 2002, Bt corn has been planted to almost 44 million hectares.

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Bt CORN

. . . what you
 need to know



The Philippines Department of Agriculture (DA) approved the first Bt corn for propagation and import for direct use in December 2002 after almost six years of trial and safety evaluation.*

This primer attempts to answer several basic questions about Bt corn.

*The DA-Bureau of Plant Industry issues permit based on transformation event. The first Bt corn, which was granted permit, was Bt corn MON810.