

This report comes from demands on problematizing and communicating about biofortification, which consists on genetic manipulation of plants aiming to raise the levels of one or more micronutrients.

Despite being practiced in Brazil for more than ten years, the implantation of such technology happened in an atmosphere of poor transparency from the public institutions that developed it and divergence of information regarding the matter.

Due to that, the Brazilian Forum of Sovereignty and Food Security (FBSSAN), along with other partners, highlight the importance of problematizing Biofortification from the perspectives of Food Security and Sovereignty, pinpointing the controversies and blanks regarding the subject.



Biofortification: A threat to food security and sovereignty?



Biofortification seeks answers for hunger and malnutrition in solutions based on specific technologies, which are confined to a limited number of food crops. Meanwhile, when we defend Food Security and Sovereignty, we seek to bring together the nutrition debate and the biodiversity one. That said, the importance of traditional knowledge, collective knowledge construction and knowledge dialogue in its various meanings, identities and territories seems quite evident. Ever since 2013, The FBSSAN has been debating with specialists of multiple areas regarding that matter.

Timeline:

November 2015 - Brasília/DF

V National Conference on Food Security (CNSAN) - Atividade integradora "Biofortificação de alimentos: contexto e controvérsias"

July 2015 - Go/GO

Brazilian Congress of Collective Health (ABRASCÃO)

May 2015 - Rio de Janeiro/RJ

International Congress on Specialized Nutrition (COINE)

November 2014 - Brasília/DF

Workshop on Food Biofortification at the National Council on Food and Nutrition Security (CONSEA)

September 2014 - Vitória/ES

Brazilian Congress of Nutrition (CONABRAN)

November 2013 - Poa/RS

Brazilian Congress of Agroecology (CBA)

Biofortification: A threat to food sovereignty?

What is Biofortification?

Biofortification is defined as the genetic manipulation of plants aiming to increasing the concentration of some specific micro-nutrients. Such technique causes the plant to express a higher concentration of one or more specific micronutrients, such as higher concentrations of iron, zinc and A Vitamin. That agricultural technology has been introduced in Brazil since 2003, under the Brazilian Agricultural Research Corporation's (EMBRAPA) supervision.

Known as Biofort, the Brazilian initiative is supported by programs like HarvestPlus and AgroSalud, which are Research Consortiums that operate in Latin America, Africa and Asia, funded by the Bill and Melinda Gates Foundation, the World Bank and International Development Agencies. Brazil is a world leader on the process of genetic manipulation, having transferred technology to other countries, such as Senegal, Gana, Nigeria, Kenya, Ethiopia, Uganda, Tanzania, Mozambique, Syria, India and China.

The term "Biofortification" suggests that the plant's life is weak and thus it

needs some action to be enhanced. As it causes an action, it also requires the definition of who will perform such action, and which attributes will improve the plant's life. At first sight, the term biofortification seems to be a way to make food richer in nutrients. However, that definition leads to deception by inducing the population into thinking that plants, grains, vegetables, fruits and tubers are weak and inferior to the "biofortified" ones. Both the farmer and the commensals get attracted to the idea of fortifying food, mainly because of a context where producing and consuming healthy food is not an easy task.

BIOS

the greek word for *life*

+

FORTIS

the latin word for *strong*,
or *physically strong*

=

the act of making
life stronger

The term "Biofortification" suggests that the plant's life is weak and thus it needs some action to be enhanced. As it causes an action, it also requires the definition of who will perform such action, and which attributes will improve the plant's life.

Its meaning, the definitions attributed to it, and what such technique brings about in a practical way are completely divergent. That is one of the most emblematic examples of how a term's definition may result in severe technopolitical repercussions, due to the misinterpretation and misuse it causes.

The Biofort initiative comes from the assumption that food included in such program should be largely produced and consumed within our country, i.e. based on traditional crops of the Brazilian alimentary culture. Thus, either farmers or consumers wouldn't have to change farming techniques or eating habits. Such proposal brings danger, as its implementation on family farm crops has a direct effect on Brazil's Food Sovereignty.

That is the case of the Cassava (mandioca), which has been the first food appointed for the biofortification

process. Also known as yucca or Brazilian arrowfoot (*aipim* or *macaxeira*), it has been granted the title of Brazilian Queen and universal Brazilian food by Brazilian folklorist, Câmara Cascudo. In southern Bahia, Indigenous communities, along with Maroons (*quilombolas*) and traditional farmers grow around 37 different varieties of such seed: caravel, butter (*aipim manteiga*), camoquem, calombo, pacare, jacobina, full plate (*aipim prato cheio*), Chilean bread (*pão do Chile*) and macaw-eye (*olho de Arara*). The Cassava is well known by its cultural value, along with its versatility for cooking and its historically attested nutritional benefits in the fight against hunger and malnutrition in Brazil, thus assuring Food Security and Sovereignty. Therefore, it is a food, which has been "fortified" by Brazilian traditions for about 7 thousand years.¹

¹ Creole varieties of yucca in southern Bahia – Practical guide on identification and usage.



Cassava, the first food that has been appointed for the biofortification process.

Does Biofortification make food stronger?

In contrast to what the name originally suggests, biofortified foods are not healthier or more powerful, because characteristics inherent to the food are eliminated, causing disequilibrium. What really happens is the impoverishment of the remaining essential micronutrients and fibers in favor of a single kind of micronutrient. In Brazil, the biofortified crops are: pumpkin, rice, sweet-potato, beans, cowpea, cassava, corn and wheat. Iron is one of the main targets of biofortification

The biofortification strategies advance even without knowing for sure if the micronutrients that are present in the plant in higher concentrations will be utilized by the human body when ingested in larger quantities. The excessive ingestion of micronutrients may cause toxic effects, including higher risk of cancer. Iron, for example, when excessively ingested may stimulate the disordered multiplication of cells on the gut, starting a cancer. β -Carotene (beta-Carotene), which is also a target to this technology, can act as pro-oxidant agent by attacking healthy cells and transforming them into cancer precursor cells. Nevertheless, Project Biofort is set to release a lettuce variety that contains even 15 times more folic acid than usual.

There are cases in which the biofortified food does not present any significant difference in micronutrient

concentrations, like the carioca beans (*feijão carioca*); in other cases, the original food has even larger quantities of micronutrients, i.e. does not need any iron enrichment, like the polished rice. Nonetheless, on the dissemination of information, the power of the name, which refers to life, may mislead the consumer into wrong and hasty choices. Due to that, it's necessary that we increase the access to information and promote the public debate with the civil society.

Brazil's most popular duo, rice and beans, is appreciated for its taste and valued for the nutrition quality it bears. What is being disseminated by Biofort as an important improvement on the levels of the micronutrient could in reality not be true. In some cases, it is possible that non-biofortified food be even richer in the micronutrient in question, which is the iron case. Nonetheless, if the error estimation of the biofortified food is considered- for more or for less-, as the same of those found in traditional food, therefore the difference on the micronutrient concentration is nothing but insignificant.

Iron per kilogram			
Carioca Beans *	80 mg	Biofortified Carioca Beans**	90 mg
Polished Rice *	7 mg	Biofortified Polished Rice**	4mg
* Brazilian Food Composition Table			
** BioFort, http://biofort.com.br/rede-biofort/			



“ The public power needs to give proper conditions to development and guide it into established purposes, from which none overlaps the people’s food emancipation. That is, leading our economy aiming the social Welfare of the community. ”

Josué de Castro, Brazilian Physician.

On beans, only a 10-grams-difference can be observed. When it comes to rice, the Brazilian Food Composition Table shows that it contains 7 grams. Whereas the biofort table indicates 2 grams, in contrast with the biofortified one, which is said to have 4 grams per kilogram, once again indicating differences on the composition.

Diet is more than intake of nutrients

One of the five principles that guided the elaboration of the Dietary Guidelines for The Brazilian Population was “diet is more than intake of nutrients”². According to the publication released by the Ministry of Health, the science of nutrition comes from the identification and isolation of food nutrients, along with studies regarding the effect of individual nutrients over the incidence of some specific diseases.

Those studies were fundamental for formulating politics and actions towards the prevention of specific nutritional deficiencies. Nevertheless, the effect of isolated nutrients has been shown to be progressively insufficient to explain the relation between food and health.

As an example, many results show that protection against heart diseases and some kinds of cancer, acquired from eating fruits and vegetables cannot be verified on interventions based on the usage of medicines or food supplements that contain individual nutrients of foods that protect against heart diseases. Those researches indicate that the beneficial effect over disease prevention comes more from food itself, from the combination of nutrients and other

chemical components that are part of the food matrix, rather than individually ingesting nutrients.

The act of eating is rooted in the symbolic signification systems of the different peoples and communities. It is deliciously connected to memory, knowledge and culinary acts, as well as to personal and collective stories, identities and territory. The permanence of gustatory memory from childhood is the concrete evidence that food is more than just a nutrient. Thus, eating shall not be restricted to the nutritional aspect, but also embrace its multiple dimensions.

It is quite unlikely to find products that do not appeal to health, with nutrient addition, vitamins and all the

other market communication strategies on supermarket shelves. That has been the duty of publicity. The consumer gets dependent on industry and marketing advices, which use medical backing from doctors, specialists and nutritionists.

We understand, thus, that it’s not the addition of nutrients that will turn an ultraprocessed food into healthy food. The best advice is to eat real food, valuing traditional knowledge and regional and local cultures.

² *Dietary Guidelines for the Brazilian Population.*

Let's rethink the meaning of some expressions that are part of the Brazilian eating culture, shall we?

² Dietary Guidelines for the Brazilian Population.

³ Thematic Glossary on Diet and Nutrition.

⁴ Consea. Real Food Manifest.

⁵ Montanari, M. Food as Culture.

NOURISHMENT

Substance that provides the necessary elements for the formation, maintenance and development of the human.³

ULTRA-PROCESSED FOOD

Industrial formulations made entirely or mostly from substances extracted from foods (oils, fats, sugar, starch, and proteins), derived from food constituents (hydrogenated fats and modified starch), or synthesised in laboratories from food substrates or other organic sources (flavour enhancers, colours, and several food additives used to make the product hyper-palatable).

Manufacturing techniques include extrusion, moulding, and preprocessing by means of frying.²



DIET

Diet refers to intake of nutrients, and also to the foods that contain and provide nutrients. Diet also refers to how foods are combined and prepared in the form of meals, how these meals are eaten, and also to cultural and social dimensions of food choices, food preparation and modes of eating.²

FOOD

Expression of a culture not only when grown but also when it's prepared and consumed. People create their own food, prepare it and choose whatever they want, according to cultural criteria.⁵

REAL FOOD

Ensures the food sovereignty, protects the cultural and genetic heritage; acknowledges the memory, aesthetics, knowledge, taste, doings, identities, rites, local Technologies and its innovations.

It is the one that considers water as food, that is farmed in decent working conditions, that is socially fair. And it's not subject to Market interests.⁴

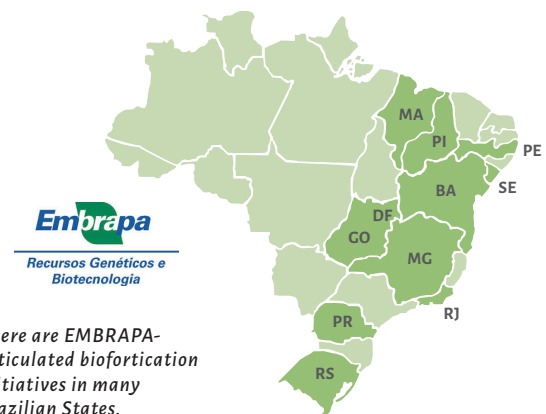
Now, shall we discuss the traditional food fortification oriented agricultural production?

Private interests in the common good

The establishment of biofortification in Brazil has been aside of any kind of public debate or social control. Real democracy is beyond the act of voting, it is about an empowered society that monitors the public policies.

Embrapa's degree of transparency is considerably low. Until the present moment there hasn't been proposed any public audience to debate such initiative, which has been present in Brazil for more than 10 years.

There are already biofortification initiatives articulated within Embrapa in Maranhão, Sergipe, Rio de Janeiro, Piauí, Pernambuco, Bahia, Distrito Federal, Goiás, Minas Gerais, Paraná e Rio Grande do Sul



There are EMBRAPA-articulated biofortification initiatives in many Brazilian States.

Such initiatives advance without any robust evidence on nutritional, economic, social and environmental impacts; or comparisons with other farming strategies. It is not possible to find even a single study about the adverse effects of biofortification and biofortified food on scientific literature. There is no involvement from health teams, boards, leaderships or social movements. The main targets of program Biofort are family farmers and basic education students, which are served by the National School Food Program.

2002



In april, **Embrapa** participated in a technical meeting to discuss a proposal from the **Biofortification Challenge Program (BCP)**, in Washington, DC. At first, the Brazilian agency would participate with the cassava. Within two months, such proposal was presented for funding. In November, BCP coordinators visited Embrapa in Rio de Janeiro in order to evaluate the possibilities of Brazilian cooperation in food science and technology.

2003

Embrapa elaborated working proposals for the Biofortification project in Brazil supported by four public universities (Unicamp, Unesp, UFRJ and UFRRJ). Cassava, beans and corn were the selected crops for the beginning of the activities, already counting on the **Harvest Plus** World Program fund release, which has more than 750 members and 100 associated institutions.

2003-2005

Around 3 thousand varieties of cassava, beans and corn are selected and multiplied among the **Embrapa** centers all over Brazil.



2004 - 2005

The **Agrosalud** consortium joined the program and has transferred about US\$ 16 million dollars for five years to fund researches in Brazil. It expects integration between Latin America, Caribbean, Africa and Southeast Asia. The main expectation is that Brazil transfer the biofortified crops and post-harvest technology. Works started in 2005.

2006

Cowpea and wheat were introduced as crops in **HarvestPlus** project. Also in this year, the first Annual Biofortification Meeting by **HarvestPlus** and **AgroSalud** Projects took place in Teresopolis, Rio de Janeiro.

2005

On March, 17th the Biofortification in Brazil: Agriculture for the prevention of micronutrients deficiencies Symposium took place in Brasilia (DF). Such event was organized by **Embrapa** and **HarvestPlus**, having the participation of the **Ministry of Health, the Ministry of Social Development, Ministry of Agrarian Development**, representatives from the private sector and public universities. In the same year, **Embrapa** visited different institutions over Senegal, Gana, Nigeria, Kenya, Ethiopia, Uganda and Tanzania, which were willing to integrate their biofortification network and get technical capacitation to analyze carotenoids. In December, **Embrapa** Cassava and Tropical Fruits released biofortified cassava varieties (BRS Gema de Ouro and BRS Dourada), which were distributed to small farmers.



2004

Harvest Plus and **Embrapa** present a complementary proposal for the biofortification project for Latin America and Caribbean in order to receive funding from the Canadian International Development Agency (CIDA).

2007

In November, the second Annual Biofortification Meeting by **Harvest-PLUS** and **AgroSalud** Projects was held in Niterói, Riode Janeiro. Project members from India, China, Peru, Colombia, Mexico, along with representatives from public institutions and private sector attended such event.



2008

Project **Biofort**: Biofortification in Brazil is proposed and approved under the coordination of Embrapa counting on funding from the **Embrapa-Monsanto** fund (first funding with national resources). Eleven **Embrapa** units work together with public institutions.



PEPSICO

2009

Project **Biofort** is presented at the third Annual Biofortification Meeting, In Aracaju (SE). In this occasion, it was held the Field Day, at the Nossa Senhora das Dores Experimental Field, aiming to show some genetically-manipulated crops such as rice, beans, cowpea, cassava, sweet-potato, corn and pumpkin. Such seeds were distributed among the farmers from Santana dos Frades Settlement. There was also a visit to a public school in Pacatuba, where crops were tested by children, attended by the **National School Food Program (PNAE)**. The Vice-president of **Pepsico** for Latin America attended to the meeting, with the intention of beginning the pilot-project for the development of biofortification-processed products.

2010 **BioFORT**

The I Global Conference on Biofortification took place in Washington (USA), being attended by **Embrapa**. The number of researchers who study Biofortification increases, providing analysis on the nutritional impact of Project **BioFort**'s crops.



2011



In July, the Fourth Annual Biofortification Meeting takes place in Teresina (PI) funded by **Nestlé**, **Monsanto** Brazil, **Pepsico** Brazil, **Agrobios**, **Votorantim Metais**, **National Council for Scientific and Technological Development (CNPQ)**, **Banco do Nordeste** (Northeast Bank – BNB), municipal and state agencies from Maranhão.



2003 - 2016

Civil Society remains absent from the construction of that genetic manipulation agricultural program to which traditional Brazilian food is destined.

BRIEF HISTORY ON THE IMPLANTATION OF BIOFORTIFICATION IN BRAZIL

Do Seeds have owners?

The same companies that control the production of seeds and pesticides are the same engaged in biofortification, whereas creole seeds are heritage of humanity and its peoples.

1950 - GREEN REVOLUTION

- Monsanto, Bayer, Syngenta and Dupont/Pioneer.

1990 - GENETIC REVOLUTION

- Monsanto, Bayer, Syngenta and Dupont/Pioneer ;
- Bill and Melinda Gates Foundation, in Africa;
- More than 10 years after the legal introduction of transgenics in Brazil, we notice that the usage of pesticides has significantly risen.

2000 - BIOFORTIFICATION

- Private actors;
- Bill and Melinda Gates Foundation fund Harvest Plus and SUN programs;
- Syngenta;
- Embrapa projeto Biofort.

From Green Revolution to Biofortification.



Biodiversity and biofortification: game of meanings

It's not new that the anti-hunger speech is used to promote companies' technological development. The solution for the so-called Hidden Hunger has served as justification for many projects with commercial purposes as top priorities. On the modern food system, hunger and malnutrition go side-by-side with the rise of obesity, eating disorders and chronic diseases. The rise of inequality, social and environmental injustice are part of the contradictions of such system, in which food is a commodity and hunger is business of multiple segments that goes from the absent of food to its excess.

“green“	Green Revolution	Biofortification	“bio“
	Green Economy	Bioeconomy	
	Green fuel	Biofuel	
	Green Technology	Biotechnology	

Have you ever observed how the terms “green” and “bio” have historically been used to designate processes and products that many times are contrary to their original meaning?

Many of those terms were released with the purpose of sharing a positive idea of the controversial technological processes and products. The fight for the resignification of their original meanings is a result from the actions of social movements. That is the case of the “Agricultural Defender”, which after the Brazilian Law 7,802 from 07/11/1989 became known as Agrochemical or pesticide. However, it's important to remind that such achievements must be defended permanently

Biodiversity as a source of suitable and healthy food

It's urgent that we maintain and renew the fight for new significations that represent and acknowledge peoples and traditional communities' way of producing, living and eating.

We, thereby, invite you to join us as we think together in new terms that may reproduce our traditions in such theme.

BIODIVERSITY	BIOFORTIFICATION
<ul style="list-style-type: none"> ■ Food that comes from agroecology, a sort of praxis that acknowledges land, people and their culture; ■ Farmed in a strong living soil, full of nutrients; ■ Based in fair and equitable production relations; ■ Values both the farmer and the consumer's health; ■ Strong food, once it observes the harvest time. It's farmed without agrochemicals or genetic-manipulation technologies; ■ Acknowledges traditional knowledge: values farming diversity and traditional food systems along with their various ways of producing and consuming food. 	<ul style="list-style-type: none"> ■ Food that comes from monoculture farming; ■ Farmed in mineralized soil, poor in nutrients; ■ Source of profit: 61% of the food are farmed with transgenic seeds, which are owned by 6 private foreign companies; ■ Strong use of agrochemicals and fertilizers; ■ Micronutrient diversity loss; ■ Farming biodiversity loss – Farmers start producing more than one specific biofortified variety, which leads to loss of food biodiversity both in production and consumption.

Biodiversity vs. Biofortification.

We start our challenge with the following proposals:

- *Laboratorially modified food* -

- *Artificially nourished food* -

- *Unfortified food* -

(due to the imminent risk of unbalancing the micronutrient structure of food)

The challenging context of climate change should also indicate an incentive to food diversification, which may turn agroecosystems more resilient to extreme events. Biofortification strategy, on the other hand, works by narrowing the supply of varieties and concentrating on seed production.

As previously observed on the transgenic case, the process of private appropriation of seeds has catastrophic consequences towards food sovereignty and biodiversity. The logic behind biofortifiers is the same: monopolize seed development and make farmers dependent. The biofortification discourse depoliticizes the problem of hunger and impoverishes the debate on biodiversity and its relation with nutrition and health. Along with that, also suggests the reduction of State responsibility in order to overcome it

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- ² **Dietary Guidelines for the Brazilian Population** http://189.28.128.100/dab/docs/portaldab/publicacoes/guia_alimentar_populacao_brasileira.pdf
- ³ **Thematic Glossary on Diet and Nutrition** http://bvsm.sau.de.gov.br/bvs/publicacoes/glossario_tematico_alimentacao_nutricao_2ed.pdf
- ⁴ **Consea. Real Food Manifest** <http://www4.planalto.gov.br/consea/comunicacao/noticias/2015/novembro/manifesto-a-sociedade-mostra-o-que-e-comida-de-verdade>
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- ⁶ **Position Paper Biofortification: A Threat to food security and sovereignty**, FBSSAN and partners.
- ⁷ Nutti, M, R. **The history of projects HarvestPlus, AgroSalud and Biofort in Brazil**. IV Biofortification Meeting. Teresina, Piauí, 2011. <http://ainfo.cnptia.embrapa.br/digital/bitstream/item/54482/1/2011-133.pdf>



The Brazilian Forum of Sovereignty and Food Security (FBSSAN), created in 1998, joins people, organizations, networks, social movements and research institutions in the fight for the Human Right to Food. It aims to sensitize to a wider vision of the matter, working with several perspectives of the food system: production, processing, supplying and consumption.

For further information, please visit our website:

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“ We don’t need these irresponsible experiments that create new threats for biodiversity and our health; we don’t need nutrient solutions imposed by powerful men sitting in distant places, who are totally ignorant of the biodiversity in our fields and meals, and who won’t have to bear the consequences of their destructive power.

We need to put food security in women’s hands so that the last woman and the last child can share nature’s gifts of biodiversity. “

Vadanda Shiva, Indian Activist