ZINC-ENRICHED WHEAT

Improving foods and the food system
with a naturally nutritious harvest

HarvestPlus
Better Crops • Better Nutrition

Globally, about 15 percent of our calories (energy) come from wheat. In some countries, it is more than 70 percent. Use zinc wheat to improve your products while positively impacting the wider food system.

HarvestPlus: Leading a global movement to deliver more-nutritious crops

Thanks to an innovative, non-GM approach to crop breeding called biofortification, wheat can now be naturally improved to provide higher levels of zinc. It turns everyday foods—such as bread or pasta—into better sources of zinc: a micronutrient that is essential for maintaining good health and strong immune systems.

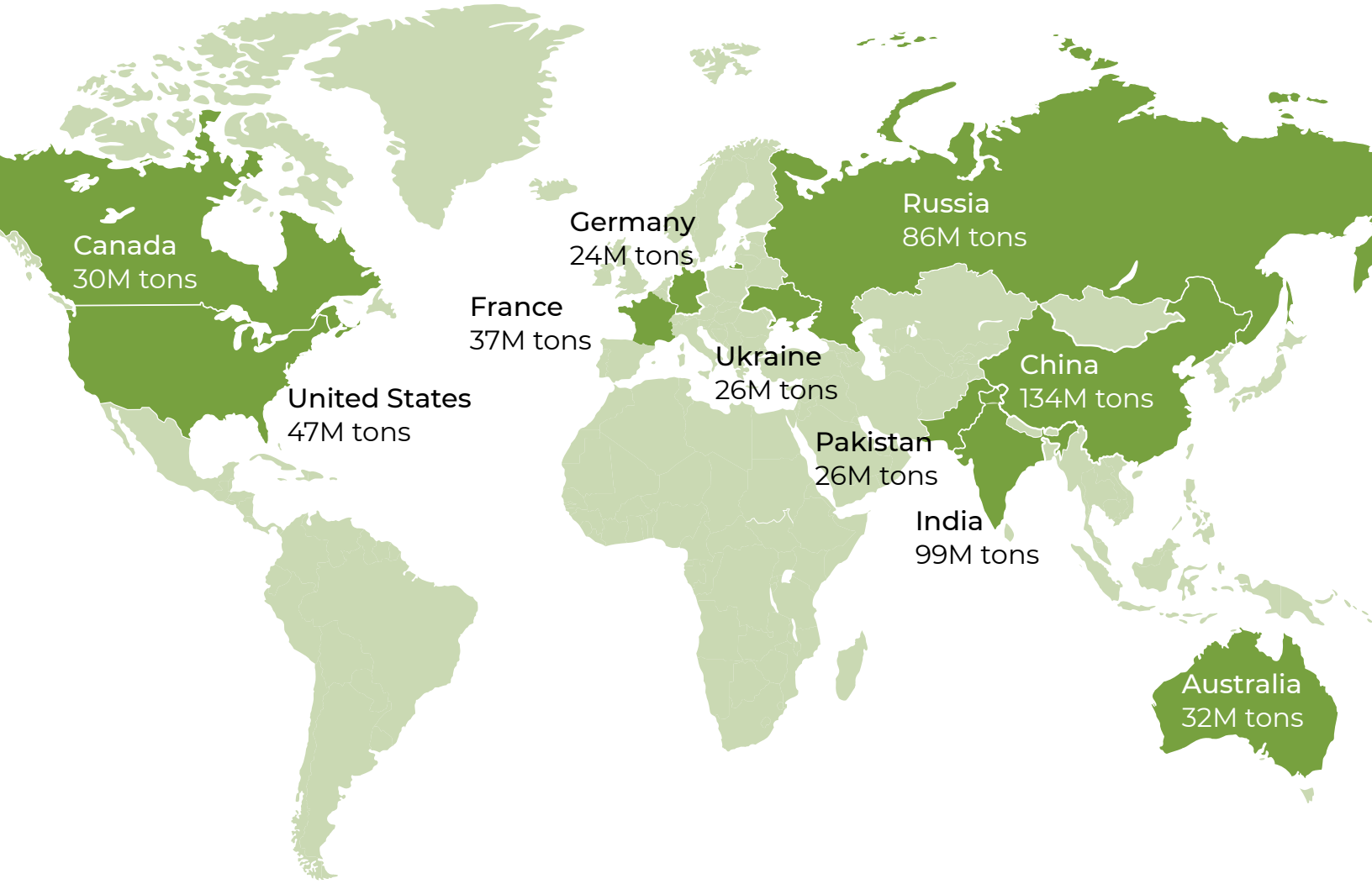
HarvestPlus experts in nutrition, crop development, and agriculture work with partners to unlock genetic variation in wheat and develop zinc-rich varieties that can provide malnourished populations with up to half of their daily zinc needs when eaten regularly. Currently-grown varieties of wheat contain small amounts of zinc compared to zinc-rich wheat.

HarvestPlus is part of the CGIAR agricultural research network and leads a global effort to improve the nutritional value of staple crops. HarvestPlus leverages its CGIAR partners' unrivaled knowledge, skills, and research capacities to respond to the global micronutrient deficiency crisis. In partnership with the International Maize and Wheat Improvement Center (CIMMYT) and national agricultural research systems (NARS), we develop and disseminate zinc-rich varieties of wheat. Whole-grain zinc wheat flour provides more zinc than highly refined wheat flour. For populations with low zinc status, eating whole-grain wheat flour can help ensure optimal intake of zinc.

CONSUMERS WANT NATURAL NUTRITION

Research shows that consumers want naturally nutritious foods. Zinc is especially attractive to consumers because of its role in immunity. Global consumer research shows consumers everywhere are increasingly motivated by ethical businesses, and more likely to buy food from a vendor that cares about the community. For food production and processing, zinc wheat is specifically designed to perform the same way as conventional wheat flour; consumer testing has also shown no perceptible difference in taste or any other sensory attributes.

World Wheat Production, 2019



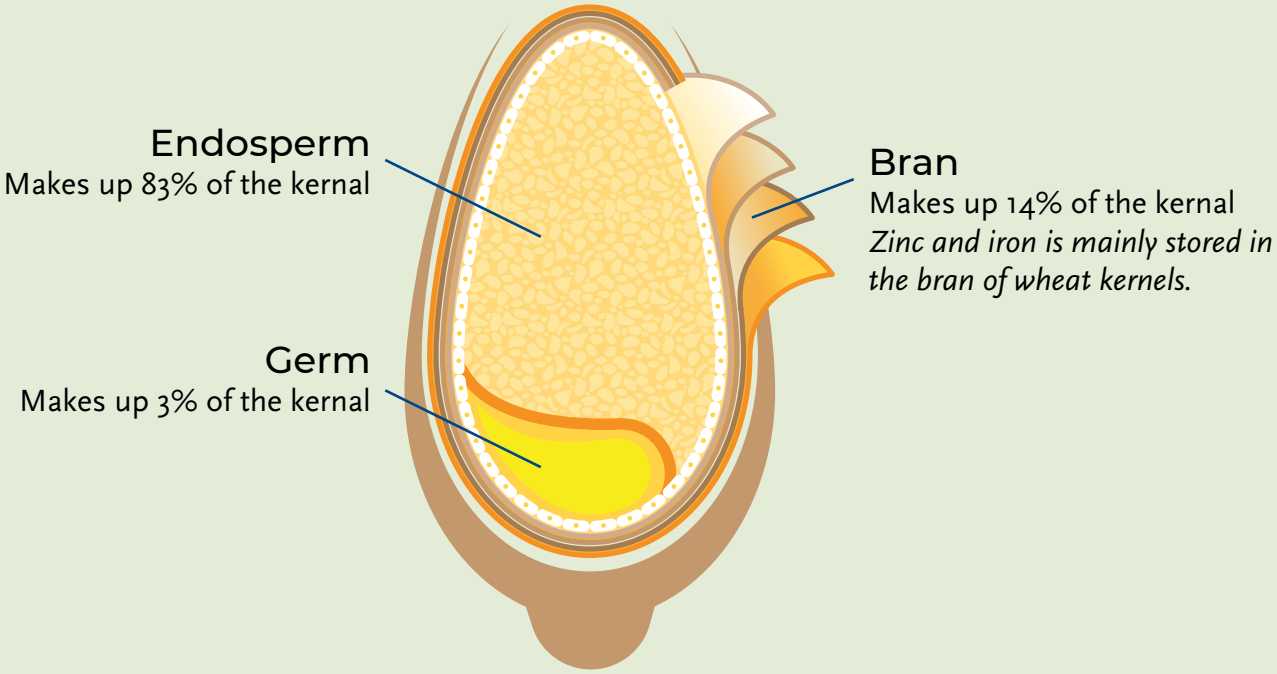
Global wheat production

Wheat was first cultivated in one of the world's cradles of civilization: the Mesopotamian region, within the Tigris-Euphrates river system. Historians believe it was the first crop that was used in organized agriculture. Currently, the leading producers of wheat are China, India, Russia, the United States, and Canada. Wheat is typically dried and milled to fine particle size to make flour, which is used to make bread, crackers, pasta, breakfast cereals, and other baked goods.

Wheat is one of the world's top three staple crops. To highlight the importance of wheat, in Pakistan for example, the population consumes an average of 240 grams of wheat daily and 124 kilograms annually, which makes up over 70 percent of their daily caloric intake. In Pakistan alone, the production of wheat for the year 2020-21 was 9.18 million hectares and 27.3 million tons, respectively. It contributes 12.5 percent to the value added in agriculture and 2.6 percent to GDP in Pakistan.

An estimated 1.2 billion people are at risk for zinc deficiency. Nearly a quarter of all children under five are physically and cognitively stunted; lack of dietary zinc is a contributing factor to stunting.

Eat the whole grain



What about white flour?

Global nutrition guidance encourages consumption of whole-grain wheat to obtain its full nutritional benefits. Whole-grain flour is the market leader in many countries in Europe, and consumption of whole grains is increasing in the US. Globally, however, consumers still prefer white flour for popular food products such as bread, pizza, pasta, and noodles.

To make white flour, the outer layer of bran is removed from the grain, reducing the zinc content.

Depending on the extraction rate (amount of bran removed), wheat flour made from zinc-rich wheat consumed by populations that rely heavily on wheat can still deliver enough zinc to make a meaningful impact on health. Furthermore, two absorption studies with foods made from biofortified and non-biofortified wheat flour showed that zinc absorption was significantly increased with biofortification (by up to 40 percent), regardless of the extraction level, thereby helping to meet dietary zinc requirements without changing food sources.

Zinc and the prevalence of zinc deficiency

Micronutrients are vitamins and minerals such as vitamin A, zinc, and iron. Although micronutrients are only required by the body in very small amounts, they are essential to maintaining good health, preventing illness, and ensuring children's proper development and growth.

More than 2 billion people around the world suffer from micronutrient deficiencies, which are collectively known as "hidden hunger." The name refers to the fact that many of the symptoms of micronutrient deficiencies are not easy to see but can have a detrimental lifelong impact, such as impairment of mental capacities, lower resistance to disease, and fatigue.

Around 17 percent of the global population (roughly 1.3 billion people) are at risk of inadequate zinc intake. The prevalence of zinc deficiency is estimated to exceed 25 percent in sub-Saharan Africa and 29 percent in South Asia. Since zinc deficiency is a cause of stunting (low height for age), stunting is commonly used as a proxy to estimate the risk of zinc deficiency in a population. **Approximately 23 percent of all preschool-age children are stunted.**

The diets of low-income consumers in developing countries usually consist of larger amounts of staple foods (such as wheat, corn and rice) and fewer micronutrient-rich foods such as fruits, vegetables, and animal products.

The double burden of disease is where undernutrition exists along with diet-related noncommunicable diseases (NCDs) such as overweight and obesity. This double burden also exists in low- and middle income countries, and zinc may play a role in addressing it. A meta-analysis from HarvestPlus analyzed research findings on the relationship between zinc supplementation and risk factors for two common NCDs: type 2 diabetes and cardiovascular disease. Research indicates that low-dose, long-duration intake of zinc through supplements reduced risk factors for these NCDs—raising the possibility that consumption of zinc-biofortified foods might have the same benefit.

Zinc is essential for good health

Zinc is involved in more bodily functions than any other mineral. Zinc is essential to more than 200 enzyme systems, normal growth and development, the maintenance of body tissues, reproductive health, vision, and the immune system. Zinc is vital for survival, meaning its deficiency has serious consequences for health, particularly during childhood when zinc requirements are higher. In addition to stunting, zinc deficiency can increase the risk of common childhood infections, including diarrhea, pneumonia, and malaria.

Most diets (especially in low-income countries) do not contain enough zinc, making zinc deficiency one of the biggest causes of hidden hunger globally. For example, inadequate zinc intake in India is partly responsible for a 35 percent rate of stunting among children younger than five years, which also leads to frequent infections and inflammation in this age group.

Why do we need zinc? Authorized nutrient function claims

Zinc is responsible for hundreds of body processes. Below are the generally accepted benefits that can be stated on food packaging when the food meets the local requirements of "source of" or "high in" zinc.

Contributes to the normal functioning of the immune system

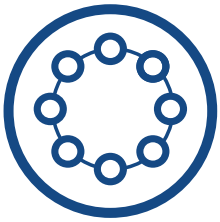
Contributes to the maintenance of normal bones

Contributes to normal cognitive function

Contributes to the maintenance of normal skin, nails, and hair

Contributes to the maintenance of normal vision

Contributes to the maintenance of normal testosterone levels



Contributes to normal fertility and reproduction

Contributes to normal metabolism

Zinc and immunity

The immune system is particularly sensitive to zinc status; the body does not store zinc, so regular intake is required. When someone is zinc-deficient, this generally manifests as poor growth and increased risk of infection. Zinc wheat provides consistent access to a micronutrient that is essential to sustaining health, optimizing immune function, and reducing the risk or severity of illnesses.

It is well known that the COVID-19 virus challenges the immune system, and it is possible that increasing intake of important nutrients could be helpful in fighting a COVID-19 infection. Zinc supports multiple areas of the immune system and is needed for the normal immune system to function.

Ways to improve foods, food systems, and diets

Some consumers seek to boost their zinc intake with supplements and some countries seek to improve population zinc status through industrial food fortification. Market trends in some countries show that consumers prefer foods that contain natural sources of vitamins and minerals, not additional ingredients on the label. Consumers are seeking “cleaner” food labels and foods with fewer added ingredients. Fortifying foods with zinc is also technically challenging, adding complexity in the supply chain. At times, demand for milled wheat is so high that there is no time to conduct the fortification process. Many countries have regulations that dictate wheat flour should be fortified, but they are rarely enforced. Biofortified zinc wheat can fill this gap when fortification is not possible or not welcomed by consumers.

Where does zinc come from?

Dietary sources of zinc include milk and other dairy products, whole grains and seeds, nuts, pulses, some shellfish, and dark chocolate. Zinc is abundant in the soil, and some plants and animals can take it from the soil more easily than others. There are also fortified foods and supplements.

Why is there so much zinc deficiency?

Animal-source or fortified foods may not be widely available or consumed in rural and resource-constrained households. It is not always possible for the human body to absorb zinc from plant-based foods.

How much zinc do we need?

As a guide, the recommended daily amount for zinc is 10 milligrams per day; this is a general guideline used for product labelling. Other references exist, and governments often have a population-specific set target.

Can I have too much zinc?

There is no risk that consumption of zinc through zinc-rich wheat products will increase a person’s zinc intake above the safe upper limit.

Zinc wheat adds more value throughout food value chains

Varieties of zinc wheat promoted by HarvestPlus are a pioneering breakthrough that will be part of the solution to one of the world's biggest problems of malnutrition in low- and middle-income countries, and will also respond to increasing consumer demand for naturally nutritious foods worldwide.

For Wheat Farmers

- I want to grow a variety that we can eat as a family and is good for us.
- I want to grow varieties that are in demand.
- I need varieties that are high yield, cost efficient and easy to grow so I get a good price.
- I want a variety that is high yielding and rust resistant.

For Food Manufacturers

- Zinc wheat brings innovation to a product category that hasn't seen innovations or growth for many years.
- I want to be ahead of the competition with the latest innovation in food systems.
- I want to invest in foods that are not only good for profits and good for consumers, but are good for the world. Social responsibility is good for business.
- I already have a solid and reliable supply chain, so I don't want to pay more or disrupt my current business activities.

For Consumers

- I want a naturally more-nutritious version of the food I commonly consume.
- I want to buy healthy foods with less added ingredients.
- I want to buy foods that are interesting and good for me.
- I want to buy foods that are good for the world, and good for the planet.
- I care about where my food comes from.

Wheat nutrition

HarvestPlus has developed labeling guidelines for many countries to demonstrate how to communicate nutrition and health claims for zinc-rich wheat to consumers. It is possible to make nutrition content claims and nutrition function claims in compliance with local legislation. For example, depending on the food format and country, a product could carry the following claims:

- Natural source of zinc
- Zinc is essential for a healthy immune system

Part of a healthy diet

Whole-grain wheat is recognized as the base for a healthy diet.

High in fiber

It is high in fiber when consumed as the whole-grain food.

Higher in iron

Zinc-enriched wheat also comes with the added benefit of higher iron content

Phytochemicals

Evidence is emerging that, in addition to fiber and minerals, the unique phytochemicals in whole-grain wheat may in part contribute to these health-promoting effects. Whole-grain wheat is rich in sources of various phytochemicals.

Apart from the higher zinc and iron content, some zinc wheat varieties have the same or very similar nutritional parameters as conventional wheat, which means no differences in food processing and taste tests.

The amount of zinc in standard flour varies throughout the world. In the UK, the zinc content of standard flour is as low as 1.5 mg/100g and in Australia it is 1.3 mg/100g. The content of zinc in biofortified zinc wheat can be as much as 70 percent higher than than standard.

Nutrition Information per 100g of zinc wheat

Nutrient	per 100g	%RDA* (per serving)
Energy	378 kcal	19%
Protein	13 g	24%
Carbohydrate	71 g	
Total sugars	4 g	
Total fat	2 g	3%
saturated fat	0.4 g	2%
cholesterol	0 mg	0%
Sodium	0.2 mg	0%
Zinc	3.5 mg	35%
Iron	3.9 mg	19%

*Recommended Dietary Allowance of an average adult per day (2000 kcal)

Standard whole-grain wheat flour contains 2.5 mg zinc per 100g, whereas whole-grain zinc wheat flour contains 3.5 mg zinc per 100g.

Product innovation and renovation with zinc wheat

The wheat and wheat flour product market has never seen any nutrition innovation! This is big news for a stable growth, low-cost commodity. Here are some examples where zinc wheat can help you and your business with new product innovation.

Flour: The boom in home-made bread is driving flour purchases globally. Consumers look for a quality product when buying flour and are more likely to look for a premium offering for home bread-making.

Traditional ground: Stone ground (in India, *Chakki*) mills are more popular. In ensuring the content of the whole grain, these traditional techniques in milling are making a comeback.

Bread-making: At home or in an industrial bakery, zinc wheat performs the same way as conventional wheat in all bread-making; in some cases consumers have said they preferred the zinc wheat versions.

Cakes and confectionary: Treats should not be promoted by their nutrient content, but if consumers do eat treat food, they can increase their zinc intake while doing so. Zinc wheat flour has been shown to perform the same as other types of wheat flour in all baking trials.

Noodles: Zinc wheat performs the same in noodle-making.

Bran products: Using the bran in products such as breakfast cereals will result in higher levels of zinc.

Fermentation of flour: Fermentation (in naan or injera breads) can improve the utilization/absorption/uptake of zinc. Fermenting flour is an innovative way to create new taste profiles and give new news to consumers.

Demand zinc wheat

Ask your suppliers for zinc-rich wheat. Use the newly published Publicly Available Standard, number 233.

How can you get zinc wheat into your product portfolio?

Build supply chains with HarvestPlus. We and our partners have developed 21 varieties of zinc wheat that have been officially released for production in eight countries, and which are adapted to numerous growing regions and climates. We can work with you to find a variety that suits your particular needs. In our work with smallholder farmers, zinc wheat is a major crop for the HarvestPlus program. It is a rich source of nutrition for low-income smallholder farming families who also depend on wheat as a source of income. HarvestPlus has many years of experience working with wheat and with our crop breeding partner CIMMYT. Depending on your location and the type and volume of wheat you are interested in, we can help you find the right wheat to grow in the right climate. HarvestPlus can enable supply chains for you and your business. Using this route, you will be providing market access for the world's most vulnerable smallholders.

However, we know that in switching to more-nutritious wheat, it is not always possible to work with smallholders; you may already be working with leading growers and have a strong and dependable supply chain of producers. In this case, we can work with you and your growers to switch over your current wheat varieties to a zinc wheat variety. The expert plant breeders, agronomists, and food technologists at HarvestPlus will help at every step of the way. This work provides a revenue stream for our nonprofit organization and, crucially, brings in investment and awareness of the malnutrition problem and food-based solution. We have several services available to assist with your transition to naturally nutritious zinc-rich wheat.

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