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ORGANIC AGRICULTURE CAN FEED THE WORLD

EKOLOŠKA POLJOPRIVREDA MOŽE HRANITI SVIJET

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ABSTRACT

Conventional high-input farming is unsustainable because of its effects on the soil and on the rural economy and because of its heavy reliance on oil both as fuel and as the source of fertilizer. Genetic modification is claimed in some quarters to have the potential to increase yields and decrease the dependence on oil, but so far it has singularly failed to deliver and there is very little to suggest that it ever will. What is more, the present technology involves many hazards to human health and to the environment and these are being deliberately ignored rather than addressed.

The alternative to high-input and GM is to use organic agriculture and farming methods that require little or no external inputs.

Many people, however, argue that attractive though this idea may be, and despite the growing evidence that organically produced crops are superior, it simply cannot provide the amount of food that ten billion people are going to need.

Until recently, there were no large scale direct comparisons of organic and conventional agriculture to support or refute this claim. In 1997, however, the government of Ethiopia, which had previously tried to promote a version of the so-called Green Revolution, introduced a new Environmental Policy. Part of the implementation of this policy involved the growing of a number of crops on many farms using either no fertilizer, chemical fertilizer, or compost. Over the six years from 2000 to 2006, data were collected for almost a thousand farmers' fields. In particular, there is a large amount of data for five crops that are especially important in Ethiopia: barley, durum wheat, faba beans, maize and teff.

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For all five crops, higher yields were achieved with compost than with chemical fertilizers. When combined with other practices such as the anaerobic digestion of waste, organic agriculture is capable of feeding the world sustainably.

Key words: high-input farming, genetic modification, organic agriculture, feeding the world.

SAŽETAK

Konvencionalna poljoprivreda velikih ulaganja je neodrživa zbog utjecaja na tlo i na ekonomiju sela. Ona je ovisna o nafti i mineralnim gnojivima. Premda je korištenje genetičke modifikacije najavljeno kao metoda koja će uvećati urode i smanjiti ovisnost o nafti, do sada se ta obećanja nisu ispunila, a mala je vjerojatnost da ikada hoće. Što više, moderna poljoprivredna tehnologija uključuje mnoge rizike po ljudsko zdravlje i po okoliš. Ovi su rizici, umjesto da budu naglašeni, svjesno zanemarivani. Ekološka poljoprivreda s malo vanjskih ulaganja alternative je konvencionalnoj industrijskoj poljoprivredi i GM. Međutim, mnogi prigovori su da iako atraktivna, ova metoda nije u stanju osigurati hranu za 10 milijardi stanovnika. Do nedavno nije bilo podataka o usporedbi ove dvije metode. Međutim, 1997. vlada Etiopije, koja je prije zastupala ideju tzv. Zelene revolucije, uvodi novu ekološku politiku. Dio te politike bio je komparativni uzgoj usjeva: bez gnojiva, s kemijskim gnojivima i s kompostom. Tijekom 6 godina (2000 -2006.), na gotovo tisuću farmi sakupljani su podaci za pet usjeva (ječam, durum pšenica, bob, kukuruz i tef.). Kod svih pet usjeva postignuti su značajno viši urodi uz primjenu komposta. U kombinaciji s drugim ekološkim metodama kao što je npr. Proizvodnja metana i komposta anaerobnim vrenjem organskog otpada, ekološka poljoprivreda je održiva i može hraniti Svijet.

Ključne riječi: industrijska poljoprivreda, genetičke modifikacije, ekološka poljoprivreda, prehrana čovječanstva.

In agriculture, the starting point, I think, has to be the recognition that the commercial industrial technologies that are used in agriculture today to feed the world are technologies that are not inherently sustainable and they have not worked well to promote either self-sufficiency or food security in developing countries. [1]

The world needs sustainable agriculture, pretty much by definition. And as the author of the above quotation, Monsanto's Robert Shapiro, has also said, feeding the world sustainably "is out of the question with current agricultural practice ... Loss of topsoil, salinity of soil as a result of irrigation and ultimate reliance on petrochemicals [which are] obviously not renewable. That clearly isn't sustainable." [2]

GM IS NOT THE ANSWER

If we cannot go on as we have been, what is the alternative? For Shapiro, of course, and for many others as well, the answer is obvious: GMOs. Genetic engineering, so we are told, is going to save the world. It has the potential to increase yields, it has the potential to permit farming without pesticides and with less herbicide, it has the potential to allow crops to grow in conditions of drought or salinity, and so on. I've used the expression "has the potential to" deliberately because it's what you see in the papers and hear on the radio and TV all the time. The GM lobby promises all sorts of wonderful things but so far almost all they've produced are plants that are resistant to specific proprietary herbicides or produce their own pesticides, and these have neither led to greater yields nor reduced the amount of chemicals sprayed on to fields. What is more, the weeds and the pests are becoming resistant to the herbicides and pesticides, so things are getting worse, not better.

GM also involves dangers to health and the environment. These have been deliberately ignored and, what is worse, the scientists who have investigated them have been prevented from carrying on their work. I haven't time to talk about this, but we mustn't forget it. I'll just point out that in the UK we often hear the claim, "There is no evidence that anyone has ever been harmed by eating GM food." Unfortunately, even if that statement is true, it is not as reassuring as it is meant to be.

First, if there is no evidence for humans being harmed, that is because that would require a proper epidemiological study, and you can't do that without a control group, which does not exist. We do not know if the health of Americans who have been eating GM foods for many years has been affected because we cannot compare those who ate them with a similar group who did not. We know that over that period there has been a large increase in the number of people with serious allergies, but we have no way of determining whether this was due

to GM foods or to some other factor. What we have is an absence of evidence, not evidence of absence. Second, no one bothers to mention that there is evidence of *animals* being harmed [3]. Third, there is certainly evidence of humans being harmed not by eating GM maize but by breathing the pollen. [4] You want to be suspicious when people are being particularly careful about the words they use.

The only sector that stands to gain from GM is the biotech industry. If they can get GM crops adopted all over the world, they can look forward to massive profits because GM varieties, unlike conventional ones, can be patented. Farmers are not permitted to save seeds from one year to the next; they have to buy new ones each year from the company. This is already having a devastating effect in India because farmers borrow money to buy the seeds and if the crop fails (which it can, because GM does not mean Guaranteed Moneymaker, whatever the company says) they lose their farms. This has led to thousands of suicides.

This is the world of business, not science and certainly not philanthropy. The rules are different and the companies are playing for very high stakes. So you can't expect them to fight fair, and of course, they don't. Never mind, the experts tell us. We have to go down this road because there is no alternative. If you oppose GM you are not only opposing the progress of science, you are condemning millions of people to starvation. What is more, if you live in a developed country you are being immoral as well, because it is in the third world that the effects of your self-indulgence will be felt. You mustn't be fooled by such emotional blackmail. In 2002, when Zambia refused to accept GM maize food aid from the USA, Tony Hall, then the US Ambassador to the UN food agencies, said, "People that deny food to their people, that are in fact starving people to death should be held responsible...for the highest crimes against humanity in the highest courts in the world." In fact, there was enough food in Zambia itself, only it was at the wrong end of the country, and the famine was averted when the EU paid for it to be transported from where it was to where it was needed. Which, by the way, is precisely what the 1999 Food Aid Convention, which the USA has signed, says should have been done: wherever possible, food for aid should be sourced locally.

You should always be suspicious when someone tells you that there is no alternative, especially when what they are proposing happens to be very much in their own interests. In this case, the Americans were looking for a market for

surplus maize (even if it was the US government that was paying) and, much more importantly, were trying to force Africa to accept GM. The plan was that some of the maize would inevitably find its way into the hands of farmers who would sow it and thus introduce GM crops to Africa. That could have been avoided by milling the maize before it was shipped, which the Americans flatly refused to do. A bit of real blackmail, when you come right down to it, and Hall's tirade about crimes against humanity was staggering in its hypocrisy. And just as there was an alternative in Zambia, so there is for the world. And it is good old fashioned organic agriculture. Well, not necessarily old fashioned, but certainly good and certainly organic [5].

ORGANIC CAN OUTPERFORM CONVENTIONAL

Can organic agriculture really feed the world? Lots of experts say it can't. And that does sound plausible if you live in a city in the developed world. Here, "organic" means the produce that you find in special stores or on designated shelves in supermarkets, always at a higher price than the equivalent non-organic items. Buying it may make us feel good, we may think it tastes better, and we may even believe that it is better for us (though the authorities are doing their best to convince us that it is not) but it doesn't make organic agriculture seem an effective way of producing the large amount of food that we're going to need to feed ten billion people.

Actually, it is, but you have to look more carefully. We mustn't compare niche growing and marketing with what organic would be like if it were the mainstream. We must remember that a lot of the extra we pay for organic is the costs associated with certification and segregation. We shouldn't look only at farms that are certified organic when many farmers even in the developed world operate what are by most standards organic farms but don't choose to get involved with certification. We should look at the picture over a period of time – the Green Revolution looked very successful in the beginning but high input farming does take its toll, as the CEO of Monsanto reminds us. And we should bear in mind that the apparent efficiency of conventional farming depends heavily on the historically low price of fossil fuels and petrochemicals. In fact, there has been evidence for a long time that when you compare like with like, organic farming comes off very well. A lot of it has recently been brought together in an important paper by Badgley and her colleagues at the University of Michigan [6]. Interestingly, they found that organic farming did slightly less

well than conventional agriculture in the developed world but slightly better in the developing world. Recently, however, we have something which as far as I know had never been done before, the results of a large scale experiment in which organic and non-organic crops were grown under similar conditions in a large number of different locations. This experiment was carried out in Tigray, a province of northern Ethiopia, and over a period of seven years, and it shows very clearly the superiority of organic farming [7,8].

Ethiopia is the third most populous country in Africa. Agriculture has been carried on there for a very long time, at least 5000 years, and up until the modern era was highly successful. Travellers from Europe in the 17th century, for example, remarked on how productive the country was. From the mid 19th century onwards, Ethiopia became more and more centralised. The loss of local governance undermined local resource management such as the protection of woody vegetation and the repair of old terraces. I mention this to stress that the reason Ethiopia was not able to feed itself was not that its farmers were backward and ignorant. On the contrary, it was because the actions of powerful people from outside the local communities and with their own agendas prevented the farmers from continuing the practices that they had developed over many centuries.

The military regime that overthrew Emperor Haile Selassie in 1974 did make efforts to rehabilitate the land, but under their centralised administration there was no increase in productivity. In 1991 the military government was itself overthrown and since 1995 Ethiopia has had a new constitution that provides for decentralisation and encourages local community governance. In 1993, it began to adopt the Sasakawa-Global 2000 approach, which was aimed at bringing the "Green Revolution" to sub-Saharan Africa. At first, the costs of the high external inputs this requires were subsidised, but the subsidy was removed in 1998 and since then the local prices of diammonium phosphate and urea, the chemical fertilisers used in Ethiopia, have doubled, as they have in other sub-Saharan countries such as Ghana.

Overall grain production in Ethiopia has increased every year since 1998. That's what you'd expect, given the state it was in before. But the Green Revolution, which requires an ample supply of water, was of no help to farmers in the drought-prone east and northeast regions. So in 1995, the Institute for Sustainable Development developed a project to work with local communities of Tigray farmers with small holdings, using an ecological, low external input

approach. (The average amount of cultivated land per household in Tigray is less than one hectare, usually in several separate small parcels.)

The aims were to

- Restore soil fertility and help farmers avoid debts by using compost instead of chemical fertilisers
- Improve water and soil conservation in crop land including rehabilitation of gullies
- Control, preferably stop, free range grazing to allow grass, herbs and trees to grow
- Establish plants, new and indigenous, in areas treated for soil and water conservation
- Help local communities to restore local control and management of their natural resources

Note that this was far more than a mere decision not to use chemical fertilisers. I'll come back to that later on, but when we speak of organic agriculture we must mean something more than that. It's being both clever and wise, using modern science and also working with nature instead of dumping chemicals on to extract what we want by brute strength – for as long as that works.

The project gave the ISD the opportunity to carry out a unique experiment. They were in contact with hundreds of farmers who were growing a variety of crops and using different methods of fertilising the soil. So as part of the project they asked the farmers to cooperate in taking yield samples from their fields in a systematic way that allowed the data to be analysed statistically.

Between 2000 and 2006, grain and straw yield data were taken separately from 974 plots. The results were clear and consistent. For all crops, both plots treated with compost and plots treated with chemical fertilisers had yields that were significantly greater than plots that received no treatment. For all crops, the mean yield in plots treated with compost was higher than in plots treated with chemicals, by about 30% on average. The difference was statistically significant for all crops but one, and in that case (faba bean) the number treated with chemicals was really too small to allow a proper comparison.

Table 1: Summary of yield data for five main crops (kg/ha). From [8]. Teff is the grain that is used to make injera, the characteristic Ethiopian bread.

Barley

Treatment	No.	Mean (kg/ha)	95% confidence interval of mean
Check	165	1 116	(---x---)
Compost	171	2 349	(--x--)
Fertilizer	108	1 861	(---x---)

100 150 200 250

Wheat

Treatment	No.	Mean (kg/ha)	95% confidence interval of mean
Check	219	1 228	(--x--)
Compost	183	2 494	(---x---)
Fertilizer	144	1 692	(-----x-----)

100 150 200 250

Maize

Treatment	No.	Mean (kg/ha)	95% confidence interval of mean
Check	87	1 642	(---x---)
Compost	117	3 552	(---x---)
Fertilizer	69	2 736	(---x---)

120 240 360 480

Teff

Treatment	No.	Mean (kg/ha)	95% confidence interval of mean
Check	312	1 151	(----x----)
Compost	222	2 264	(--x--)
Fertilizer	207	1 171	(---x---)

0 70 140 210

Faba Bean

Treatment	No.	Mean (kg/ha)	95% confidence interval of mean
Check	60	1 739	(------x------)
Compost	72	2 862	(----x----)
Fertilizer	9	2 696	(----------x----------)

80 160 240 320

(A word about the statistics, for those who are interested. If you compare compost and chemicals using the ordinary t-test, you get significance at the 1% level for everything except the faba bean. The error bars are very large because there was a lot of variability among the sites and that made the standard deviations very large. To get a feel for what was happening, I carried out a 2-way ANOVA on some of the barley data that happened to be structured in a way that allowed it. I got highly significant variation both for treatment and for location, and also for interaction.)

I mention this to stress that the results are conservative. Had the experiment been designed to allow a more sophisticated analysis, I'm sure the differences would have been even more significant than are shown here. There is no doubt at all: compost really did improve yields better than chemical fertiliser.

These are really very important results. This is the first comparison of its kind on such a scale, and it was carried out by real farmers in the third world. So much for the argument that organic agriculture is fine for those of us that can afford the luxury, but not for making sure that everyone on the planet has enough to eat.

Why has there not been such a study in the developed world? Well, I can think of a number of reasons. One of the most important is that this was part of a major rehabilitation project in Tigray, the aim of which was to repair damage that had been done over a century and a half. This gave the organisers the opportunity to interact with a very large number of farmers and a strong incentive for finding out what really works. It also gave the farmers an incentive for participating, since they would be even more concerned to find out what would work for them. There is less incentive in a prosperous area where most farmers are already content with what they are doing.

There is, of course, another reason. These results are very important for farmers the world over. They show that it is possible to get even better yields using compost, which is essentially free, than chemicals, which are expensive and bound to be more expensive in the future. And with no recourse to GM, which for farmers means (on top of everything else) having to buy seeds every year rather than saving them.

But that is also precisely the major objection to the work. If farmers can manage without fertilisers, there are no profits for the companies that manufacture them. If farmers can manage without GM, there are no profits for Monsanto and the rest of the biotech industry.

Remember, if you invent a new kind of fertiliser or create a new GM variety, you can patent it and make lots of money. If, however, you show that farmers can improve their yields and profitability by composting instead of using chemical fertilisers, or by intercropping instead of spraying pesticides, the farmers will be better off, the world will be better off, and you won't get a penny.

That obviously means that industry won't invest in that kind of research, but these days universities and government research establishments are supposed to raise their own research funds and to concentrate on "wealth creation", so they too are concentrating more and more on what is patentable. Worse, those who are promoting chemical and GM solutions to the same problem will do everything they can to stop you, as many scientists have found to their cost. The same is true in health care, where the record of the big pharmaceutical companies is disgraceful.

As you all know, compost has other advantages as well. First of all, it's essentially free, whereas chemical fertiliser costs money, and is getting more expensive as the price of oil rises. It provides more than just nitrate or phosphate or whatever the chemical company chooses to put in. It is returning to the soil almost everything that growing the crops or raising the animals took out of it, and especially things like the trace elements that no one noticed. It also does not lead to high nitrate levels in rivers.

On that last point, about 20 years ago, Mae Wan Ho and I visited a small village in northern Thailand. The mayor explained how workers from some UN agency had come and offered them fertiliser for their crops. They had tried it, he told us, but they had given it up. We asked him why, and he explained that they seemed to be putting a lot of fertiliser on, and in return were getting only a very small increase in yield. "We wondered where the rest of the fertiliser was going," he said, "and when no one could tell us, we stopped using it." I have to admit I was surprised by the sophistication of this man whose village had at the time only just been connected to the rest of the country by a road and an electric power line, but of course I shouldn't have been. There's a lot of real science in the world that isn't done by people who call themselves scientists and that doesn't appear in scientific journals.

It seems to me there are three important things about organic agriculture that are generally neglected by its opponents and perhaps not stressed as much as they ought to be by its supporters. First, it can produce yields that are just as good or even better than can be achieved with chemicals. This is especially true under third world conditions. High input farming is better suited to large monoculture farms in developed countries. In both developed and developing countries, by the way, the yields on small farms are better than on large ones. Organic farming uses less petrochemicals and less fossil fuel than conventional farming, but it tends to be more labour intensive. Since everybody agrees that

we are going to have a shortage of oil, whereas nobody expects a shortage of people, it makes little sense to go out of our way to replace a resource we have a surplus of by one that is rapidly running out, whatever the accountants may say.

A third point is that organic is portrayed as an attempt to return to the old days. It is not, far from it. What we need is an organic agriculture that combines the knowledge and experience that farmers have acquired over many generations with whatever modern science can contribute. Even in its present state, organic agriculture can feed the world. Think how much better it could do if the same sort of funding and effort that has gone into developing GM was put into research into improving organic farming.

DREAM FARM 2

To get the full benefit from organic agriculture it should be a part of a whole scheme all of which is designed to be sustainable. In fact, while "organic" has come to mean "grown without chemicals", that's too narrow a definition. The use of chemicals is obviously a key issue, but it's not the only thing that should concern us. Even the EU regulation on organic agriculture deals with the environment and animal welfare.

The aims of the Ethiopian project included far more than just using compost, and I'm sure that was right. If organic agriculture even in the limited sense of the word can produce the sorts of yields we need to feed the world, we should go on to see how we can expand it into a truly organic and sustainable agriculture. And this is what we are trying to do in developing what we call Dream Farm 2. The number 2 is in the name because the original Dream Farm was an idea of George Chan, an engineer from Mauritius who has been working on this sort of thing since the Second War. Starting from what he accomplished in many countries, and inspired by his vision, we are trying to take the concept forward.

There is a diagram of a complete Dream Farm 2 on page 152. You'll probably find it too complicated to take in quickly, and so it is. To get minimum input and minimum waste you have to do a lot of cycling and recycling and that tends to make things a bit complex. But it's not so difficult to understand if you build it up a bit at a time.

For example, there are two ways of supplying nutrients to a plant. You can use a one-pass method: you put chemical fertiliser on the land, some goes into the plant and the rest runs off. When you harvest, you dispose of the parts of the plant you don't use, which is most of it, and then next season you buy more fertiliser and start again. Alternatively, you can set up a simple cycle. You collect the leftover vegetable matter and the manure from your animals. You turn these into compost, and so put them back into the soil to be used again. Very little is wasted, and so very little has to be supplied from outside. Of course farmers have been doing this for millennia. What is more, we now have scientific evidence that it works better than pouring chemicals on. But we can improve on it. Composting releases methane into the atmosphere, and methane is a very strong greenhouse gas, much worse than CO_2. Methane is, however, also a very good source of energy, and because it has four hydrogen atoms and only one carbon, most of what is produced when it burns is water.

That's why at the centre of the diagram there is an anaerobic digester. Organic waste of just about any kind is broken down by bacteria and the methane that is given off is captured and stored to be used as fuel. From the digester we also obtain solid matter which is used as fertiliser. The water that comes out is not potable, but we can pass it through an algal basin to get rid of the pollutants. It can then go into fish ponds, where the fish will remove any remaining organic material, and now it is pure enough to drink or to feed back into the river from which it may have come in the first place, thus completing another cycle. As for the fish, we can eat them. Naturally, all the waste associated with that process goes into the digester – more cycles. If you look at every process and ask if there is a better way, and especially if you look at everything that is considered waste and ask how it can be put to use, you end up with a diagram like Figure 1.

If you look at every process and ask if there is a better way, and especially if you look at everything that is considered waste and ask how it can be put to use, you end up with a diagram like the one on page 152. Of course the cycle at the heart of everything is the one in which we collect seeds from the plants and, instead of discarding them as waste, carefully put them back into the earth to start next year's crop. Farmers who adopt GM do not utilise even that cycle; they aren't allowed to save their seeds but must buy them from the company every year. That really symbolises how far apart GM and Dream Farm 2 are.

Unlike the claims that are made for GM, what I've been describing is not a pipe dream. Biogas digesters are already are in use. Small ones have been used in China for centuries and the simple design, the so-called China dome, is being used in other countries as well. These are often used chiefly for sanitation and are seen as good value even before you factor in the fuel. There are industrial size digesters in Sweden and France that produce fuel that is used mostly for busses because without a network of supply stations, biogas is currently better suited for vehicles that stay in the vicinity of their home base. Of course this includes all the tractors and other machinery that a farmer himself would use; a digester could produce all the energy that the farm needs and leave some over to be sold, for example as electricity to be fed into the national system just as wind-generated energy is in Germany.

The only real problem is in the middle range, digesters in the range of about 500 to 1000 litres, which is what a typical farmer in many countries would need. There's no difficulty in principle; the problem is finding a design that is relatively cheap to build, preferably by local labour. It has to be robust, so that it is unlikely to go wrong or, if it does, is easily repaired by local semi-skilled labour. It needs good internal circulation to ensure that whatever is taken from the digester has actually been in it long enough to have been broken down by the bacteria; waste must not be allowed to enter and pass directly to the outlet. But those aren't insuperable problems, and if a tiny fraction of the millions that have gone into research into nuclear power and GM crops had been allocated to anaerobic digesters, they'd have been overcome long ago. We were in China last year and saw a prototype of a new design in Nanjing. It looks promising but the trials are not yet complete – it works, but we don't yet know if it is as efficient as the inventor hopes, or if needs more tweaking.

You can see how the Dream Farm idea differs from the industrial model of farming from a criticism made by Dennis Avery, a member of the Hudson Institute in Washington and, as you'd expect, an opponent of organic agriculture [9]. Avery claims that poor farmers find it hard to get and manage compost, whereas chemical fertiliser is cheap (well, that's what he says) and all you have to do is pour it on. Now in Ethiopia the farmers, who were certainly not well off, didn't seem to have any problems about getting or dealing with compost and the price of chemical fertiliser has been rising rapidly. They also found that, unlike with chemical fertiliser, it was not necessary to apply compost to all their cultivated land every year. That means they can get by with less compost and

less work than you'd think. Compost is also always there when you need it; in Ethiopia and I expect in other developing countries as well, you can't take it for granted that chemical fertiliser will be delivered on time. Avery points out that in Bangladesh, dung is used as fuel and consequently isn't available for compost. In fact, dung is an inefficient fuel, and when it is used in a traditional stove the fumes are a serious health hazard to the cook – and to her children too, because children in any country tend to stay close to their mother when she's working in the kitchen. An anaerobic digester produces methane, which is a superior fuel in many ways and which does not present the same dangers to the people who use it. It produces fertiliser as well; if you burn dung directly, you lose the nutrients, if you burn it as methane, you leave them all to be put back into the soil.

The digester most commonly used in Bangladesh is the China dome, which is not ideal for use by a whole village. One of our chief aims is to produce a design that will bring better digesters within the reach of people who have very little money and have to do the construction themselves. But let's keep this in proportion: The simple digester works, the smell it occasionally produces and the flies it sometimes attracts are no worse than you often get on farms, and it provides both fertiliser and a source of energy that is clean, inexpensive and safe. You could describe this as a "win-win" situation except that there is a loser, the chemical industry. Which is precisely why you'd expect a member of the Hudson Institute to be against it. At present, we are collaborating with Professor Ou, the designer of the digester we saw in Nanjing, and the Third World Network (TWN), to bring the digester to the point where it can be taken up for use in both the developed and third worlds. We're also keeping an eye on what other work is being done on biodigesters. We're pretty optimistic about the Nanjing model but the Dream Farm project does not stand or fall with it, and some of the other designs may succeed as well.

We are also cooperating with a number of people that we know are interested in setting up Dream Farms. One is already being established in Indonesia, with assistance from TWN, and the owner is monitoring what happens so that lessons from his experience can be passed on to others. We have also had expressions of interest from other countries, including the UK, Italy, Nigeria and Australia. While Dream Farm 2 is a new concept, everything it requires is already being used on real farms: composting rather than chemicals, intercropping to reduce pests, reed beds and algal basins to purify

water, careful choice of varieties to suit local conditions, biodiversity to reduce the damage that a disease like bacterial rice blight can do. The biogas digester has been used in China for centuries and now in many other countries as well. Unlike the GM lobby, we are not talking about castles in the air. The technology exists and has been proven.

It can also be phased in. The key step is installing the digester, which is why it is so important to have a design that is robust and not too expensive. Beyond that, a farmer can choose which components he wants and over what period of time he wants to install them. The system can be adapted to suit all sorts of conditions and individual preferences. Organic agriculture can feed the world at least as well as conventional agriculture can. What is more, it will still be able to do this 10, 20, 50 years from now, which conventional agriculture will not. It can help make farmers independent of the big corporations. It carries none of the hazards of GM. It can also make a substantial contribution to reducing the amount of greenhouse gases we release into the atmosphere. Why on earth would you want to do anything else?

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