Peran Bioteknologi dalam Pasokan Pangan Kita
NOTE TO PRESENTER: To customize this presentation, start by introducing yourself & your background. See Chapter 3 on Preparing the Presentation at www.foodinsight.org/foodbioguide.aspx for ideas for answering tough questions, and further details on the following Tips for Communicating with Impact:

1. Relate as a person, as well as a professional.
2. Show empathy for others and that you care about the issue.
3. Know your audience and prepare accordingly.
4. Be straightforward, clear, and concise.
5. Be confident in handling questions.

In the Notes Page view of this presentation, you will see not a script, but rather suggested messaging and key points for you to tailor to your own style, expertise, and audiences. See Chapter 2 on Language at www.foodinsight.org/foodbioguide.aspx for further detail on Key Messages.

Also, see the Glossary in Chapter 7 at www.foodinsight.org/foodbioguide.aspx for definitions of terms, as needed.
Today’s talk will cover:

• A definition and history of biotechnology in food production.

• A discussion of why biotechnology is being used today, including benefits with respect to:
  
  • Food safety;
  • Direct consumer benefits, such as improved nutrition or improved quality, and a stable, affordable food supply;
  • Sustainability for environment, economy, and society; and
  • Global food and nutrition needs for a rapidly growing population with increasingly complex health needs.

• An overview of foods available today and in development through biotechnology.

• A brief consideration of communication lessons from other food technologies
• Food biotechnology is a process that has resulted in improved nutrition, taste, quality, and freshness of many foods today.
• Bio means life; techno- means tools; -ology means use or study of
  • So, bio-techno-logy means using biology (the study of life) to create or improve tools, products, or processes, such as:
    • Genetic engineering of food crops.
    • A number of advanced food animal breeding practices, such as genetic engineering and cloning, as well as use of products such as the protein hormone recombinant bovine somatotropin (rbST) given to dairy cows.
    • We will cover specific products and why they are used in this talk.
• 74% of Americans have heard at least a little about biotechnology, while only 1 in 10 have heard a lot.
• According to research, consumers are most supportive of food biotechnology when:
  • it provides a health or nutrition benefit (35%)
  • it improves taste or quality (22%)
  • there a price/economic benefits (21%)
• The majority of consumers are not aware that foods developed with biotechnology are available today. (IFIC 2012)
While the origins of biotechnology can be traced to the ancient Egyptians, significant strides were made in the 1900's through today. A few of the highlights include the following. Refer to the Timeline handout available in the IFIC Foundation Food Biotechnology Communications Guide, available at www.foodinsight.org/foodbioguide.aspx, which provides more historical information: [NOTE TO PRESENTER: Select 2-3 milestones below to read off.]

1865 From observing pea plants in a garden, Mendel concludes that “unseen particles” (later known as genes) pass traits from parents to offspring in a predictable way—the laws of heredity begin to be understood.
1944 Avery, MacLeod, and McCarty determine that Mendel’s “unseen particles” can be transferred from one bacterium to another.
1973 Scientists Cohen and Boyer successfully transfer genetic material from one organism to another.
1992 FDA issues a policy stating that foods from biotech plants would be regulated in the same manner as other foods. Pre-market consultation with FDA is encouraged, consistent with industry practice.
1993 Recombinant bovine somatotropin (rbST) – a naturally occurring protein hormone that is reproduced using biotechnology and used in cows to increase milk production – is approved in the U.S.
1994 The first whole food produced using biotechnology—the FlavrSavr® tomato—enters the marketplace after FDA issues its advisory opinion on safety. Virus-resistant squash is also planted.
1997 Dolly the sheep is the first animal clone to be born.
1998 Virus-resistant papaya, developed through biotechnology to save the crop from devastation, is planted in Hawaii. Insect-protected sweet corn is also planted.
2012 Researchers report that the first “hypoallergenic” cow, Daisy, has been genetically engineered to remove a protein that can trigger whey allergy in humans.
2012 Biotech crops are planted on 420.8 million acres by 17.3 million farmers in 28 countries. More than 90% of farmers planting biotech seed are small, resource-poor farmers in developing countries.
MENGAPA KITA MENGGUNAKAN BIOTEKNOLOGI?
• Scientists and farmers have been striving for generations to increase the quality and quantity of food for the world’s growing population.
  • The importance of this research made clear by the words of Norman Borlaug, a Nobel Peace Prize winner for his work in agriculture: [NOTE TO PRESENTER: read quote on slide]
  • Ensuring adequate food is not the only answer to the question, “Why biotechnology?” It is certainly an important one, however.
• Biotechnology is one of many tools farmers and food producers may use to provide a food supply that is safe, affordable, plentiful, flavorful, nutritious, convenient, and sustainable.
One reason biotechnology is used is to meet consumers expectations about food:

- Thirty-five percent of consumers believe they will benefit from food biotechnology over next 5 years.

When those consumers are asked what benefits they expect from biotechnology, they say:

- Health & nutrition
- Improved quality, taste, and variety
- Price & economic benefits
- Improved agricultural production
- Safer foods
- Reduced pesticides
(IFIC 2012)

**NOTE TO PRESENTER:** You may want to ask the following question of the audience, and solicit input that can be used for dialogue at the end of your talk.

- What are your thoughts on why biotechnology is used today, or why it may be used in the future, in agriculture and food production?
Four key benefits related to biotechnology help to answer the question, “Why biotechnology?”

1. Maintains and in some cases improves safety of the food supply.
3. Plays a role in improving sustainability for the environment, economy, and communities.
4. Improves quantity and quality of staple foods to meet the needs of the growing global population.

Let’s discuss each point further...
Foods produced using biotechnology that are currently available are safe for people and our planet, and in some cases the technology may be used to improve safety.
Top medical professionals agree that biotechnology is a safe food technology. For example, Dr. Ronald Kleinman, Physician in Chief at Massachusetts General Hospital for Children in Boston, notes:

“For thousands of years we’ve been breeding plants...so that we can have fruits and vegetables that are safe and healthy. We’re now using the latest generation of biotechnology to...make them even safer.”

Most food products currently available through biotechnology are derived from crops.

- The safety of biotech foods has been established through extensive research and affirmed by numerous regulatory agencies, scientists, health professionals, and other experts around world, such as:
  - World Health Organization (WHO 2005)
  - Food and Agriculture Organization of the United Nations (FAO 2000)
  - American Medical Association (AMA 2012)
  - Institute of Food Technologists (IFT 2000)
  - U.S. Food and Drug Administration, Environmental Protection Agency, and Department of Agriculture (EPA 2012)
  - Consumers have been eating biotech foods safely since 1996, with no evidence of harm demonstrated anywhere in the world. (Massengale 2010)
  - Consuming foods produced through biotechnology is safe for children and women who are pregnant or nursing. (FDA 2012)
  - Biotechnology’s use does not increase the potential for food allergies.
    - For those with food allergies, the use of biotechnology itself will not increase the potential for a food to cause an allergic reaction or a new food allergy. The food label is the best guide for consumers to avoid ingredients to which they are allergic. (FDA 2012b)
    - During FDA’s extensive review of a new food product developed using biotechnology, if one or more of the eight major food allergens (milk, eggs, wheat, fish, shellfish, tree nuts, soy, or peanuts) were introduced, testing for the potential to cause allergic reactions is required. (FDA 2012b)
    - The FDA required special labeling of any food, whether produced through biotechnology or not, if a protein from one or more of the major food allergens is present. (FDA 2012)
- Also, animal feed containing biotech crops is the same as food and feed derived from conventionally-grown crops, just as meat, milk, and eggs are the same, whether the animal is fed biotech or conventional feed.
Animal biotechnology is a safe technique for producing meat, milk, and eggs.

- The safety of milk and other dairy products from cows supplemented with rbST has been established and reinforced through decades of research (FDA 2011)
  - Recombinant bovine somatotropin (rbST) is a protein hormone produced through biotechnology and given to dairy cows to increase milk production, allowing more to be produced with fewer animals, a sustainable practice that has a positive impact on the environment.
- When new food products from animals bred using genetic engineering are proposed, federal regulators have a process in place to evaluate their safety on a case by case basis. (FDA 2012b; FDA 2012d; Lai 2006; Wu 2012)
- The FDA has concluded that the use of cloning in breeding cows, goats, and pigs is a safe agricultural practice, and the meat and milk from these animals is the same as from other animals. (FDA 2008; FDA 2010)
- Although not animal biotechnology, there are other agricultural tools used in animal agriculture that have also been deemed safe by FDA, such as:
  - Ractopamine hydrochloride, used to increase lean meat content in livestock. (FAO/WHO 2010)
  - Antibiotics, mainly used to treat and prevent disease in farm animals. (FDA 2012a; IFT Foundation 2006)
• Overall, the majority of U.S. consumers are consistently confident about the safety of the U.S. food supply, according to a long-running survey conducted by IFIC.

• Although some may perceive that many consumers are concerned about biotech, research shows only 2% name biotechnology as a food safety concern (asked as an open-ended question, not multiple choice). To put this into perspective:
  • 29% are concerned about foodborne disease and contamination, and
  • 21% are concerned about poor food handling and preparation.

• In addition, while 53% of consumers say they are avoiding certain foods or ingredients, they do not name foods produced through biotechnology as foods they are avoiding.

(IFIC 2012)
The U.S. Department of Agriculture (USDA), Food and Drug Administration (FDA), and Environmental Protection Agency (EPA) coordinate regulation and provide guidance on safety testing of agricultural crops and animals produced through biotechnology and the foods derived from them. This ensures the safety of the U.S. food supply.

These regulations address impacts on human food, animal feed, and the environment (EPA 2012) as follows: [NOTE TO PRESENTER: The following details may be of interest to some audiences, but not others.]

- FDA - safety review and guidance for foods from biotech crops or animals; labeling of all foods and animal feed
- EPA - specific to crops that are genetically engineered to be protected from pests, or developed to tolerate herbicide application; safety evaluation for humans and environment; oversight of field testing (crop characteristics in the field), sale, transportation
- USDA’s Biotechnology Regulatory Service (BRS) of the Animal and Plant Health Inspection Service (APHIS) - agricultural and environmental safety; field testing, movement, and importation of biotech crops and seed. When BRS determines that the crop is unlikely to pose a risk to other plants compared to similar conventional crop varieties, the crop is “deregulated” and therefore no longer subject to regulatory requirements.

- Foods derived from animals bred through cloning are regulated in the same manner as other animal-based food products. (FDA 2008; FDA 2010)
- Milk and other dairy products from cows supplemented with rbST have been determined by FDA to be the same as other dairy products, so they are regulated in same manner. (FDA 2011)
- When new food products from animals bred using genetic engineering are proposed, federal regulators have a process in place to evaluate their safety on a case by case basis. (e.g. salmon enhanced to grow more quickly to maturity, currently in the final stages of FDA review) (FDA 2012b)
• FDA holds foods produced using biotechnology to same high standards for safety and quality as all other foods (FDA 2012c)

• Special labeling is required only to disclose a material change, such as: (FDA 2012c)
  • Allergens present in the food.
  • Increased levels of naturally occurring toxins.
  • Changes to nutrient composition or profile.

• However, the FDA has determined the process of biotechnology is not a “material fact” to be mandated on the food label. (FDA, 2013)

• No product of biotechnology on the market today has introduced any major allergen to any food. And, the use of biotechnology itself does not increase the potential for a food to cause an allergic reaction or increase the potential for a new food allergy to develop.
  • Note that if a person is already allergic to a food, the use of biotechnology in currently available foods would not change that. Food allergic individuals can be guided by the ingredient list on the food label.
Today biotechnology protects food safety by reducing spoilage post-harvest:
• Corn protected against insects is also protected against mold, which can otherwise grow in the holes created by plant pests and produce toxins that threaten food safety. (Brookes and Barfoot 2012)
• Low-lactose milk is now produced more efficiently with enzymes produced through biotechnology, important for people with lactose intolerance or sensitivity (IFIC 2011)

New products are in development and research is underway to expand biotechnology’s food safety benefits:
• Insect-protected rice and sugar cane are in development.
• A potato that produces less acrylamide when heated or cooked is currently under U.S. regulatory review. (Rommens 2008)

NOTE TO PRESENTER: Depending on the audience, an explanation of acrylamide may be needed: It is a compound that forms in some foods during the cooking process (e.g., frying, roasting, or baking), due to heat interacting with sugars and an amino acid naturally present in some foods.

• Biotechnology may be used to “silence” allergenic proteins, such as those found in peanuts, milk, and soy, making the food supply even safer for allergic individuals. (Lehrer 2005; Newell-McGloughlin, 2008; United Nations University 2005)
Food biotechnology is being used to improve nutrition, enhance food safety and quality, and protect crops and food animals from diseases that would otherwise threaten our stable, affordable, and wholesome food supply.
Advanced breeding and modern food production have been used to develop canola, soybean, and sunflower oils that do not produce *trans* fats. (Crawford 2011; Damude 2008; DiRienzo 2008; Mermelstein 2010; Tarrago-Trani 2006)

Soybean and canola oils are being developed with biotechnology to provide the specific omega-3 fats that are most protective for heart health. Existing soybean and canola are already high in omega-3 fats—these advancements are intended to provide additional heart-healthy options from plant-based food. (Mermelstein 2010; Damude 2008; DiRienzo 2008; Lichtenstein 2006)

The majority of Americans are interested in biotech foods that provide better nutrition (69%), more healthful fats (71%), and less saturated fat (68%). (IFIC 2012)
• Above all else, consumers want food that tastes good. 69% say they’d buy foods enhanced through biotech to taste better. (IFIC 2012)

• Currently in regulatory review are apples (pictured) that keep their original color longer after slicing or rough handling, don’t bruise as easily, and stay crisp longer. (USDA APHIS 2012; Photo source: http://www.okspecialtyfruits.com/arctic-apples/about-our-nonbrowning-apples)

• Potatoes that brown more slowly are also in development.

• Scientists have developed tomatoes, melons, papaya through biotechnology that ripen at the right time are to deliver a fresh product with better flavor to consumers (not available in stores today). (ISAAA 2004)

• Biotechnology is also being used to develop enzymes used in food production:
  • Hard cheeses, baked goods, alcoholic beverages, and juices
  • Ingredients such as corn syrup, glucose, starches
  • More precise action, which allows for better flavor and other desirable product characteristics
• Improved disease, pest, and weed control for crops leads to:
  • Reduced farming costs, including labor, pesticides, fuel, and fertilizers.
  • More consistent harvest.
  • Fewer harvested foods lost to contamination during transportation and storage.
  • More stable food prices for consumers.
    • Example: In the 1990’s, the Hawaiian papaya crop was nearly devastated by papaya ringspot virus, which would have eliminated the only U.S. supply of the fruit. While other approaches to controlling the virus failed, biotechnology saved the crop and Hawaii’s papaya industry with the development of virus-resistant papaya.

• These efficiencies mean:
  • Consumers enjoy a more consistent supply of affordable, high-quality foods

(Brookes and Barfoot 2012; Park 2010)
Biotechnology supports the social, economic, and environmental sustainability of agriculture.
• **NOTE TO PRESENTER:** for some audiences, may supplement basic definition on slide with the following:
  
  • According to USDA, sustainable agriculture is an integrated system of plant and animal production practices that will, over long term:
    
    • satisfy human food and fiber needs;
    • enhance environmental quality and the natural resource base upon which the agricultural economy depends;
    • make the most efficient use of nonrenewable resources and integrate natural biological cycles and controls;
    • sustain the economic viability of farm operations; and
    • enhance the quality of life for farmers and society.

  (USDA)
• Responsible use of biotech seeds and crop protection products, as well as integrated weed and pest management practices, are all important tools in protecting both crops and the environment.
• Biotechnology allows for more judicious use of insecticides:
  • From 1996-2011, biotech crops have collectively reduced global pesticide applications by 1.04 billion pounds of the active ingredient. (ISAAA 2012)
  • Farmers can spray insecticide less often with Bt (insect-protected) crops, so farmers are protected from accidental poisoning.
    • Insect protection is incorporated into the seed, so farmer exposure is greatly reduced (Shutske, 2005)
    • Within 5 years of growing Bt corn in China, only 5-8% of Bt cotton farmers in China became sick from accidental pesticide poisoning, compared to 22-29% who planted non-Bt cotton or a combination of Bt and non-Bt cotton (Pray 2002)
  • Bt crops target only the pests that eat those crops, rather than honey bees or natural predators of the crop pests, which is good for the ecosystem. (NAS 2010)
  • Thanks to widespread planting of Bt corn, European Corn Borer (a major pest for corn crops) has been suppressed so effectively that the pest is no longer a threat, even to non-Bt corn in nearby fields. (Hutchinson, 2010)
• With the adoption of herbicide-tolerant crops, farmers have more choices in sustainable weed management, and can select herbicides that break down more rapidly and therefore have less impact on the environment than older herbicides.
  • The use of the herbicide glyphosate has increased with glyphosate-tolerant crops. It is 16 times less toxic that older herbicides, therefore much safer to use (Shutske, 2005; Brookes and Barfoot 2012)
• Since crops were first domesticated centuries ago, insects, weeds, and plant diseases have adapted to farmers’ efforts to manage them, whether crops are grown with organic, conventional, or biotechnology methods.
  • New types of herbicide-tolerant corn and soy have been developed that help address ongoing challenges with herbicide resistance of certain weeds.
Photos on slide:

- On the left (less sustainable), the traditional practice of moldboard plowing: The ground is turned over in preparation for planting and/or for weed control, which exposes soil to wind and erosion.
- On right, no-till farming (more sustainable): The farmer plants seeds directly into the residue of the previous year’s crop, which is made possible through better weed control.
- Biotechnology and good agricultural practices improve soil quality by allowing farmers to till (or mechanically work the soil) less often or not at all.
- As of 2009, two-thirds (65%) of soybeans were being grown using conservation tillage, resulting in a 93% decline in soil erosion, and preserving an estimated 1 billion tons of top soil. (CAST 2009)
- Adoption of no-till farming has increased 35% since the introduction of biotechnology. It is more easily adopted with herbicide-tolerant crops because they eliminate or greatly reduce the need to till for weed control. (CAST 2009; CTIC 2010)
- With adoption of no-till and conservation tillage farming systems, soil erosion has decreased by 93%, preserving an estimated 1 billion tons of top soil. (CAST 2009; CTIC 2010; Fawcett 2002)
- In addition to improving soil quality, the demand for converting more land to agriculture is reduced, because farmers are able to get more healthy crops from a given amount of land. Therefore, land less suited for agriculture (e.g., hilly vs. flat land), as well as forests, can continue to serve as wildlife habitats.
• Biotechnology and good agricultural practices also reduce agriculture’s carbon footprint by reducing fossil fuel use and by trapping carbon in the soil.
  • With adoption of no-till and conservation tillage farming systems, seed is planted directly into the residue of the previous year’s crop.
    • Agriculture’s “carbon footprint” has decreased by 46.5 billion-pounds because more carbon is retained in the soil with no-till farming facilitated by herbicide-tolerant crops.
• Carbon emissions from fuel use are lower on farms that use biotechnology, as the ability to apply pesticides and till less often means that farmers do not have to drive their tractors over their fields as often. In 2011, resulting carbon dioxide reductions were estimated to be 4.19 billion pounds.
Biotechnology and other agricultural technologies help to increase amount of food that can be harvested per acre of land or per animal.

- As a result, less land, insecticides, fertilizers, fuel, animals, and feed are needed to produce same amount of food
- Biotechnology helps reduce the need to use more land to feed growing population

- From 1996 to 2010, 97.5 million tons of soybeans and 159.4 million tons of corn have been added to global harvest. (Brookes and Barfoot 2012)
- Crops thrive with better weed and insect control through biotechnology (Brookes and Barfoot 2012; Park 2011)
- With the use of rbST and proper management, five cows can produce the same amount of milk that once took six cows, resulting in less feed used and less methane gas (a greenhouse gas) produced by dairy herds. (Capper 2008)
• Biotechnology and modern farming practices strengthen the economic sustainability of family farms in the U.S. and around the globe, regardless of the size of the farm, by:
  • Reducing farming costs related to labor, pesticides, fertilizer, and fuel;
  • Protecting crops from pests and diseases;
  • Decreasing post-harvest losses due to contamination during transportation and storage; and
  • Greater farm income through higher yields and disease-free crops. (Brookes and Barfoot 2012)
• Farmers in developing countries have benefited economically from biotechnology through lower production costs and a more reliable harvest. (ISAAA 2011; Brookes and Barfoot 2012; Park 2010)
Agricultural biotechnology efforts in developing nations are being pursued with the guidance of and in cooperation with local people to ensure a positive social impact, including:

- Whether to use biotechnology
- Which crops to improve and how

(AATF 2012; ABS 2012; Gates 2012; IITA 2012; WHO 2009)

Food security (or regular access to food) is essential to a nation’s overall stability.

It has been suggested that increased food security, in part through the use of biotechnology, could help increase school attendance (because fewer children are needed to work on the farm and are being encouraged to attend school), leading to improvements in a country’s overall infrastructure and stability. (Gates 2012)

Projects such as Water Efficient Maize for Africa (WEMA) and Africa Biosorghum Project are examples of biotechnology projects led by and addressing the needs of resource-poor farmers and families in developing nations. (ABS 2012; AATF 2012)
Biotechnology has a role to play in ensuring that safe and abundant food can be produced on existing farm land to meet the increasing needs of the world’s growing population.
By 2050, the global population is expected to reach 9 billion people, requiring 70% more food than is produced today. (Godfray 2010; FAO 2009)

It is important to use existing farm land more efficiently, while preserving wildlife habitats. (Edgerton 2009)
Increasing yield in staple food crops in developing nations is critical to ensuring that the most disadvantaged people around the world have greater access to food (Edgerton 2009; Newell-McGloughlin 2008).

Biotechnology has already been shown to increase yields by reducing crop loss to pests through the use of herbicide-tolerant and insect-protected crops. (Godfray 2010)
- From 1996 to 2010, biotechnology led to the addition of 97.5 million more tons of soybeans and 159.4 million more tons of corn to the harvest, an increase that was needed to meet global food demands. (Brookes and Barfoot 2012)

Biotechnology has the potential to strengthen crops against extreme temperatures, drought, poor soil conditions, etc. - critical in developing nations where crop losses can mean health and economic devastation (Newell-McGloughlin 2012; Owens 2001)
- Biotechnology is being used to develop drought-tolerant soybeans, corn, and rice, which could improve food production, even when water is scarce.
- Research is being conducted to develop corn, wheat, and rice that can withstand changes in growing conditions brought about by climate change, aiming to protect the food supply against related declines in production and availability.
- 25 million acres of farmland have been lost to high salinity (salt content) conditions resulting from poor irrigation. Biotechnology is being employed in the development of salt-tolerant crops, which would thrive in salty soils.
Where malnutrition is rampant, nutritionally improving staple food crops and native foods has great potential to improve the health of entire communities.

- Golden Rice (not yet available) (IRRI 2012; ISAAA 2011; UN University 2005; USDA ARS 2010; WHO 2009)
  - Rice is a staple food for a significant portion of the world’s population.
  - Vitamin A deficiency is a common cause of blindness in developing countries.
  - Rice and corn have been enhanced to produced beta carotene, which the body uses to produce vitamin A.
  - Golden Rice is expected to be approved in the Philippines by 2014. It is also currently under review in China, Vietnam, and Bangladesh.

- Biofortified sorghum (not yet available) (ABS 2012)
  - The Africa Biofortified Sorghum Project was formed to address severe malnutrition.
  - Sorghum is one of Africa’s most important staple crops.
  - Using biotechnology, progress has been made towards increasing vitamin A, iron, and zinc content, as well as improving protein quality and improving availability of nutrients to the body.
BIOTEKNOLOGI PERTANIAN SAAT INI
Food biotechnology traits that are in use in crops grown in the U.S. today include: (ISAAA 2012)

- Insect protection
- Herbicide tolerance
- Virus-resistance
- Stacked traits (combinations of the above traits)

In animal agriculture, a biotech protein hormone is used for more efficient milk production in cows.
There are many foods available today that are grown using biotech or contain ingredients derived from biotech crops, or in the case of dairy products, are derived from cows treated with rbST (see previous slide for applications in use today). Some of these products include:

- Sweet corn
- Papaya
- Dairy Products
- Packaged foods from the grocery store may contain a wide range of ingredients derived from biotech soybeans, corn, sugarbeets, or cottonseed, such as:
  - Sweeteners (e.g., corn syrup, sugar)
  - Vegetable oils (*Note, does not include nutritional improvements through biotech*)
  - Corn starch
  - Soy protein
  - Etc.
- The exception would be anything labeled as USDA-certified organic, which by definition do not contain ingredients from genetic engineering and must be certified as 95% organic. (USDA 2013)
Biotechnology is an important factor in our American harvest:
• Today, there is wide use of biotechnology among farmers. (ERS 2012)
  • US farmers planted 171.7 million acres of biotechnology varieties of soybeans, maize (corn), cotton, sugar beet, canola, squash, papaya, and alfalfa.
  • More than 90% of all US soybean acres are herbicide-tolerant.
  • Nearly 70% of all US corn acres are insect-protected.
  • Virus-resistant papaya is the main source of today’s papaya supply.
  • Stacked traits, which entails enhancing multiple traits in one crop through biotechnology, can be tailored to agricultural and consumer needs.
Biotechnology: An Important Factor In Our **Global** Harvest

- In 2012, 17.3 million farmers in 28 countries grew biotech crops on 420.8 million acres.
- More than 15 million of those farmers were small, resource-poor farmers in developing countries.  
  (ISAAA 2012)
APA YANG DIHARAPKAN PADA MASA MENDATANG?
• Given the forecast for increased food demand around globe, foods in the biotechnology pipeline include (some already mentioned): (CBI 2012)
  • Improvements in nutrition to help alleviate nutritional deficiencies and improve public health, particularly in disadvantaged populations
  • Improvements in nutrition to enhance overall health such as higher omega-3 fats
  • Improvements in the ability to grow crops in stressful conditions such as drought or on existing farmland that has not previously been productive
  • Further improvements in yield and disease protection
    • Insect-protected sugar cane, rice
(Lai 2006; USB 2012; Wu 2011)
• Other food technologies have faced similar communication and acceptance challenges as food biotechnology:
  • Lack of awareness of purpose and benefit
  • Technical names
• We can apply insights and techniques used to communicate about biotechnology to these other food technologies.
• It is important to raise awareness of new technologies in development and newly available technologies to ensure transparency and to improve acceptance when they are ultimately introduced to the food supply.
• Examples:
  • Animal Antibiotics: Used to treat and prevent illness in farm animals, improving animal quality of life and food safety.
  • Animal protein hormones: Increase food production per animal, resulting in fewer animals needed.
  • Ractopamine: An animal feed additive used to improve the amount of quality lean meat in pigs and cattle, increasing sources of healthful protein.
  • Nanotechnology: A science that involves the design and application of structures, devices and systems on an extremely small scale, called the nanoscale - that is, billionths of a meter, or about 1-millionth the size of a pinhead. May be used in food packaging to increase food safety and quality, and to improve the nutrient profiles of foods, making them more healthful.
Biotechnology has not only positively influenced agriculture and food production, but has had a significant impact on public health through the development of medicines and therapies to treat and prevent disease. For more on these developments, visit [www.fda.gov](http://www.fda.gov).

As noted by Kathleen Sebelius, USDA Secretary of the Department of Health & Human Services (The Biotech Meeting, 2010):

“When we look back over the last century, we see that biotechnology is responsible for some of our greatest progress in public health, from the discovery of penicillin to the development of effective therapies for HIV infection ...Today... we can see even bigger opportunities ahead.”
TERIMA KASIH!


Referensi


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