The Green Challenger

Official Newsletter of the Willunga Hillsface Landcare Group

Willunga Hillsface Landcare Group

Winter 2012

How science aims to feed seven billion people

By Catherine Clabby

With seven billion people on the planet, traditional farming struggles to put enough food on everyone's table. But a host of hi-tech tools aim to save the day.

As birth announcements go, it was a pretty big one. Sometime around the end of October last year, the world's population officially reached seven billion people.

Seemingly, it is the kind of celebration we should get used to. By 2050, an extraordinary nine billion people are expected to call Earth home. But these are milestones we cannot yet afford to celebrate, because as the population swells, our ability to feed everyone diminishes. Globally, one billion people are undernourished at present, especially in sub-Saharan Africa and Asia.

By around 2050, the swelling global population and affluence is expected to increase demand for food production by 70%, with a 100% increase expected in some developing countries. Yet most of the globe's best farmland is already planted or grazed. And when you factor in climate change, limited fresh water supplies and competition for harvests from biofuel makers, it is clear the world faces a major challenge.

One note of reassurance is that we have been in a similar fix before, and our ingenuity proved to be up to the challenge. In the mid-20th Century, when the global demand for food outpaced supply and famine was routine in places such as India and Pakistan, what helped save the day was the so-called "Green Revolution". The movement was spearheaded by American agronomist Norman Borlaug, who cleverly bred wheat to be shorter but sturdier and better at producing the parts we eat.

Borlaug's approach drew its fair share of critics, in part through its reliance on pesticides and fertilizers. But breeding high-yield crops in this manner more than doubled farm field yields globally in 50 years, particularly in Latin America and Asia, and helped to avert mass famines – an achievement that earned Borlaug the 1970 Nobel Peace Prize.

Recently, however, the trend toward higher yields has flattened, and the world finds itself in need of another revolution. This time, however, there is no obvious blueprint. Green Revolution 2.0 is possible, scientists say, but it will be engineered using tools that were unavailable to Borlaug and others in their pioneering days. Instead of relying on traditional breeding techniques and the lavish use of chemicals, the machinery sowing this new revolution includes supercomputers, molecular biology and arrays of sensors.

Here, BBC Future profiles four areas of research to discover how close they are to feeding the coming nine billion.

Squeezing more from the sun

In a corner of Illinois, they are trying to improve on billions of years of evolution. A group led by British-born plant scientist Stephen Long is trying to improve the ability of plants to harness energy from the sun. Their aim is to turbocharge photosynthesis, the fundamental process that allows plants to use the light they capture to convert carbon dioxide into organic necessities like sugar and starch – or food, as we like to call it.

According to Long, plants currently operate at about one third of their potential efficiency when it comes to photosynthesis, which hints that if you can find a way to ramp it up, you can also produce more food. In 2006, Long and his colleagues described how climate-change experiments have shown that rising atmospheric levels of carbon dioxide lead to higher rates of photosynthesis in plants. When this happens, yields can improve by 15% in vital crops like wheat, rice and soybean.

Increasing atmospheric carbon dioxide further is hardly a practical or desirable way to boost crops, so the team set about looking for the genetic switches

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Editorial

Here in Willunga I recorded better than average rainfall in May and June also has been good so far with 44mm in the first week. Hope you've done as well. In my Autumn Green Challenger I had an article about the carbon capture project at Henbury Station that's been funded by the Federal Government. Henbury Station has been de-stocked and allowed to return to its natural state with the goal of sequestering 1.5 million tonnes of carbon dioxide each year.

Brushfires have upset this plan, destroying about 60 percent of the cover. I received the following comment by email:

Hello Brian,

Thanks for the newsletter. My view on the carbon capture programme, as an ex pastoralist who happily sold his property for conservation, is that the idea has little practical value at best and at worst will add to carbon emissions. I am happy to admit that there are probably good biodiversity reasons for de-stocking the property.

Whilst cattle are sustainably grazing they prune and encourage regrowth, hence taking more carbon from the atmosphere and whilst they expel methane, I believe this to be over-estimated and possibly based on grain-fed animals. Anyway cattle manure has a beneficial effect on soils and also sequesters carbon. Un-grazed pastoral land, particularly grass land is highly susceptible to fire and for thousands of years has been managed with fire by Aborigines. To try and preserve pasture for short term sequestration can only be harmful to biodiversity (through hot fires), feral animal infestation, and carbon emissions from fire. Also it is irresponsible placing neighbours in danger of frequent fire events.

I do believe that farming has great potential for storing carbon in the soil, but this occurs in regions where highly modified systems of agriculture are practiced, not where grazing of natural pasture takes place (well grazed perennial grass pasture intakes more carbon than a similar area of forest). I have been told, although I'm not sure how correct this is, that the annual burn-off conducted naturally and by pastoralists and Aborigines in the top end of Australia contributes about half of our total carbon emissions. The potential release of carbon from un-utilised pasture is immense, and the longer it has been conserved, the greater the environmental damage when ignited. Unfortunately we have politicians making ideological decisions rather than well considered scientific decisions. Of course farmers, and their representative bodies, who are concerned that they may be taxed for animal emissions will counter with an argument for carbon in soil capture as a cancelling effect.

Regards,

Langdon Badger

Glyphosate found in air, rain and streams in US

Glyphosate, also known by its trade name Roundup, is commonly found in rain and rivers in agricultural areas in the Mississippi River watershed, according to two new USGS studies released this month.

Glyphosate is used in almost all agricultural and urban areas of the United States. The greatest glyphosate use is in the Mississippi River basin, where most applications are for weed control on genetically-modified corn, soybeans and cotton. Overall, agricultural use of glyphosate has increased from less than 11,000 tons in 1992 to more than 88,000 tons in 2007.

"Though glyphosate is the mostly widely used herbicide in the world, we know very little about its long term effects to the environment," says Paul Capel, USGS chemist and an author on this study. "This study is one of the first to document the consistent occurrence of this chemical in streams, rain and air throughout the growing season. This is crucial information for understanding where management efforts for this chemical would best be focused."

In these studies, Glyphosate was frequently detected in surface waters, rain and air in areas where it is heavily used in the basin. The consistent occurrence of glyphosate in streams and air indicates its transport from its point of use into the broader environment.

Additionally, Glyphosate persists in streams throughout the growing season in Iowa and Mississippi, but is generally not observed during other times of the year. The degradation product of Glyphosate, aminomethylphosphonic acid (AMPA), which has a longer environmental lifetime, was also frequently detected in streams and rain.

Detailed results of this Glyphosate research are available in "Occurrence and fate of the herbicide Glyphosate and its degradate aminomethylphosphonic acid in the atmosphere," published in volume 30 of Environmental Toxicology and Chemistry and in "Fate and transport of Glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins," published online in Pest Management Science. Copies of the reports are available from the journals or from Paul Capel (capel@usgs.gov)

Research on the transport of glyphosate was conducted as part of the USGS National Water-Quality Assessment (NAWQA) program. The NAWQA programme provides an understanding of water-quality conditions, whether conditions are getting better or worse over time, and how natural features and human activities affect those conditions. Additional information on the NAWQA programme can be found online.

This article taken from: www.usgs.gov/newsroom/article.asp?ID=2909#.T7zRWey-MfU

"Living bags" helping to control erosion

Living bags are helping to stop erosion above a concrete-lined channel of Second Creek. Living bags are sandbags planted with local riparian seedlings which are then placed into eroded sections of the creek.

The seedlings grow roots through the bags to stabilise the soil. Nine months on and the sedges are already large enough to protect the banks when the water flows fast! (see pics on the right-hand side).

Borthwick Park, Kensington was chosen as the test site for the first Living Bags trial. The bank was at risk from flooding in spring 2010 and threatened the Kensington Residents' Associations revegetation site.

The Association started a revegetation project at the site (winter 2010) with the support of Norwood Payneham & St Peters Council and the Board's Community Group Action Programme.

The trial will monitor the bags' ability to mitigate the re-occurrence of erosion to the site in the longer term as a cost-effective solution to repair small-scale erosion.

A working bee at the park was staged over two days using 370 plants divided into 835 stems. These stems were then planted into 300 bags filled with 5.5 tonnes of a sand loam mix.

How it works

Living bags are made from hessian and will create a soft form and settle into the surrounding bank, binding the soil and becoming solid amongst the changing water flow.

The natural fibre of the bag breaks down while the plant establishes its roots. The loose weave of the fabric allows new shoots to be sent up and roots to penetrate into the soil.

Hessian sandbags are filled to a third and flattened, and riparian plants placed into holes inserted into the top of the bag.

The species selection includes a mixture of spreading- and clumping-root plants. The bags are then installed in rows, each bag overlapping running parallel to the flow. In wider erosion sections multiple rows are built up as though building a brick wall stepped to contour the section.

Results

The trial was subjected to its first significant test within nine hours of installation, as a large rain event created a high velocity water flow submerging the bags.

Only one of the 300 plants was dislodged from where it was planted and no movement of the bags occurred.

The flow levelled and settled the sand, dampened the hessian and deposited debris immediately blending them into the site.

Nine months after the first installation the bags started to break down. The plants have developed enough roots to hold and protect the bank and the thick cover of sedges that are developing are already protecting the bank by laying down in high flow events.

During the trial no weeds germinated from below the bags, however the hessian did allow weeds to germinate on it.

Further trials

Two further trials have been set up.

These will test how effectively living bags:

- suppress weed growth
- protect areas that have been highly disturbed prior to installation
- create mini crescent-shaped weirs to encourage the deposit of sediments raising the stream bed.

This article, together with photos can be viewed at the following:

www.amlrnrm.sa.gov.au/Communityaction/NRMCommunities/Livingbags.aspx

When I first joined this Landcare group, one of the major concerns was the ongoing erosion in local gullies. The method we used in those days was to tie up bundles of newspapers *(most people still bought them then)* and place them to form mini dams. These slowed the water flow and allowed settling of the soil before the water rose sufficiently to go over them. This system worked well, but it's really good to see the innovation that's taken place with 'Living Bags.'

Brian

Sustainable Viticulture at McLaren Vale

Launch of the McLaren Vale Sustainable Winegrowing Australia programme in April was a big step forward in an important development for this region.

Group Chair, Peter Hayes, said the programme is the first of its kind in Australia, but expects other regions to follow their lead.

Irina Santiago, PhD research student from Adelaide University was recruited to help turn the programme from a trial into a reality. Her 3-year PhD project aims to investigate the assessment and adoption of sustainability in vineyards, to ensure growers' longevity in the wine business… a combination of data reporting and self-assessment through a workbook of viticultural practices and third party audits will help growers improve vineyard sustainability.

Soil health, nutrition, fertilizer, pest, disease, water waste, and biodiversity management are all included in this programme.

For more on this programme, visit:
www.mclarenvale.info

Seed Destructor on course for commercial production

The Harrington Seed Destructor is edging closer towards commercial production, offering an additional strategy in the grains industry's battle against herbicide resistance in weeds.

Designed to destroy weed seeds present in chaff during harvest, the Grains Research and Development Corporation-funded HSD recently completed a series of harvest trials and demonstrations for growers in South Australia, Victoria and New South Wales.

The results of those trials will be known in March-April this year when the season-opening rains stimulate germination of weeds, particularly annual ryegrass.

The trials and evaluations are being overseen by Australian Herbicide Resistance Initiative (AHRI) researcher, Dr Michael Walsh, who says the trial sites will be revisited as soon as the break in the season occurs to assess the efficacy of the unit in reducing annual ryegrass emergence.

"We are hoping for an early, widespread break so we can undertake the evaluations before growers apply herbicides," said Dr Walsh, who is based at the University of Western Australia.

The grain industry's latest weapon in weed control, the Harrington Seed Destructor, in action at Bute in South Australia. Dr Walsh said the trials and demonstrations in the southern cropping region during December involved 15 sites over 16 days and a travelling distance of 4000 kilometres during that time.

"We were very happy with how the trials went. It was a huge success in terms of the number of grain growers who came out to see the HSD in action, and the feedback from growers was very positive," he said.

Dr Walsh commended trial site co-ordinators, grain growers and landowners for their support and assistance with the trials programme: "It was a fantastic team effort by everyone involved."

He said the trials, conducted as part of a new Rural Industries Research and Development Corporation-funded project focussing on harvest weed seed management systems, had demonstrated that the core principals of the machine's cage mill were sound and that only some minor fine-turning of the HSD was required before it entered into commercial production, possibly this year. The GRDC is managing the commercial development of the HSD.

The HSD has already been successfully evaluated in WA and is expected to be subject to a summer crop trial near Coonamble in northern NSW in late February-early March.

The HSD has been developed by WA grower and inventor Ray Harrington, with assistance from AHRI, the University of South Australia and the GRDC.

Towed behind a harvester like a chaff cart, the HSD has been designed around a cage mill crushing unit originally developed for use in the mining industry.

Those involved in development of the HSD stress that it is not a "silver bullet in weed management" but is in fact one more string in the bow of overall integrated weed management.

For more information: Dr Michael Walsh
08 6488 7872 or 0448 847272
Contact: Sharon Watt
Porter Novelli: 0409 675100
www.grdc.com.au/media

Poor farmers guard Earth's crop riches

If you like potatoes, chances are you will one day owe some measure of thanks to the Quechua Indians of Peru. That's because they will be making sure that potatoes continue to be available whatever the vagaries of future climate change. The Quechua are among the first recipients of a new global fund, established last week, to make poor farmers the custodians of all the world's threatened crops.

Importantly, the move could provide valuable options should the world find itself in another food crisis. The Peruvian farmers will be paid to look after the most diverse collection of potatoes in the world. They will try growing varieties at different altitudes and in different climatic conditions so that if today's commercially available potato varieties start to fail anywhere in the world, replacement varieties will be ready and waiting.

The aim of the new fund is to achieve the same level of readiness for all the world's staple food crops. It is a key practical element of the International Treaty on Plant Genetic Resources for Food and Agriculture, which aims to provide an "insurance policy" for crops. The fund has two main goals – to prevent the loss of neglected or under-utilised crop varieties, and to sustain the full diversity of common crops. Though the treaty was agreed in 2001 and came into effect in 2004, the rich and poor factions of the 120 signatory nations have been haggling until now over who should pay, and how much.

During tense negotiations last week in Tunis, Tunisia, rich countries of the world finally agreed to bankroll the five-year $116 million "Benefit-Sharing Fund" that will finance projects like the one in Peru. In essence, the fund will compensate farmers so they

Poor farmers guard Earth's crop riches— *Continued*

carry on growing unusual or traditionally grown crops instead of switching to more profitable -commercial varieties.

By keeping as many food varieties as possible ticking over as usual in small-scale farms throughout the world, the hope is that they will be available if needed in a climate crisis, or a food shortage like last year's. "In Peru, the aim is to react to climate change," says Bert Visser of the Centre for Genetic Resources in Wageningen, the Netherlands, and a key negotiator.

Visser points out that the treaty has already enabled the establishment of an international vault containing 1.1 million seed varieties, which opened last year in Svalbard, Norway. The new fund aims to secure the food varieties which cannot be banked in this way, and that can only be preserved if farmers carry on growing them.

Norway, Spain, Italy and Switzerland have already contributed $500,000 to the fund, which was last week divided between the recipient projects. Crucially, rich signatories to the treaty have now committed to supplying the remaining millions over the next five years. The US is currently considering signing up. If it does, China, Mexico and Japan are likely to follow suit.

Andy Coghlan – New Scientist, 13th June, 2009

BUILDING NEW TOPSOIL

The most meaningful indicator for the health of the land, and the long-term wealth of a nation, is whether soil is being formed or lost. The future for Australia depends on the future of our soil. If soil is being lost, so too is the economic and ecological foundation on which production and conservation are based. In little over 200 years of European land-use in Australia, more than 70 percent of land has become seriously degraded (Flannery 1994). Despite our efforts to implement 'best practice' in soil conservation, the situation continues to deteriorate.

Annual soil loss figures for perennial pastures in Tablelands and Slopes regions of NSW generally range from 0.5 to 4 t/ha/yr, depending on slope, soil type, vegetative cover and rainfall (Edwards and Zierholz 2000). These figures probably underestimate the total amount of soil lost. Erosion can occur at much higher rates during intense rainfall events, particularly when ground cover is low. Areas which have been cultivated are more prone to soil structural decline. Under bare fallows in the northern part of NSW, annual erosion losses in the order of 50 to 100 t/ha are common, with losses from individual rainfall events of 300-700 t/ha recorded in some situations (Edwards and Zierholz 2000). Research efforts in the soil science arena have concentrated on reducing the rate of soil loss. The concept of building new topsoil is rarely considered.

For the full article go to: http://managingwholes.com/new-topsoil.htm

Regreen The Range Report

Good news! The Landcare group has just been successful in receiving funding from the Federal Government for the next six years to continue with the Regreen The Range project across the Willunga-Sellicks escarpment.

The funding is part of the Clean Energy Future programme run by the Federal Government and allows the Landcare group to revisit some of the areas previously revegetated and to revegetate properties where no revegetation has been previously established. This funding opportunity will allow the group to undertake revegetation on properties over a number of years knowing that money will be made available to the group to conduct the programme. This certainty is also reassuring for landholders, as it allows plans to be put in place for a number of years with the knowledge the programme will proceed.

In areas where revegetation has been conducted previously, the Landcare group will revisit these properties, construct exclusion enclosures and conduct trials on the planting of ground-cover species, native grasses and native forbs.

This group of species have previously been lacking from the initial revegetation due to the competition from exotic annual grass weed species. In many cases the trees and shrubs planted for the revegetation have now suppressed these species, thereby reducing the competition which will increase the chance of success for the smaller and more delicate plants.

By undertaking this programme, the Landcare group will be able to increase the biodiversity within the revegetated sites and this in turn will make the sites more resilient to environmental stresses.

The Landcare group is planning to establish the enclosures on a number of properties across the hills face in locations with differing aspects and soil types and then monitor each enclosure to determine the survival and recruitment rates at each site so as to determine the optimum method for introducing these species back into the environment.

The Landcare group are still looking for properties to undertake revegetation programmes across the hills face. The Landcare Group would like to once again thank the Federal Government for making the funding available for this project and the group would like to thank the Federal member for Kingston, Amanda Rishworth and Mayor of the Onkaparinga Council, Lorraine Rosenberg, for letters of support for the project and the support both have given the project over the years.

Wayne Lawrence

How science aims to feed seven billion people – *Continued from Page 1*

that could mimic the action and ramp up the plant's ability to harness the sun.

That is easier said than done. More than 100 different proteins play a role in photosynthesis, interacting in countless different permutations, Long says. Trying to work out which ones could boost photosynthesis through trial and error would take years. But there is a shortcut: supercomputers.

Long's team broke photosynthesis down into a long series of mathematical equations and fed them to the National Centre for Supercomputer Applications in Illinois. The supercomputer whirred through the numbers and spat out a list of "best-bet" interventions.

For example, one potentially easy win they identified was to dial up production of just a single protein known as sedoheptulose bisphosphatase, or SBPase. British researchers have already shown that tobacco plants engineered to express more SBPase grew 10% larger in a glasshouse. And if it works in them, Long says, then it is likely to work in any crop, since photosynthesis does not vary much among plants.

However, this is not the only way of increasing photosynthesis. Scientists are also exploring the idea that genes from the ancestors of modern-day plants might boost the ability of crops to harness the sun. It is well known that primitive plants known as cyanobacteria have a talent for concentrating CO_2 within their cells at levels that make photosynthesis more efficient. It is believed that plants lost this ability when they transferred to the land 500 million years ago, because they did not need it.

Researchers at the Hebrew University of Jerusalem have evidence that this may be one key to increased yields. In trials, they achieved a 20% increase in tobacco plants after adding a single cyanobacteria gene called inorganic carbon transporter B (IctB). Long says that he and colleagues from the University of Nebraska have carried out some initial tests on soybeans transformed with the same gene, and have recorded a 10% increase in yield.

However, there is a long way to go before either of these techniques can be used in the field. There is huge opposition to genetically modified crops in many countries, with some groups citing safety concerns and others ethical, arguing that the developing world should not be used as a laboratory to test such crops. But even if these arguments are won and efforts to re-engineer photosynthesis succeed, Long admits it would take at least a decade to move these transformed plants from research settings to farm fields. It would also take a lot of money. "The cost of meeting global regulatory requirements for a single gene engineered into a crop can run into many millions," says Long. "While we can show ways of achieving this, actually getting this to farmers could be more difficult."

Turning the world green

Traditionally, farmers have sought out the best places to plant their crops – nutrient rich flood plains and the sides of volcanoes. But we have reached a point where all of this high quality land is taken. Instead, farmers are forced to use ever more marginal land – plots that are too wet, too dry, too short on vital nutrients, or are laced with damaging aluminium or salt.

As a result, there is a push to develop crops that not only grow in these conditions – they relish them. For example, researchers like Abdelbagi Ismail at the International Rice Research Institute (IRRI) in the Philippines are developing strains of rice that can flourish in flooded areas.

This is an important problem to tackle. As many as 20 million hectares of cultivated rice are affected by submergence in Asia every year.

To get round the problem, Ismail and his team scoured the vaults of their institute's rice seed bank – the world's largest with more than 110,000 varieties. They were looking for types of rice that survive on sketchy land, regardless of whether they produced low or high yields. In one case, they found a strain that did not waste precious energy trying to elongate itself above the waters when submerged by a flash flood, and instead put itself into a sort of temporary slumber. Using genetic techniques unavailable to Borlaug, they then crossed this flood-tolerant strain with a high-yield strain of rice.

"This [form of breeding] used to take 6–5 years," says Ismail. "Now we can have a tolerant variety in only 2–3 years."

It seems to work. Tests have shown that fields planted with the hybrid that experienced flooding show average yield gains of close to one ton per hectare, says Ismail.

Their submergence-resistant rice has been distributed to farmers in India, Bangladesh, Nepal, Indonesia and the Philippines. IRRI hopes it will reach 5 million farmers in Asia and Africa by 2014 and 20 million farmers by 2017.

Vitamin shake

Increasing the amount of food we produce is one thing. Producing nutritious food is another, according to Yassir Islam, spokesperson for HarvestPlus, a non-profit organisation looking to improve nutrient content in staple foods.

He says the next green revolution will have to be accompanied by a rethink about how nutritious the food is that we put on the table of millions of people every day. Too many people in Asia and Africa

Continued next page

already suffer from what HarvestPlus calls "hidden hunger", or deficiencies in key micronutrients. These people live in parts of the world where their diets are dominated by staples – foods such as rice, wheat, cassava, millet and maize – that are high in calories but lack iron, zinc, vitamin A and other micronutrients. Deficiencies can reduce IQ, lower disease resistance, stunt growth and even cause blindness, which greatly increases a person's risk of death in the developing world.

The best-known example of boosting nutrition in staple crops is golden rice, which has been engineered with genes from daffodils and bacteria to produce beta-carotene, a nutrient that the body can convert into vitamin A. Developed in the 1990s, and field tested in the 2000s, golden rice is still not available for general use. Some environmental groups, including Greenpeace, fear that this genetically modified strain could contaminate and harm other vital rice strains.

But rather than importing genes from another organism, researchers are now trying to find maize strains that naturally produce high levels of beta-carotene. Torbert Rocheford of Purdue University, Edward Buckler of Cornell University, and their collaborators screened around 300 maize strains, and unearthed some with boosted beta-carotene levels. They then looked for any genes in these maize strains that resembled genes linked to high beta-carotene levels in other plants.

"It's the sort of process where either you hit a grand slam home run or strike out. There's nothing in between," says Rocheford.

They scored, finding a small number of maize varieties that grow in both tropical and temperate climates and which carry a gene variant that slows down the conversion of beta-carotene to other substances, leaving more to make vitamin A. As important, they also found a genetic marker that signals when this sought-after gene variant is in place.

Plant breeders are using the naturally occurring maize plants and those markers to breed new plants. So far, the process has boosted concentration of beta-carotene in the corn from practically nothing to about 8 micrograms per gram – around 53% of HarvestPlus' target for the micronutrient. The organisation expects to release corn that achieves that target in 3–4 years.

What will really determine its success is if farmers will regularly plant this orange corn in a region where people traditionally eat white corn with no beta-carotene. This year, HarvestPlus, which like the IRRI is funded by the Bill and Melinda Gates Foundation, is releasing the fortified corn in Zambia, where more than half of children experience vitamin A deficiencies. The plan is to eventually adapt the plants to fields elsewhere in Africa, in Latin America and in Asia.

Plant smart

Every one of us likes to be treated as an individual. And it is no different for fields, say advocates of an expanding type of agriculture called precision farming.

This is based on research that shows there is a significant variation in how crops grow over distances as small as an acre, says Raj Khosla, an agriculture researcher at Colorado State University, and president of the International Society of Precision Agriculture.

He is helping farmers to harvest a new crop: data. They do it by bringing electronic tools into their crop rows – global positioning systems, infrared devices that measure soil's electrical conductivity and light and sound sensors. Combining all that and more gives farmers precise information about variety in plant health, size and even nitrogen needs. The idea is that by collating all of this, farmers can produce highly detailed maps of their fields so that they can identify how much seed, fertilizer, water, herbicides and pesticides different areas require.

At first the appeal was that farmers would save money and avoid environmental harm by not adding unnecessary fertilizer or water, Khosla says. "But with precise input management, farmers can also influence grain yield and efficiency."

Some academics and sustainable farming advocates see this type of farming as one more push toward industrialising food production and making more farmers dependent on agribusiness. But José Molin, a precision farming researcher at the University of Sao Paulo in Brazil, says the concept has promise for farmers with and without the means or inclination to buy expensive equipment.

"We still have to develop the concept to apply it to small farmers and to low tech or low income areas," says Molin. "But the concept is always the same. Even small fields are different in different locations. We should treat them differently."

Given the imperative to expand the world's food supply, farmers need as much help as they can get, even down to the acre, says Khosla. "Previously we just raised food for humans and animals. In 2011 more corn went to bio-fuel than to feed for the first time in the US. Another big pressure is climate change. A third is the lack of water." Khosla says. "We're working under tremendous pressures today compared to those in the first green revolution. We can't just continue to do things the way we have done them."

If you would like to comment on this story or anything else you have seen on Future, head over to our Facebook page or message us on Twitter.

http://www.bbc.com/future/story/20120210-is-this-the-new-green-revolution

Willunga Hillsface Landcare Group

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Meeting dates vary, but are usually held on Mondays monthly at 5.00 p.m. in the Willunga Hub, Corner St. Peters Terrace, Willunga.
All members are welcome to attend these meetings.

If you prefer to receive your copy in PDF format (via email) please let me know at this address: viza05@westnet.com.au.

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Our thanks to Leon Bignell, MP, local Member for Mawson for printing this newsletter.