

# **Transgenic Seeds Market – Global Industry Size, Share, Trends, Opportunity, & Forecast 2019-2029 Segmented By Trait (Herbicide Tolerance, Insect-resistance, Others), By Crop Type (Corn, Soya, Cotton, Canola, Others), By Region, Competition**

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## **Abstracts**

Global Transgenic Seeds Market was valued at USD 22.25 billion in 2023 and is anticipated to project robust growth in the forecast period with a CAGR of 5.28% through 2029. The global transgenic seeds market, often referred to as the genetically modified (GM) seeds market, is a vital component of modern agriculture. It involves the cultivation of crops with genetically engineered traits, such as resistance to pests, herbicide tolerance, and environmental stress tolerance. These genetically modified crops have significantly impacted agricultural practices, productivity, and sustainability.

The global transgenic seeds market plays a pivotal role in addressing the challenges of food security, sustainable agriculture, and resource efficiency. It continues to evolve with innovative traits, advanced biotechnology, and an increasing focus on environmental sustainability and consumer preferences. However, it also faces regulatory, environmental, and consumer perception challenges that need to be addressed for continued growth and acceptance.

### **Key Market Drivers**

#### **Increased Agricultural Productivity**

Increased agricultural productivity is a fundamental driver for the growth of the global transgenic seeds market. This concept refers to the ability of transgenic seeds, also known as genetically modified (GM) or genetically engineered seeds, to enhance the

efficiency and output of agricultural production. Transgenic seeds are designed to carry specific genetic traits that enable crops to achieve higher yields. These traits may include resistance to pests, diseases, or environmental stress, as well as improved growth characteristics. For instance, crops engineered to resist insect pests can result in larger and healthier harvests, ultimately increasing overall productivity.

With the world's population steadily growing, there is an increasing demand for food. The agricultural sector faces the challenging task of producing more food with limited arable land and resources. Transgenic seeds have the potential to play a pivotal role in ensuring global food security by increasing crop yields and making more efficient use of available resources. Increased agricultural productivity benefits not only the global food supply but also the financial well-being of farmers. Higher crop yields mean more income for agricultural producers. This can help improve their livelihoods, provide stability for their businesses, and contribute to economic growth in rural areas. Farmers adopting transgenic seeds often find themselves with greater financial security due to reduced production costs and increased revenues.

Transgenic seeds can lead to more sustainable and environmentally friendly farming practices. For instance, crops engineered for pest resistance reduce the need for chemical pesticides. This results in less chemical runoff into the environment, decreased harm to non-target species, and a reduced carbon footprint associated with pesticide application. Similarly, herbicide-tolerant crops enable farmers to control weeds with less environmental impact, provided sustainable farming practices are followed. Transgenic seeds can also contribute to resource efficiency in agriculture. For example, crops engineered for drought tolerance can thrive with less water, which is especially important in regions facing water scarcity. This efficient use of resources, such as water, can help conserve valuable natural resources and reduce production costs. Continued research and development in the field of transgenic seeds are leading to the creation of crops with multiple beneficial traits. This includes crops that resist both pests and drought, providing a holistic approach to enhancing agricultural productivity.

## Pest and Disease Resistance

Pest and disease resistance is a critical driver for the growth of the global transgenic seeds market. This concept refers to the genetic modification of seeds to confer resistance to specific pests, insects, and plant diseases. These genetically modified (GM) crops are designed to withstand attacks from harmful organisms, resulting in several benefits for farmers, consumers, and the agricultural industry as a whole. Pest and disease resistance in transgenic seeds helps reduce crop losses. Traditional crops

are often vulnerable to various pests and diseases, which can lead to significant yield losses. GM crops, on the other hand, have built-in resistance mechanisms, allowing them to fend off these threats. This translates to higher crop yields and, ultimately, increased agricultural productivity.

One of the most significant advantages of pest-resistant transgenic seeds is the reduced reliance on chemical pesticides. Farmers cultivating GM crops can use fewer or less potent pesticides, which has several advantages: Fewer pesticides mean less chemical runoff into water bodies and reduced harm to non-target organisms, leading to a lower environmental impact. Farmers spend less on purchasing and applying pesticides, contributing to reduced production costs. Reduced exposure to pesticides benefits farmworkers and minimizes health risks associated with chemical handling.

Pest and disease-resistant transgenic seeds promote more sustainable agricultural practices. By reducing the need for chemical inputs and minimizing crop losses, they contribute to a more eco-friendly and economically viable approach to farming. This aligns with the growing demand for sustainable agriculture in today's world. GM crops with pest and disease resistance offer improved food quality and safety. Reduced pesticide residues on crops mean that consumers are less exposed to potentially harmful chemicals. In addition, the decreased risk of contamination by pests and pathogens during crop cultivation, harvesting, and storage enhances food safety. By mitigating the impact of pests and diseases, pest-resistant transgenic seeds provide stability for farming communities. These communities can depend on more consistent yields and reduced financial risk, which, in turn, can help alleviate rural poverty and support livelihoods.

### Herbicide Tolerance

Herbicide tolerance is a significant driver for the growth of the global transgenic seeds market. This concept involves the genetic modification of seeds to make crops resistant to specific herbicides. These genetically modified (GM) crops can withstand the application of certain herbicides, which offers various benefits for both farmers and the agricultural industry. Herbicide-tolerant transgenic seeds simplify weed management for farmers. Weeds are a major challenge in agriculture as they compete with crops for nutrients, water, and sunlight. Herbicide-tolerant crops allow farmers to use specific herbicides that target weeds while sparing the crop. This targeted approach streamlines weed control efforts and reduces the labor required for manual weeding. Herbicide-tolerant GM crops contribute to higher crop yields. By effectively controlling weeds with herbicides, the crop can grow with reduced competition, resulting in more robust and

productive plants. Enhanced yields are a significant incentive for farmers to adopt these transgenic seeds.

Herbicide-tolerant crops can promote resource efficiency in agriculture. They enable more efficient use of resources such as water, as weeds compete for limited water resources. Reducing weed pressure through herbicide application ensures that the primary crop receives an adequate supply of water, leading to improved water use efficiency. Farmers who use herbicide-tolerant transgenic seeds often experience cost savings. They spend less on labor for weeding and use fewer herbicides compared to traditional farming practices. Reduced expenses enhance the economic viability of farming operations and contribute to improved profitability. While herbicide use is associated with environmental concerns, herbicide-tolerant crops can contribute to a reduction in the environmental impact of agriculture: Targeted herbicide application minimizes chemical runoff into water bodies, which can harm aquatic ecosystems. Effective weed control prevents soil erosion by maintaining ground cover, protecting valuable topsoil, and preserving soil health.

### Environmental Stress Tolerance

Environmental stress tolerance is a significant driver for the growth of the global transgenic seeds market. This concept involves the genetic modification of seeds to enhance a crop's ability to withstand adverse environmental conditions, such as drought, salinity, extreme temperatures, and other environmental stresses. These genetically modified (GM) crops offer a range of benefits to farmers and the agricultural industry, contributing to the expansion of the transgenic seeds market. Environmental stress-tolerant transgenic seeds are designed to make crops more resilient in the face of challenging conditions. Drought-tolerant crops, for instance, can maintain productivity even in periods of water scarcity, contributing to stable yields and food security.

Crops engineered for drought tolerance can make more efficient use of water resources. They require less water to produce the same or even higher yields, which is particularly valuable in regions with limited access to irrigation or facing water scarcity. Some transgenic seeds are developed to thrive in saline soils, where traditional crops struggle to grow. Salinity-tolerant crops can expand arable land by making use of soil that would otherwise be unproductive. Crops engineered for temperature resilience can withstand temperature extremes, including cold and heat stress. This enables farmers to cultivate crops in regions with unpredictable or extreme weather patterns. Environmental stress tolerance ensures more stable crop yields. This is especially important in the face of climate change, which can lead to increased weather variability.

Stable yields contribute to food security and reduce economic risks for farmers. Tolerant transgenic crops often exhibit better resource efficiency. By requiring less water and withstanding environmental stresses, they make more efficient use of natural resources and reduce production costs.

## Key Market Challenges

### Regulatory Hurdles

The regulatory approval process for transgenic crops can be time-consuming and costly. Biotechnology companies must navigate a complex web of regulations and safety assessments before commercializing their products. Delays in approvals can hinder the timely introduction of new transgenic seeds to the market.

Different countries have distinct regulatory frameworks for genetically modified organisms (GMOs). This inconsistency can lead to market fragmentation, with companies needing to seek approvals from multiple agencies or adapt their products to comply with various national regulations. This can increase costs and slow down market expansion. Opposition to transgenic crops by some governments, NGOs, and segments of the public can lead to regulatory hurdles. Political decisions and public perception can influence whether GM crops are approved or banned, further complicating the regulatory landscape. Some regions and countries require labeling of GM products. Compliance with labeling and traceability regulations can be complex and costly, affecting market access and consumer acceptance.

### Environmental and Ecological Concerns

The development of pest and disease resistance to transgenic crops, as well as the emergence of herbicide-resistant weeds, is a growing concern. These issues can result in reduced effectiveness of transgenic seeds over time, increasing the need for additional pest control methods.

There are concerns that transgenic crops may have unintended impacts on local ecosystems, potentially harming non-target species and biodiversity. This can lead to ecological imbalances and harm the environment. Transgenic crops may crossbreed with wild or non-GM crops, leading to gene flow. This can raise concerns about the spread of transgenic traits beyond cultivated fields, potentially impacting non-GM crops and natural ecosystems. The reduced use of pesticides with some GM crops can result in the resurgence of secondary pests that were previously controlled by broad-spectrum

pesticides. This can necessitate the use of additional pest management strategies.

### Consumer and Public Perception

Skepticism and concerns regarding the safety of transgenic crops can influence consumer behavior. Some consumers may choose non-GM products, which can reduce demand for transgenic crops and limit market growth.

The demand for clear labeling and transparency regarding the presence of GM ingredients in food products can lead to higher costs for manufacturers and impact consumer choices. This can also affect market dynamics. Misinformation and misconceptions about GM crops can persist in the public domain. Accurate and accessible information is essential to address these concerns and improve consumer acceptance. Activist groups opposed to GM crops may engage in campaigns that raise public awareness about perceived risks associated with transgenic seeds. These campaigns can influence public opinion and, in turn, affect market demand.

### Key Market Trends

#### Advanced Biotechnology and Trait Stacking

One of the prominent trends in the transgenic seeds market is the continual advancement of biotechnology, which allows for more precise and complex genetic modifications. This trend encompasses several aspects:

Trait stacking involves introducing multiple genetically engineered traits into a single crop variety. For example, a single crop may be engineered to resist multiple pests, tolerate environmental stress, and deliver improved nutritional content. Trait stacking enhances the value proposition of transgenic seeds by offering more comprehensive solutions to farmers. Emerging gene-editing techniques like CRISPR-Cas9 have opened new possibilities for crop improvement. These technologies allow for precise modifications of specific genes, which can lead to the development of new traits or the fine-tuning of existing ones. Gene editing offers the potential to accelerate the development of transgenic seeds. RNA interference (RNAi) is another innovative biotechnological trend. It enables the silencing of specific genes in pests or pathogens, reducing their ability to cause harm to crops. RNAi technology can complement existing transgenic traits by providing an additional layer of protection.

#### Focus on Sustainability and Environmental Impact

A growing concern for sustainability and environmental impact is driving several trends in the transgenic seeds market:

As climate change poses increasing challenges to agriculture, there is a heightened focus on developing crops that can thrive in adverse conditions, such as drought or extreme temperatures. Transgenic seeds with improved environmental stress tolerance are becoming more essential. In response to concerns about pesticide and herbicide usage, there is a trend toward developing transgenic crops that require fewer chemical inputs. This not only addresses environmental concerns but also reduces production costs for farmers. Crop developers are increasingly considering the potential impact of transgenic crops on local ecosystems and biodiversity. Efforts are being made to minimize unintended ecological consequences, such as gene flow to wild relatives, through containment strategies and risk assessments. In recognition of the growth of organic farming, there is an emerging trend to develop transgenic traits that are compatible with organic agricultural practices. Organic-compatible traits allow organic farmers to benefit from genetic advancements while maintaining their certification.

### Consumer Demand for Transparency and Traceability

Consumers are becoming more discerning about the food they consume, leading to trends that emphasize transparency and traceability:

Increased demand for clear labeling of genetically modified (GM) products is leading to greater transparency in food labeling. This trend enables consumers to make informed choices about the products they purchase. There is a growing market for non-GMO (genetically modified organisms) and identity-preserved crops. This trend allows consumers to access products that are not genetically modified and are carefully monitored throughout the supply chain to maintain their non-GMO status. The trend of educating and engaging consumers in discussions about GM crops and their benefits and risks is gaining momentum. Companies and industry stakeholders are investing in outreach and communication efforts to provide accurate information to the public. The coexistence of GM and non-GM crops is increasingly considered, with efforts made to establish buffer zones and best practices to prevent cross-contamination and gene flow in areas where both types of crops are grown.

### Segmental Insights

### Trait Insights

Based on the category of Trait, the Herbicide tolerance (HT) segment emerged as the dominant player in the global market for Transgenic Seeds Market in 2023. Herbicide-tolerant transgenic seeds simplify weed management for farmers. Weeds are a persistent problem in agriculture, competing with crops for nutrients, water, and sunlight. The HT trait enables farmers to use specific herbicides that target and eliminate weeds while leaving the crop unharmed. This targeted approach reduces the labor and time required for manual weeding, making it an attractive choice for farmers.

Herbicide tolerance contributes to higher crop yields. With effective weed control, transgenic crops can grow with reduced competition from weeds. As a result, they develop more robustly and produce larger harvests. Improved yields are a significant incentive for farmers to adopt herbicide-tolerant transgenic seeds. Herbicide-tolerant crops conserve water by eliminating the need for extensive weed control that typically requires extra irrigation. This is especially valuable in regions with water scarcity. While herbicides are used, the targeted application of herbicides is more efficient and requires fewer chemicals than broad-spectrum pesticide applications. This reduction in pesticide usage has environmental and economic benefits. Farmers adopting herbicide-tolerant transgenic seeds often experience cost savings. These savings come from reduced labor costs for manual weeding, fewer herbicide purchases, and increased productivity. This combination of cost-effective weed management and enhanced yields makes HT crops financially attractive for farmers. These factors are expected to drive the growth of this segment.

### Crop Type Insights

The Corn segment is projected to experience rapid growth during the forecast period. Corn has a significantly high adoption rate among transgenic crops. Many countries have embraced GM maize varieties, making it one of the most widely grown genetically modified crops globally. This high level of adoption demonstrates the strong demand for transgenic corn among farmers. Corn is a staple crop with vast economic importance. It is used for various purposes, including food and feed production, as well as industrial applications such as ethanol production. The economic significance of corn drives the adoption of transgenic varieties, which offer several advantages to growers. Transgenic corn is engineered to provide resistance to pests and tolerance to herbicides. For instance, Bt (*Bacillus thuringiensis*) corn varieties produce a protein toxic to certain insect pests, reducing the need for chemical insecticides. Herbicide-tolerant corn varieties allow farmers to use specific herbicides for weed control without damaging the crop. These traits contribute to increased yield potential and cost savings for farmers.



Transgenic corn varieties are developed to exhibit high yield potential. The resistance to pests, coupled with efficient weed control, allows the crop to grow more robustly and produce larger harvests. The high yield potential of transgenic corn aligns with the demand for increased food production to feed a growing global population. These factors collectively contribute to the growth of this segment.

## Regional Insights

North America emerged as the dominant player in the global Transgenic Seeds Market in 2023, holding the largest market share in terms of value. North America, particularly the United States, was one of the earliest regions to adopt and develop genetically modified (GM) crops. The introduction of transgenic seeds, such as herbicide-tolerant soybeans and insect-resistant maize (corn), marked a turning point in agriculture. This early adoption allowed North American farmers to benefit from improved crop traits and higher yields. North America cultivates a diverse range of transgenic crops, including maize, soybeans, cotton, and canola, among others. The availability of various genetically modified crops provides options for farmers to address specific agricultural challenges, leading to a significant market share in the global transgenic seeds market. Transgenic seeds in North America have demonstrated increased agricultural productivity and economic benefits for farmers. Traits such as herbicide tolerance and pest resistance have reduced production costs and contributed to higher yields, making transgenic crops a preferred choice for North American growers. North America has a strong tradition of modern agricultural practices and large-scale farming. Transgenic seeds align with the region's focus on efficiency and productivity in agriculture, making them an integral part of the farming landscape. The regulatory framework for GM crops in North America has been relatively supportive, which has encouraged their adoption. Streamlined approval processes and clear guidelines have facilitated the commercialization of transgenic crops.

The Asia-Pacific market is poised to be the fastest-growing market, offering lucrative growth opportunities for Transgenic Seeds Market players during the forecast period. Factors such as the Asia-Pacific region is home to a rapidly growing population. As the demand for food increases, there is a need for technologies that enhance agricultural productivity. Transgenic seeds can address food security challenges in the region. The Asia-Pacific region encompasses a wide range of agroclimatic conditions, from tropical to temperate. Transgenic seeds engineered for pest resistance, herbicide

tolerance, and environmental stress tolerance can adapt to and thrive in diverse environments, making them appealing to farmers in this region. Rice and wheat are staple crops in many Asian countries. The development of transgenic varieties of rice, such as Golden Rice, and wheat with improved traits has the potential to significantly impact food production in the region. Several countries in the Asia-Pacific region have shown support for transgenic crops, recognizing their potential to enhance agricultural productivity and address challenges like pests, diseases, and adverse environmental conditions. The Asia-Pacific region includes emerging economies with expanding agricultural sectors. These markets are increasingly adopting transgenic seeds to improve agricultural practices and achieve higher yields.

## Key Market Players

Monsanto Co

E.I du Pont de Nemours & Company

Syngenta AG

Vilmorin & Cie SA

Bayer CropScience AG

BASF SE

Dow Agrosience LLC

Suntory Holdings Ltd

## Report Scope:

In this report, the Global Transgenic Seeds Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Transgenic Seeds Market, By Trait:

Herbicide Tolerance

Insect-resistance

Others

Transgenic Seeds Market, By Crop Type:

Corn

Soya

Cotton

Canola

Others

Transgenic Seeds Market, By Region:

North America

United States

Canada

Mexico

Europe

France

United Kingdom

Italy

Germany

Spain

Asia-Pacific

China

India

Japan

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Transgenic Seeds Market.

Available Customizations:

Global Transgenic Seeds Market report with the given market data, Tech Sci Research

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offers customizations according to a company's specific needs. The following customization options are available for the report:

#### Company Information

Detailed analysis and profiling of additional market players (up to five).

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