Young boy selling local vegetables at a roadside market in Mandawa, Northern Rajasthan, India.

who benefits from gm crops?

an industry built on myths

april 2014 | **summary**

Friends of the Earth International

A Woman selling eggplant at a roadside stall in Mandawa, Northern Rajasthan, India.

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Friends of the Earth International is the world's largest grassroots environmental network with 74 member groups and over two million members and supporters around the world.

Our vision is of a peaceful and sustainable world based on societies living in harmony with nature. We envision a society of interdependent people living in dignity, wholeness and fulfilment in which equity and human and peoples' rights are realised.

Friends of the Earth International has groups in
Africa Cameroon, Ghana, Liberia, Mali, Mauritius, Mozambique, Nigeria, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Tunisia, Uganda

Asia - Pacific Australia, Bangladesh, Indonesia, Japan, Malaysia, Nepal, New Zealand, Palestine, Papua New Guinea, Philippines, South Korea, Sri Lanka, Timor-Leste

Europe Austria, Belgium (Wallonia & Brussels), Belgium (Flanders), Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, England, Wales and Northern Ireland, Estonia, Finland, France, Georgia, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia (former Yugoslav Republic of), Malta, Netherlands, Norway, Poland, Scotland, Slovakia, Spain, Sweden, Switzerland, Ukraine

Latin America and Caribbean Argentina, Brazil, Chile, Colombia, Costa Rica, Curaçao (Antilles), El Salvador, Grenada (West Indies), Guatemala, Haiti, Honduras, Mexico, Paraguay, Uruguay

North America Canada, United States

Available for download at www.foei.org

Authors Myrto Pispini with contributions from Mute Schimpf, Juan Lopez and Kirtana Chandrasekaran.

Editing team E. Collins, Helen Burley, Ronnie Hall, Mute Schimpf, Kirtana Chandrasekaran

Design our@onehemisphere.se, www.onehemisphere.se

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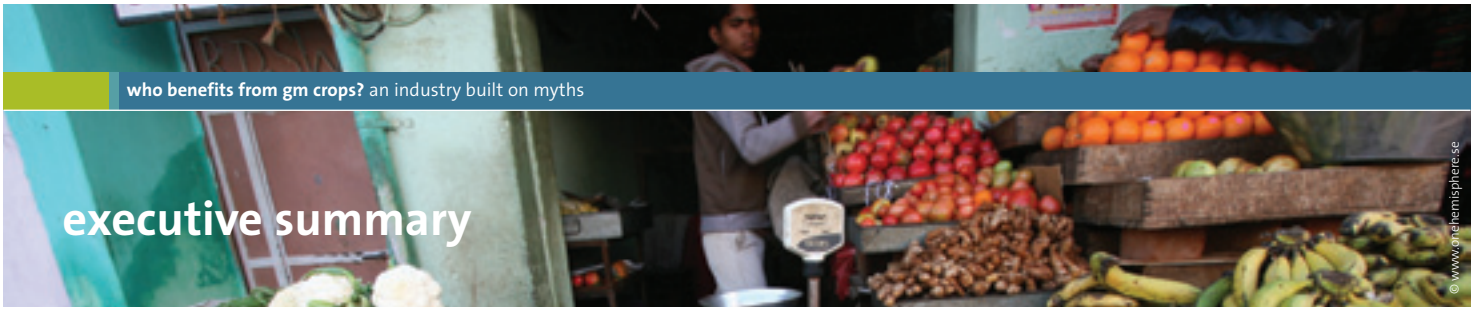
Friends of the Earth International

P.O. Box 19199
1000 GD Amsterdam
The Netherlands
Tel: 31 20 622 1369
Fax: 31 20 639 2181
info@foei.org
www.foei.org



A roadside stall in Mandawa, Northern Rajasthan, India.

executive summary: who benefits?

Our relationship with food and the way in which we farm is under increasing pressure. Extreme weather events, a changing climate and a growing population are putting the food sovereignty of communities at risk. At the same time health experts have raised serious questions about our modern diet. The World Health Organization (WHO) has warned of a 'global obesity epidemic'[1] yet an estimated 868 million people are suffering from chronic hunger.[2] It is perhaps no wonder that there are calls for a fundamental change to the ways in which we farm and feed the world.

The biotech industry has placed itself at the heart of this debate. Biotech corporations are working alongside governments and the aid community on initiatives they claim will improve yield and nutrition. Advocates argue that genetically modified (GM) crops can help to feed a climate-constrained world.

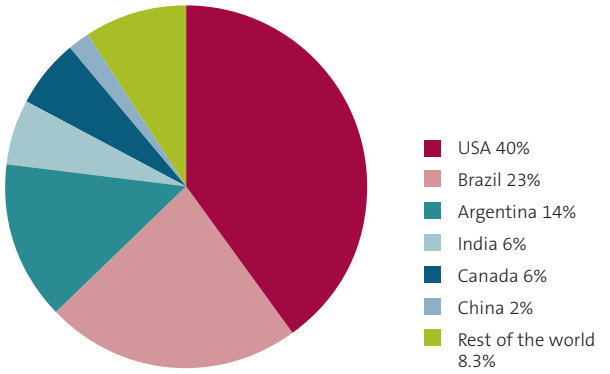
This report examines the reality of GM crop production worldwide. It differentiates the claims from the reality, drawing evidence from the experiences of small farmers and the communities who live with GM. It finds:

- *There is significant resistance to GM crops on all continents.*
- *Evidence from the cultivation of GM crops in North and South America, going back over two decades, shows increased levels of pesticide use due to weed and insect resistance – herbicide tolerant and insect tolerant (BT) GM crops do not provide an effective solution to the problem of agricultural pests.*
- *Emerging evidence of the negative impacts of pesticides on the environment and people's health suggest that these GM crops are not sustainable.*
- *There is no scientific consensus on the safety of GM crops – with many doubts and questions unanswered.*
- *Bio-fortified GM Golden Rice is not the best solution for vitamin A deficiency.*
- *Despite hype around new GM varieties for improved nutrition and climate adaptation industry figures show about 99 per cent of the GM crops grown are still herbicide tolerant, insect resistant or a combination of both.**

Where is GM grown?

There is a shortage of independent data on GM crops, with many of the figures only available from the industry bodies. These figures from 2013 show that 18 million farmers grow GM crops in 27 countries worldwide. This figure represents less than one per cent of the world farming population.[3] GM crops are predominantly found in six countries (92 per cent of GM crops) and these countries mainly grow just four GM crops: soya, maize, oilseed rape and cotton. Eighty eight per cent of arable land remains GM-free.[4]

FIGURE 1 **GM PRODUCTION OF TOP SIX COUNTRIES**



Source: *Calculations based on ISAAA (2014). Special Brief 46 – 2013 Executive Summary, Global Status of Commercialised Biotech/GM Crops: 2013, http://www.isaaa.org/resources/publications/briefs/46/executivesummary/*

* Calculations based on ISAAA Special Brief 44 (2012), http://www.isaaa.org/resources/publications/briefs/44/executivesummary/ and Nature Special Report, GMO Crops: Promise and Reality, http://www.nature.com/news/specials/gmcrops/index.html

"Our relationship with food and the way in which we farm is under increasing pressure. Extreme weather events, a changing climate and a growing population are putting the food sovereignty of communities at risk."

North America

The largest concentration of GM crops is in the United States where GM varieties of soya, maize and cotton account for 90 per cent or more of production of these crops. But there is also strong public opposition to GM in the US, with a growing campaign for GM food labelling. This has triggered fierce opposition from the food industry.[5]

The first GM drought-resistant maize was approved for commercial production in the US in 2013, but official assessments suggest it is only designed to maintain yields under moderate drought conditions, and does not perform as well as regionally adapted conventional maize.[6]

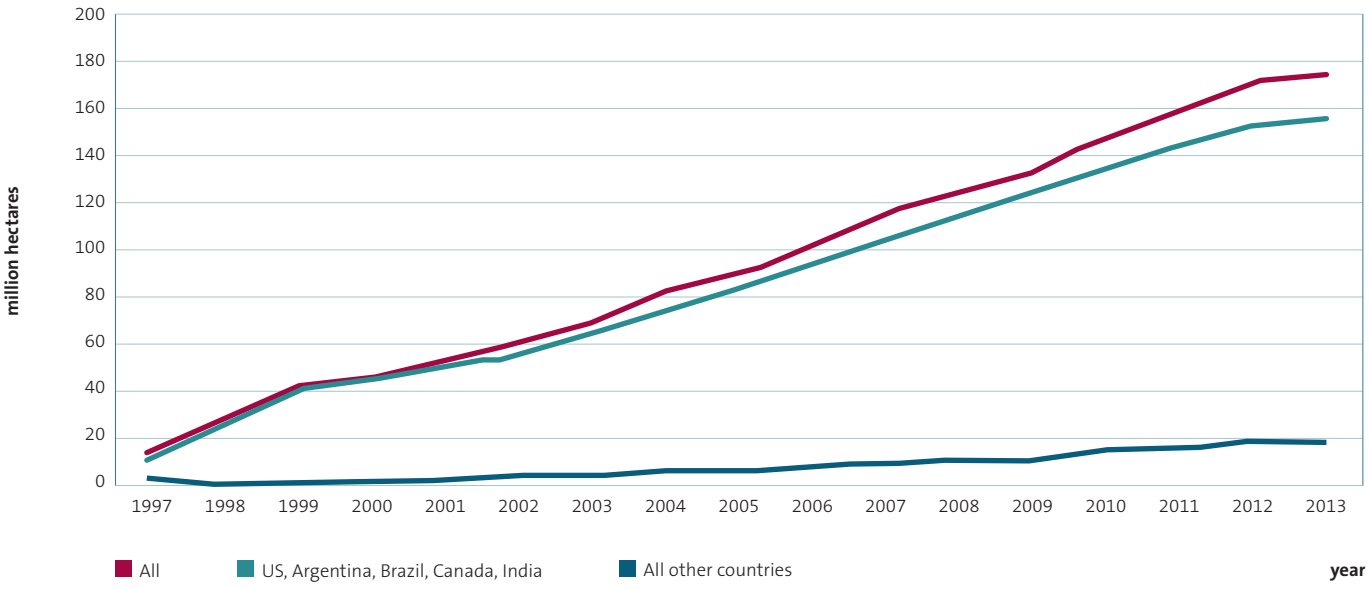
Canada has approved GM canola, maize and sugar beet, but there is no government data on how much is grown. Canada also approved production of genetically engineered fish eggs in 2013.

This is the first time that the genetic modification of an animal has been authorised for food purposes. The eggs will be shipped to Panama for production. Researchers are developing some 35 species of GM fish, using genes from coral, mice, bacteria and even humans.[7] The US Food and Drug Administration (FDA) announced it was considering an application to approve GM salmon for human consumption. Several retailers in the US and Europe have announced that they will not sell GM seafood.[8]

South America

In South America, GM soy, maize and cotton are grown most extensively in Brazil, Argentina and Paraguay. In Brazil, where 89 per cent of the soy is GM, Monsanto has been ordered to compensate farmers after a court ruled that the royalty fees being charged for Roundup Ready soy were unlawful. Claims from farmers are estimated to be in the region of $US 1 billon.[9]

FIGURE 2 **GLOBAL AREA OF GM CROPS**



Source: *Based on ISAAA annual reviews of GM crop area. *data for 1988 excludes China.*

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Asia

In Asia, GM insect-resistant cotton is grown in India, China, Pakistan, and Myanmar, while GM maize is grown in the Philippines. In India, public protests led to a moratorium on the commercial introduction of Bt brinjal (aubergine). Attempts to introduce GM rice, GM papaya and GM maize to Thailand have so far failed,[10] although new varieties of GM papaya, sweet potato, cotton and abaca are under development in the Philippines.[11]

Asia has also been the testing ground for the first nutrient-enhanced GM crop, 'Golden Rice', with field trials carried out in the Philippines, with funding from the Bill and Melinda Gates Foundation. The crop has been genetically modified to increase levels of pro-vitamin A, designed to counter vitamin A deficiency which is a major problem in some developing countries and the major cause of blindness in children.[12] There is widespread public concern about the wider impacts on farmers of Golden Rice and some of the field trials were destroyed by protestors.[13] Little data is currently available about the effectiveness of Golden rice[14] in curing Vit A deficiency and there do not appear to be plans to be make it available commercially. China, one of the world's biggest rice producers, is reported to have decided not to commercialise GM rice because of concerns about safety.[15] Even advocates of Golden Rice recognise that it is not the best solution to malnutrition.

"The best way to avoid micronutrient deficiencies is by way of a varied diet, rich in vegetables, fruits and animal products.[16]

Africa

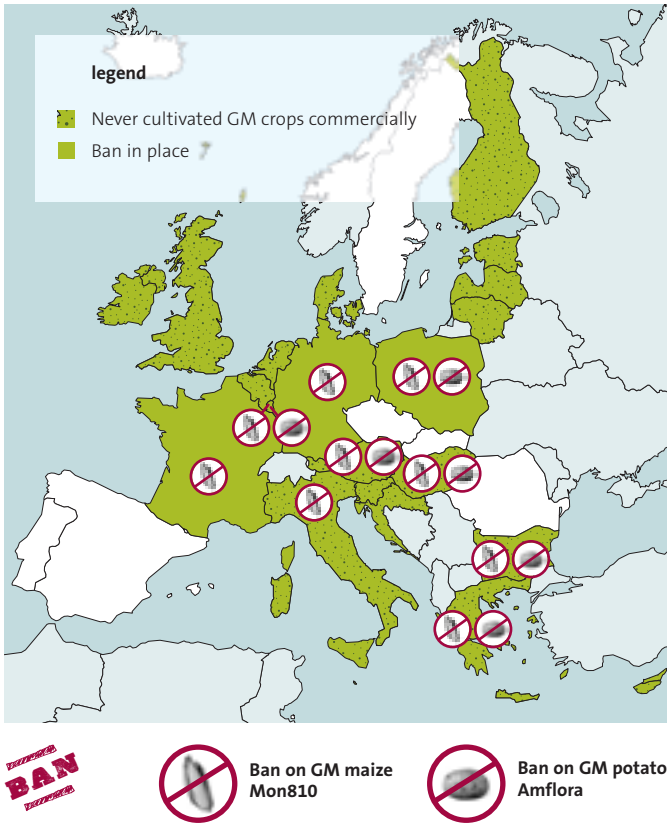
In Africa, GM crops are grown only in three countries (South Africa, Burkina Faso and Sudan), but as this report shows, the biotech industry has ambitions to extend its market into Africa, with the development of other nutrient-enhanced GM crops. Research is underway to add vitamin A and other micronutrients to African staple crops such as cassava, sweet potato and sorghum. African countries are under extreme pressure to allow GM crops in their countries, with industry associations lobbying heavily against a Kenyan decision to introduce a ban.[17]

But African countries are also increasingly looking to alternative agricultural solutions, drawing on local knowledge and research to find more sustainable solutions. Co-chair of the biggest global assessment of agricultural science and winner of the World Food Prize and Alternative Nobel Prize, Hans Herren has said that such approaches have revealed far greater success in terms of increasing yields, and in pest control.[18]

Europe

In Europe, GM crops are only being grown on around 0.14 per cent of the farm land.[19] One of the two previously authorised GM crops had its authorisation annulled by the highest European Court in 2013 and a number of European countries have banned the cultivation of GM crops.[20] In recent years public concern in the EU about GMOs has increased to 66 per cent, up four points.[21] Faced with this resistance, biotech company BASF announced in 2012 that promoting GM crops in Europe no longer made business sense,[22] and Monsanto has withdrawn some of its applications from the authorisation process. But a number of GM applications remain, including a new variety of maize recommended for approval by the European Commission in 2013 despite opposition from the European Parliament and most member states.[23]

FIGURE 3 **GMO-FREE EUROPEAN UNION**



Source: *Reuters (2013). Italy moves to ban growing of Genetically Modified Maize Type, http://www.reuters.com/article/2013/07/12/us-italy-gmoidUSBRE96B0OS20130712; EU Business (2013) Poland bans cultivation of GM maize, potatoes, http://www.eubusiness.com/news-eu/poland-biotech.llx/ ; ISAAA (2014). Special Brief 46 – 2013 Executive Summary, Global Status of Commercialised Biotech/GM Crops: 2013, http://www.isaaa.org/resources/publications/briefs/46/executivesummary/default.asp*

Evidence of impacts

While there has been no systematic international evaluation of GM crops, there is a growing body of evidence based on the experience of farmers and communities, which raises serious questions about their environmental impacts. Scientific discussions about these impacts have become highly politicised.

More than 99 per cent of the GM crops grown are herbicide tolerant, insect resistant or a combination of both.[24] These crops are essentially extensions of the pesticide-dependent model of industrial agriculture, suited to large scale, corporate-based food production. The industry claims these crops help reduce the environmental impact of these industrial models, but the evidence from farmers and rural communities suggests that this is not the case.

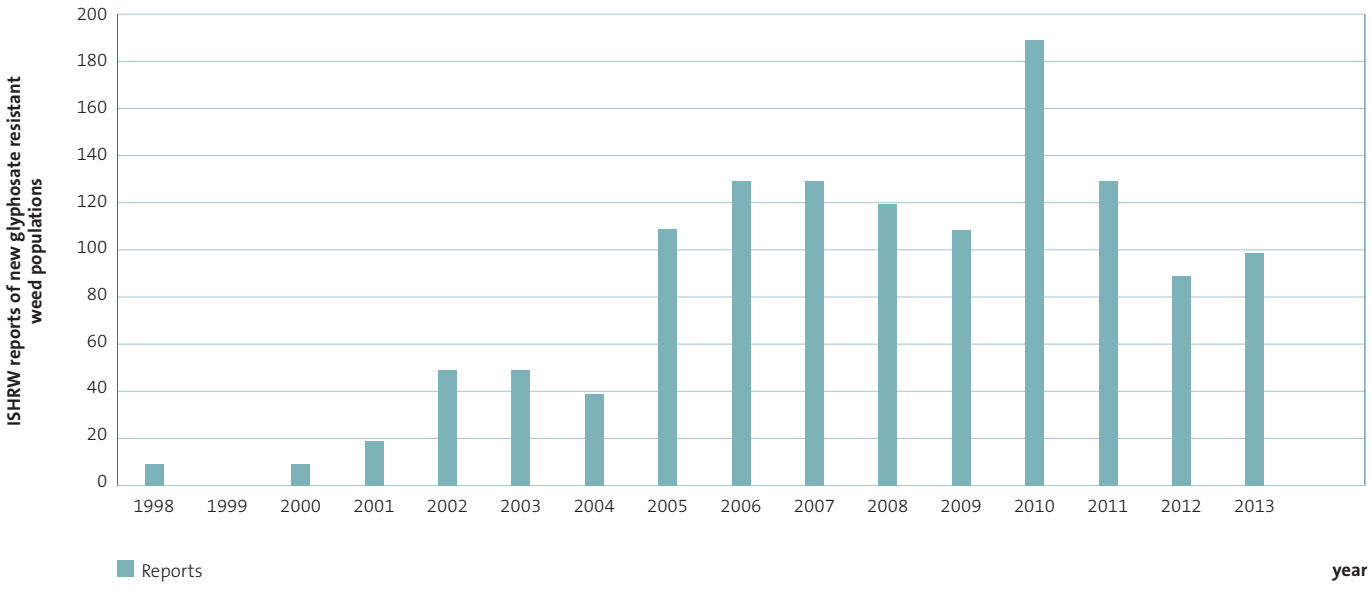
Farmers in the US, India and Argentina have reported that they need to use increasing levels of pesticides on GM crops,[25,26,27] and evidence from communities in Argentina and Paraguay has raised concerns about the health impacts of these pesticides.[28, 29, 30] Costs have also been reportedly rising for GM seeds.[31]

In the US, 21 different weed species have been identified that show resistance to glyphosate herbicides,[32] with almost half of farmers affected.[33] In Canada, 12 per cent of farmers in Ontario have reported problems with glyphosate-resistant weeds.[34] Monsanto now advises farmers to use a mix of chemical products and to plough, which would seem to undermine its claims about the supposed environmental benefits of this model of farming.

Government data from India suggests that after an initial reduction in pesticide use, farmers growing genetically modified Bt cotton need to increase pesticide use after the first two years,[35] as insects develop resistance to the toxin in the plant. A recent scientific review found that at least five species of major pests have evolved resistance to Bt crops by 2010 – up from just one in 2005.[36]

The Monarch Butterfly appears to be one victim of the spread of GM crops. In January 2014 it was reported that the number of these butterflies returning to Mexico to overwinter had declined to the lowest level since surveys began in 1993.[37] Scientists believe a major factor in the decline is the rapid disappearance of milkweed from US fields as a result of the pesticide treatment for GM resistant crops.[38,39] Milkweed is the only food source for the Monarch butterfly caterpillars – but levels have plummeted in maize and soybean fields.

FIGURE 4 **REPORTS OF GLYPHOSATE RESISTANT WEED POPULATIONS IN THE USA**



Source: *Based on data from the International Survey of Herbicide Resistant Weeds (ISHRW).*

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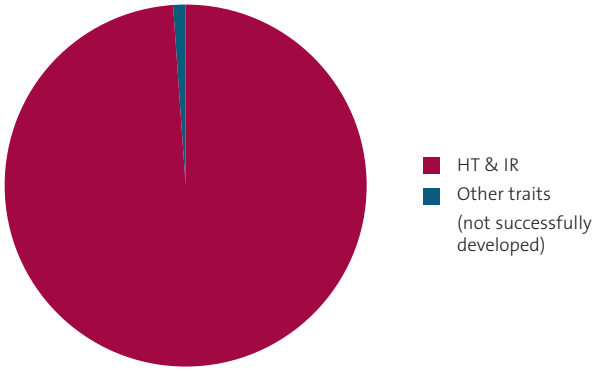
In Argentina links have been made between high levels of pesticide use in areas growing GM crops and increased cancer rates and birth defects.[40] In the soy-growing Chaco region of Argentina, the rate of congenital birth defects is reported to have quadrupled.[41]

More than 200 scientists, physicians, academics and experts signed an open letter in 2013 declaring that there was no consensus on the safety of GM crops, highlighting the lack of epidemiological studies on the potential health effects of GM food.[42]

FIGURE 5

SHARE OF GM CROPS THAT ARE HERBICIDE TOLERANT (HT) AND INSECT RESISTANT (IR)



Source: *Based on ISAAA Special Brief 44 (2012), http://www.isaaa.org/resources/publications/briefs/44/executivesummary/ and Nature Special Report, GMO Crops: Promise and Reality, http://www.nature.com/news/specials/gmcrops/index.html*

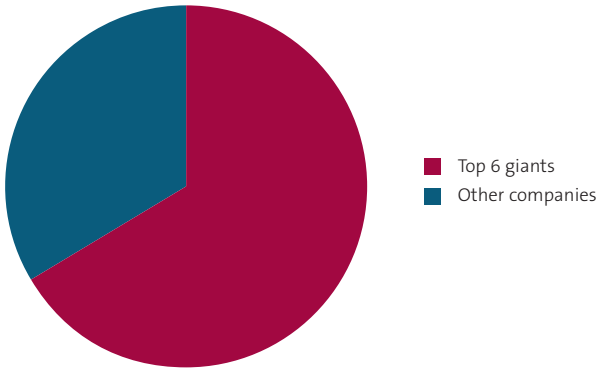
Rising costs

The rising costs of seeds and inputs reflect the near-monopoly power of the biotech companies, and the growing market concentration in the wider agricultural input sector. Monsanto controls 98 per cent of the US seed market for soy and 79 per cent of the maize market,[43] while in South Africa the company has a *de facto* monopoly over the R1.5 billion market for GM maize seed,[44] as all seeds contain Monsanto patented traits.

The high cost of seeds is seen as a particular problem for small farmers, many of whom already struggle with debt. A study in Burkina Faso found that because of the high costs, the risks of GM cotton production were *"disproportionately high."*[45] A study in the Philippines found that many GM maize farmers did not know they were growing GM maize because seeds were not clearly labelled.[46] The same study found many farmers were getting into debt because of the cost of the seeds and inputs needed.

FIGURE 6

BIOTECH COMPANIES MONOPOLIZE GLOBAL SEED MARKET



Global Seed Sales totalled US$34,495 million in 2011

The same six multinational companies — Monsanto, DuPont, Syngenta, Bayer, Dow, and BASF — control:

75% of all private sector plant breeding research
60% of the commercial seed market
100% of the GM seed market
76% of global agrochemical sales

Source: *ETC Group (2013). Gene Giants See Philanthrogopoly, http://www.etcgroup.org/content/gene-giants-seek-philanthrogopoly and ETC Group (2013) 'Putting the Cartel before the Horses and Farm, Seeds, Soil and Peasants' http://www.etcgroup.org/content/new-report-putting-cartel-horse%E2%80%A6and-farmseeds-soil-peasants#_edn1*

Tackling hunger

Those calling for a new Green Revolution argue that what is needed to tackle hunger is more intensified agriculture, which relies heavily on increasing use of non-renewable resources such as fertilizers and fossil fuels. There is mounting evidence that this system of farming is destroying the resource base we rely on to produce food.[47, 48] Genetically modified crops have been developed as part of this damaging industrial model and it seems unlikely that they can successfully be adapted to meet the challenges and needs of smallholder farmers in the poorest parts of the world.

The causes of chronic hunger are rarely to do with low crop yields *per se*, but are related to poverty, inequality of food access, and inequality of access to land and resources with which to grow food.[49] Yet much of the food we currently grow is not used efficiently. Over half of cereals produced globally go towards feeding livestock in intensive systems,[50] and approximately 1.3 billion tons of the food produced for human consumption is lost or wasted.[51]

Growing support for agro-ecology

At the same time there is growing evidence from around the world of sustainable food and farming models that guarantee food sovereignty while respecting and developing the role of small holders. The main such approach, agroecology, is both a science and a set of practices, as well as a social and political movement. It is the approach increasingly called for by international agencies as well as millions of small scale farmers. These approaches can control pests and also dramatically increase yields, doubling them in some countries.[52]

Rather than relying on expensive inputs, farmers in Africa are increasingly turning to the 'push-pull' method to control pests. For example, they use inter-cropping with repellent plants to deter the insects, alongside a border of more attractive plants which entice the pests away.[53]

Agro-ecological intensification methods have also been shown to successfully increase rice yields by as much as a third, according to studies in Kenya.[54] The ´system of rice intensification´ known as SRI, uses a less intensive method of planting for irrigated crops in order to increase yields. Organic matter is added to improve soil fertility, water use is reduced, and planting methods are designed to improve the vigour of individual plants.[55]

As a way to improve the resilience and sustainability of food systems, agroecology is now supported by an increasingly wide range of experts within the scientific community.[56, 57, 58]

BOX 1: Food sovereignty

Friends of the Earth International adheres to the definition of food sovereignty (established by the Nyeleni Forum on Food Sovereignty in 2007) as the right of all peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.

Food sovereignty puts those who produce, distribute and consume food at the heart of food systems and policies, rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers an alternative to the current trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers. Food sovereignty prioritises local and national economies and markets and empowers peasant and small-scale sustainable farmer-driven agriculture, artisanal fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. See **www.nyeleni.org**

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There are cheaper, better and more readily available solutions than GM crops to address hunger and malnutrition. Governments, policy advisors, donors and international agencies should:

- *Build capacity to produce food for local consumption rather than for export, with an emphasis on small-scale farmers*
- *Increase investment in agro-ecology to support small farmers including:*
  - *Participatory research that uses small holders' traditional knowledge combined with modern approaches*
  - *Research into enabling development and access to low cost traditional varieties of seeds and livestock breeds, led by local communities*
  - *Provision of agricultural extension services so farmers can access and implement knowledge that will enable them to farm more sustainably, and which can ensure that farmers are involved in developing research programmes*
  - *Support for the establishment of farmers' cooperatives and other producer organizations for small holders ensuring local and national markets can work for smallholders*
- *End the large amounts of crops and land diverted from food to agrofuel production*
- *Introduce measures to reduce high levels of consumption of livestock products in rich countries that are eating up global grain supplies*
- *Reduce high levels of retail and household waste in rich countries, and prevent post-harvest loss in the developing world*

"There are cheaper, better and more readily available solutions than GM crops to address hunger and malnutrition."

footnotes

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